

NATIONAL INTEGRATED GUIDELINES FOR

FOODBORNE DISEASE SURVEILLANCE AND RESPONSE

for Health, Agriculture, and Environment Sectors

FEDERAL MINISTRY OF HEALTH
FEDERAL MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
FEDERAL MINISTRY OF ENVIRONMENT

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TABLE OF CONTENTS

TABLE OF CONTENTS i
LIST OF FIGURES iii
LIST OF TABLES iii
FOREWORD iv
ACKNOWLEDGEMENT vi
ABBREVIATIONS vii
SECTION 1 – INTRODUCTION 1
1.1 Background 1
1.2 Importance of Foodborne Diseases in Attaining Global and Regional Development Goals 2
1.3 Need for Integrated Guideline 3
1.4 Challenges of Foodborne Disease Surveillance and Response 4
1.5 To whom this Manual is Intended 5
1.6 Monitoring and Evaluation of Surveillance and Response 7
SECTION 2 – DEFINITION OF FOOD SAFETY EMERGENCY AND PRIORITISATION OF FOODBORNE DISEASES 8
2.1 Defining Food Safety Emergency 8
2.2 Prioritising Nigeria Foodborne Diseases 9
2.3 Official List of Priority Foodborne Diseases in Nigeria 10
2.4 Priority Foodborne Disease Categorization 10
SECTION 3 – INTEGRATED FOODBORNE DISEASE SURVEILLANCE SYSTEM GUIDELINE 11
3.1 Introduction 11
3.2 The Goal of Integrated Foodborne Disease Surveillance System 12
3.3 Steps to Establish Coordination for Integrated Foodborne Disease Surveillance 13
SECTION 4 – GUIDELINE FOR PRIORITY FOODBORNE DISEASES SURVEILLANCE 18
4.1 Introduction 18
4.2 Response to Alert and Action Threshold 19
4.3 Cholera 19
4.4 Viral Hepatitis A and Viral Hepatitis E 21
4.5 Organophosphates/Organochlorides Poisoning 23
4.6 Diarrheagenic *Escherichia coli* pathotypes 24
4.7 Mycotoxicosis (Mycotoxins) 25
4.8 Lassa Fever 26

4.9 Typhoid Fever 27
4.10 Botulism 29
4.11 Listeriosis 30
4.12 Rotavirus Infection 31
SECTION 5 – GUIDELINE FOR INVESTIGATION, RESPONSE, AND MANAGEMENT OF FOODBORNE DISEASE EMERGENCIES 32
5.1 The Goal of Investigating Foodborne Disease Emergency 32
5.2 Foodborne Disease Emergency Control (FDEC) Team 32
5.3 Shared Responsibilities 32
5.4 Steps in Investigating a Foodborne Disease Event 33
5.5 Protocol for Collecting & Testing Specimen for Priority Foodborne Diseases 36
5.6 Protocols for Case Reporting 36
5.7 Protocols for Verification of Diagnosis 37
5.8 Protocols for Product Investigation 37
5.9 Protocols for Traceback Investigations 37
5.10 Protocols for Initiating Food Recall(s) 38
5.11 Protocol for Risk Communication and Community Engagement 39
ANNEXE 1 – RESPONSIBILITIES OF STAKEHOLDERS BEFORE, DURING AND AFTER A FOODBORNE DISEASE EMERGENCY 41
ANNEXE 2 – FOODBORNE DISEASE REPORTING FORM/QUESTIONNAIRE 47
ANNEXE 3 – INVESTIGATION LINE LISTING 49
ANNEXE 4 – MODEL PRESS RELEASE 50
ANNEXE 5 – HEALTH CARE PROVIDER GUIDELINES FOR REPORTING SUSPECTED FOODBORNE DISEASE EMERGENCY 51
ANNEXE 6 – A-Z OF COMMON FOODBORNE DISEASES 52
ANNEXE 7 – FLOWCHART FOR ANIMAL DISEASE REPORTING IN NIGERIA 53
ANNEXE 8 – CONDENSED CLASSIFICATION OF COMMON FOODBORNE DISEASES 54
ANNEXE 9 – FULL LIST OF CONTRIBUTORS 59
ANNEXE 10 – OTHER REFERENCES 60

LIST OF FIGURES

FIGURE 1: COMPONENTS OF THE SURVEILLANCE AND RESPONSE SYSTEM FOR FOODBORNE DISEASES 2
FIGURE 2: CHALLENGES IN FOODBORNE DISEASE SURVEILLANCE AND RESPONSE 5
FIGURE 3: SCALABILITY OF RESPONSES TO FOOD SAFETY EVENTS 8
FIGURE 4: EXAMPLE OF AN EPI CURVE TRACKING CASES AND EVENTS DURING A FOODBORNE DISEASE OUTBREAK 34
FIGURE 5: STEPS IN INVESTIGATING A FOODBORNE DISEASE EVENT 35
FIGURE 6: DIAGRAM TRACING THE MOVEMENT OF FOOD FROM THE CONSUMER BACK TO THE RETAILERS, RESTAURANTS, DISTRIBUTORS, PROCESSORS, AND PRODUCERS. 38

LIST OF TABLES

TABLE 1: SUMMARISED RANKING SCORE FOR EACH OF THE PRIORITY FOODBORNE DISEASES 10
TABLE 2: TOOL FOR DOCUMENTING HAZARDS UNDER SURVEILLANCE IN EACH SECTOR 15
TABLE 3: FOODBORNE INFECTIONS, CAUSATIVE AGENTS, SYMPTOMS, AND COMMONLY AFFECTED FOODSTUFFS 54
TABLE 4: FOOD POISONING, TOXIN TYPE, CAUSATIVE AGENTS, SYMPTOMS, AND COMMONLY AFFECTED FOODSTUFFS 57

FOREWORD

Foodborne diseases and outbreaks remain a substantial cause of preventable morbidity and mortality in Nigeria and across the world. It is estimated that one in ten people worldwide suffer from diarrhoea foodborne diseases. It is usually believed that foodborne disease outbreaks are under-recognized and under-reported, and the inability to detect and investigate clusters of illness creates a giant gap in improving the health security indices of the country. There are many reasons why foodborne diseases are a significant public health issue – as you control some diseases, others emerge as new threats. These emerging threats can survive traditional food preservation techniques and significantly affect vulnerable populations such as infants, the elderly, or the immunocompromised.

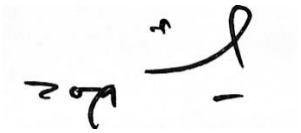
Increasing complexities in food production and distribution systems are affecting the ways foodborne diseases arise and spread. This mystifies the investigation of foodborne disease outbreaks, making them difficult to detect and link to the food commodity. A holistic response to foodborne disease outbreaks provides an opportunity to identify sub-par food safety practices and other contributing factors and link the attribution of illness to definite food commodities while improving the opportunity to detect and prevent future events.

These guidelines are projected to serve as a general introduction to the integrated surveillance, identification, response, and management of the myriad of foodborne disease emergencies as well as to facilitate the generation of data to be used for public health interventions. The guidelines also prioritise the top ten foodborne diseases, including those of biological and chemical origins. It is important to note that no general guidelines will fit all specific situations perfectly, and adaptable judgements from relevant trained health officers are required to ensure modifications to investigation techniques account for the unique characteristics of every outbreak and local environmental factors. It is also vital to note that responding to foodborne disease emergencies is beyond the duty of one sector but requires the implementation of an effective and integrated food control system. Therefore, all relevant sector organisations need to work together for the successful implementation of this guideline document.

Finally, the implementation of these guidelines is part of the requirements of the International Health Regulations (2005), to which foodborne disease emergencies of international concern must be reported to the IHR secretariat via the International Food Safety Authorities Network (INFOSAN) Emergency Contact Point for Nigeria. Nigeria, therefore, prioritises food safety as a matter of public health importance.



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Our appreciation also goes to the consulting partners who developed and reviewed the draft document at various stages: Mr Oluwafemi Stephen (Federal Ministry of Health, Abuja), Mr John F. Tehinse (FUNTA Services), Dr Salome Bawa (Federal Ministry of Agriculture and Rural Development, Abuja), Prof. Adewale Obadina (Federal University of Agriculture, Ogun State), Ms Kefilwe R. Moalosi (AU-NEPAD), Dr Helen Onyeaka (University of Birmingham, United Kingdom), Prof. Tine Hald (Technical University of Denmark), and Dr Olanrewaju E. Fayemi (Mountain Top University, Ogun State).

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Notably, the guidelines were developed through an extensive consultative process involving all stakeholders in the health, agriculture, and environment sector. We are therefore, grateful to all.



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ABBREVIATIONS

CHEWS	Community Health Extension Workers
DSNO	Disease and Surveillance Notification Officer
EBS	Event-Based Surveillance
EHCON	Environmental Health Council of Nigeria
EHOs	Environmental Health Officers
EOC	Emergency Operations Centre
FBD	Foodborne Disease
FBO	Food Business Operator
FMARD	Federal Ministry of Agriculture & Rural Development
FMENV	Federal Ministry of Environment
FMOH	Federal Ministry of Health
IBS	Indicator-Based Surveillance
IDSR	Integrated Disease Surveillance and Response
INEHSS	Integrated National Environmental Health Surveillance System
INFOSAN	International Food Safety Authorities Network
LMIC	Low- and Middle-Income Countries
MDA	Ministry, Department and Agency
NADIS	National Animal Disease Information Service
NAFDAC	National Agency for Food and Drug Administration and Control
NAQS	Nigeria Agricultural Quarantine Services
NCDC	Nigeria Centre for Disease Control
NESREA	Nigerian Environmental Standard Regulation Enforcement Agency
NiCoFST	Nigerian Council of Food Science and Technology
NVRI	National Veterinary Research Institute
SON	Standards Organisation of Nigeria
VCN	Veterinary Council of Nigeria
WOAH	World Organisation for Animal Health

SECTION 1 – INTRODUCTION

1.1 Background

Foodborne disease (also called "foodborne illness," "foodborne infection," or "food poisoning) is a common, costly, yet preventable public health problem. In recent years, the international community and the Nigerian Government have recognised the public health effect of foodborne diseases in causing a considerable burden of disability and mortality. World Health Organization (WHO) studies of the global burden of foodborne diseases in 2010 estimated that 31 hazards (including viruses, bacteria, protozoa, helminths, and chemicals) led to over 600 million cases of foodborne illnesses and 420 000 deaths[1]. In 2014, the World Bank's "Safe Food Imperative" found that the cost-of-illness of diarrhoea, attributable to food contamination, is about US$10 per case, with Nigeria estimated to lose about US$6 billion annually in productivity[2] which underscores the staggering impact of foodborne illness on the national workforce.

The most common clinical presentation of foodborne disease is gastrointestinal symptoms like diarrhoea and bloody diarrhoea. Other serious consequences include organ failure, neurological disorders, and cancer.

To ensure that the disease burden is controlled and monitored, every national authority must have an effective food safety control system that takes account of hazards from the place of production to the point of consumption.

1.1.1 The Goal of Foodborne Disease Surveillance and Response System[3]

The short and long-term goals of the foodborne diseases surveillance and response system are to:

1. Detect and respond to foodborne disease emergencies to allow rapid implementation of control measures;
2. Monitor trends to understand the epidemiology of foodborne diseases (e.g., the geographical distribution of diseases, seasonality, and vulnerable populations);
3. Determine the burden of foodborne diseases;
4. Motivate targeted ad hoc research about foodborne diseases;
5. Attribute food sources to specific foodborne diseases;
6. Inform clinical management policy, where appropriate (e.g., antimicrobial stewardship as it relates to antimicrobial resistance in humans);
7. Inform risk-based inspection services;

[1] WHO estimates of the global burden of foodborne disease, 2015

[2] The Safe Food Imperative: Accelerating Progress in Low- and Middle-Income Countries, 2018

[3] Adapted from WHO Stage 3 booklet on Strengthening surveillance of and response to foodborne diseases

8. Monitor and evaluate interventions and measures taken to control and prevent foodborne diseases;
9. Contribute data from the human, animal, and environmental health sectors for integration with data from all sectors across the food chain to guide public health action while preventing and controlling foodborne diseases.

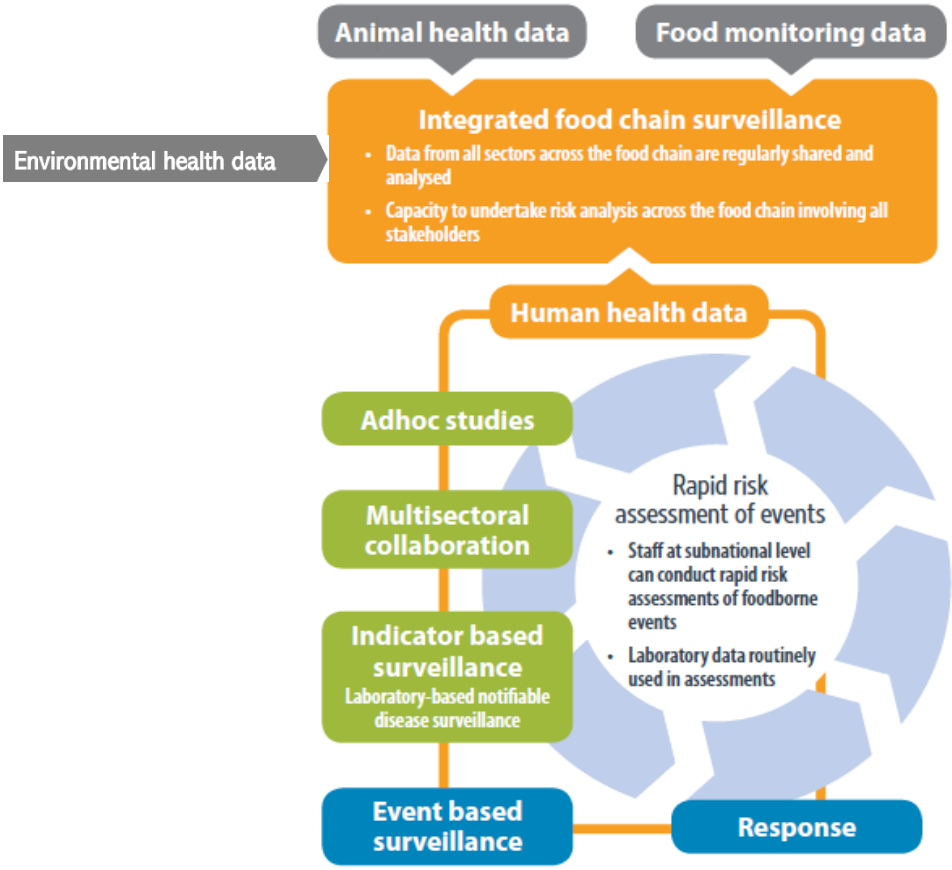


Figure 1: Components of the surveillance and response system for foodborne diseases[4]

1.2 Importance of Foodborne Diseases in Attaining Global and Regional Development Goals

Controlling foodborne disease emergencies and reducing the burden of foodborne diseases are vital for achieving many of the **Sustainable Development Goals (SDGs)**, in particular:

- **SDG 1: End poverty**. Foodborne disease is a major cause of ill health among the poor and is associated with a high cost of medical bills and reduced value of livestock and other assets.
- **SDG 2: End hunger**. Foodborne hazards negatively impact some of the targets of this goal and prevent all persons from having safe and nutritious foods. Foodborne

[4] Adapted from WHO Stage 3 booklet on Strengthening surveillance of and response to foodborne diseases.

diseases also have multiple complex interactions with nutrition and some toxins directly leading to malnutrition.

- **SDG 3: Good health and well-being**. The global health burden of FBD is comparable to that of malaria, HIV/AIDS, and tuberculosis, and the people most vulnerable to FBD are infants, pregnant women, the elderly, and those with compromised immunity.
- **SDG 6: Clean water and sanitation**. Having clean water reduces the risk of transmission of some infectious foodborne diseases. Proper sanitation at homes and food service establishments also helps to reduce the burden of foodborne diseases.
- **SDG 8: Decent work and economic growth**. The 2018 World Bank report on the impact of foodborne diseases on the economy of countries, especially the LMIC, shows that if the burden of foodborne disease is reduced, it increases the way out of poverty for many poor people.

Reducing the burden of foodborne diseases is also important in ensuring that we meet the **African Union Agenda 2063**[5] Goals, especially the following:

- **Agenda 2063 Goal 1** – A high standard of living, quality of life and well-being for all citizens
- **Agenda 2063 Goal 3** – Healthy and well-nourished citizens;
- **Agenda 2063 Goal 4** – Transformed Economies;
- **Agenda 2063 Goal 5** – Modern Agriculture for increased productivity and production.

1.3 Need for Integrated Guideline

In 2019, the World Health Organization (WHO) published an updated benchmark for Health Security strengthening for all member states[6]. Food Safety was one of the technical areas that were incorporated into the benchmark. To strengthen food safety for health security, two indicators were developed to ensure "*a functional system is in place for surveillance and response capacity of States Parties for foodborne disease and food contamination risks or events with effective communication and collaboration among the sectors responsible for food safety*." These indicators are:

1. Surveillance systems in place for the detection and monitoring of foodborne diseases and food contamination,
2. A functional mechanism is in place for the response and management of food safety emergencies.

In response to this, and to meet the requirements of the benchmark, Nigeria embarked on its first country-wide assessment of the foodborne disease surveillance and response system between October 2020 to April 2021. A report of the assessment was published in August of 2021[7]. The assessment report showed glaring gaps in the foodborne disease surveillance and

[5] Goals & Priority Areas of Agenda 2063
[6] WHO Benchmarks for International Health Regulations (IHR) Capacities, 2019
[7] A Report of the Assessment of Foodborne Disease Surveillance and Response System in Nigeria, 2021

response system and what is expected of Nigeria to improve its foodborne disease surveillance, monitoring and response system.

This guideline is therefore developed to ensure that foodborne diseases surveillance and response system are in place and are integrated with the disease surveillance and response system and structure currently implemented in the country. The manual will also look at a One Health approach to foodborne disease surveillance and response. Therefore, this document should not be used in isolation but alongside the technical guideline of the National Integrated Disease Surveillance and Response (IDSR), National Animal Disease Information System (NADIS) and Integrated National Environmental Health Surveillance System (INEHSS).

1.4 Challenges of Foodborne Disease Surveillance and Response

The horizontal and vertical communication between responsible agencies of government – especially across the One Health spectrum – has been lacking coordination for proper surveillance and response to foodborne diseases. It is important to note that the approach to surveillance of foodborne diseases is currently done on a case-by-case basis and needs to be linked with the current disease surveillance system and structure in the country. The lack of published food monitoring data across the entire food chain from farm to table is also of great concern.

Nigeria being a federated state, also have the challenge of different Sub-National Governments having the power to develop their respective disease surveillance and response system at their own pace – usually dictated by the priorities of the political class.

Challenges also abound within the scientific and technical capacities of responsible agencies in identifying and sequencing foodborne disease-causing organisms or chemicals. The poor capacity of laboratory personnel and poor infrastructure (power, ICT equipment) are also of great challenge. A summarised view of the challenges is in Figure 1 below.

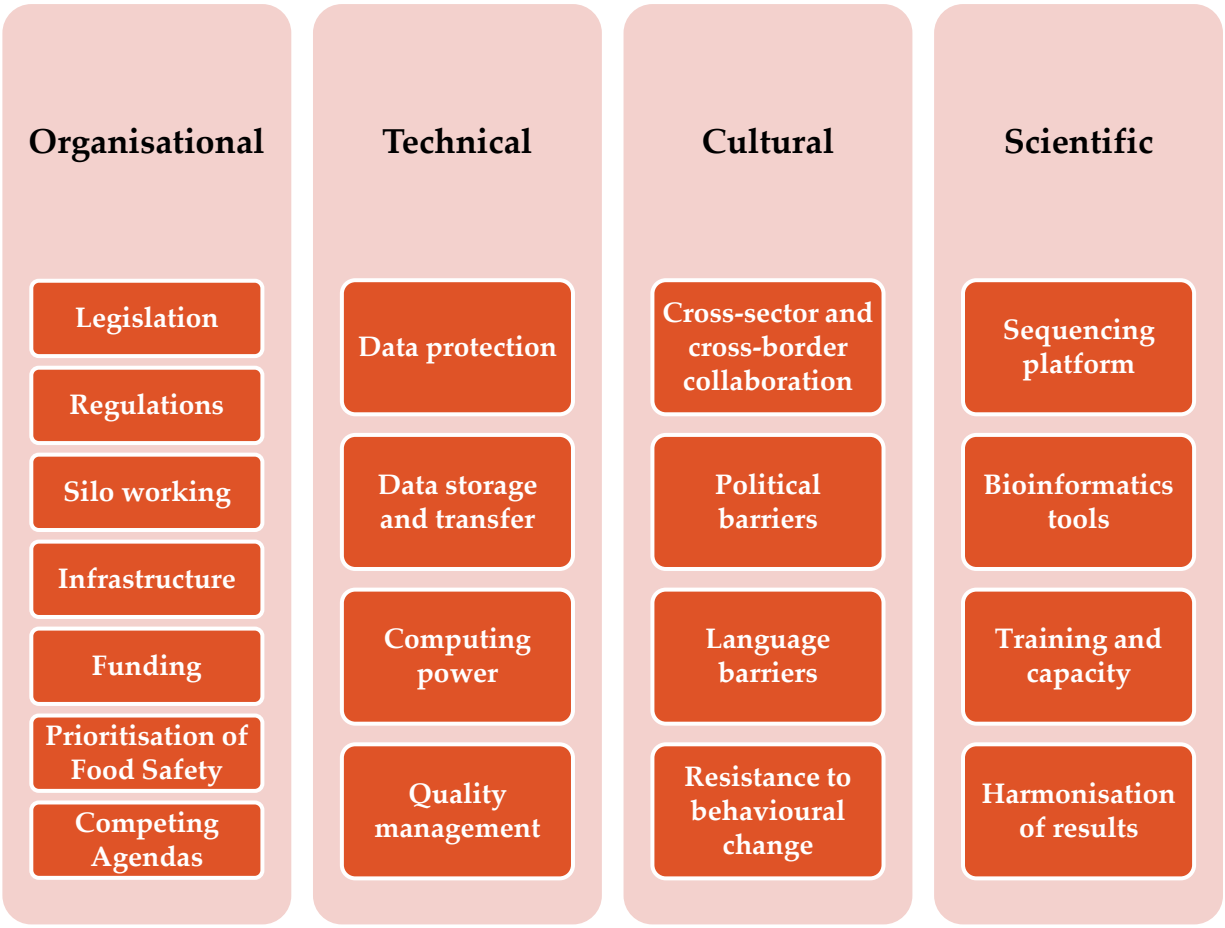


Figure 2: Challenges in foodborne disease surveillance and response

1.5 To whom this Manual is Intended

This manual is intended for technical officers who are responsible for the implementation of disease surveillance and response in the county. Of particular importance are the following:

Federal Level

1. Public Health Surveillance officers
2. Veterinary Surveillance officers
3. Environmental Health officers
4. International Food Safety Network (INFOSAN) Emergency Contact Point and Focal Points
5. International Health Regulation (IHR) Focal Point
6. World Organisation for Animal Health (WOAH) Focal Point
7. Health Management Team
8. Medical and Nursing officers
9. Veterinary Inspectors
10. Fisheries Inspectors
11. Food regulators

12. Food professionals' regulators
13. Health professional regulatory authorities
14. Food business operators
15. Public health officers and administrators
16. Laboratory personnel
17. Medical laboratory scientists
18. Higher education institutions
19. Port Health Officers
20. Health records officers
21. Agricultural quarantine officers

State and LGA levels

1. State Epidemiologist
2. Food Safety focal person
3. Laboratory personnel
4. Medical officers
5. Nursing officers
6. Medical laboratory scientists
7. Environmental Health Officers (EHOs)
8. Health Education Officers
9. Disease Surveillance and Notification Officers (DSNOs)
10. Community Health Extension Workers (CHEWs)
11. Area Veterinary Officers
12. State Animal Health/Epidemiology Officers
13. Meat Inspectors
14. Community Animal Health Workers (CAHWs)
15. Community Pharmacists
16. Food industry managers
17. Food business operators/owners (FBOs)
18. Community Leaders
19. School administrators
20. Security Officers

External Partners and Non-Governmental Organisations

1. World Health Organization (WHO)
2. Food & Agriculture Organization of the United Nations (FAO)

3. United Nations Environment Programme (UNEP)
4. World Organisation for Animal Health (WOAH)
5. World Fisheries Organization
6. Africa Union-Inter African Bureau for Animal Resources (AU-IBAR)
7. Africa Centre for Disease Control (ACDC)
8. Africa Field Epidemiologist Network (AFENET)
9. International Food Safety Authorities Network (INFOSAN)

1.6 Monitoring and Evaluation of Surveillance and Response

Monitoring and evaluation of surveillance and response systems are essential for assessing the success of the intervention given further action and systems improvement. Information on timely reporting from one level to another, the quality of data and the quality of routine prevention and control activities will be used for the routine monitoring and annual evaluation of surveillance and response systems.

The progress of the surveillance and response system may be monitored using the 2019 FAO and WHO-published food control system assessment tool[8]

[8] FAO/WHO Food control system assessment tool, dimension B: control functions 2019

SECTION 2 – DEFINITION OF FOOD SAFETY EMERGENCY AND PRIORITISATION OF FOODBORNE DISEASES

2.1 Defining Food Safety Emergency

In defining food safety emergencies, this document will adopt the Codex Alimentarius definition[9], which defines a "food safety emergency" as:

> ***"a situation, whether accidental or intentional, that is identified, by a competent authority as constituting a serious, and as yet uncontrolled, foodborne risk to public health that requires urgent action."***

This definition by Codex applies to a broad range of food safety emergencies. It is widely known that food safety events can range from minor incidents to major crises, and the judgement of the competent authority is essential to define what constitutes a food safety emergency. Several factors can influence the scale of approach to food safety emergencies. This may include:

1. number of people ill;
2. the severity of illness;
3. distribution and volumes of food;
4. whether the contaminant is known or unknown; and
5. international and trade implications.

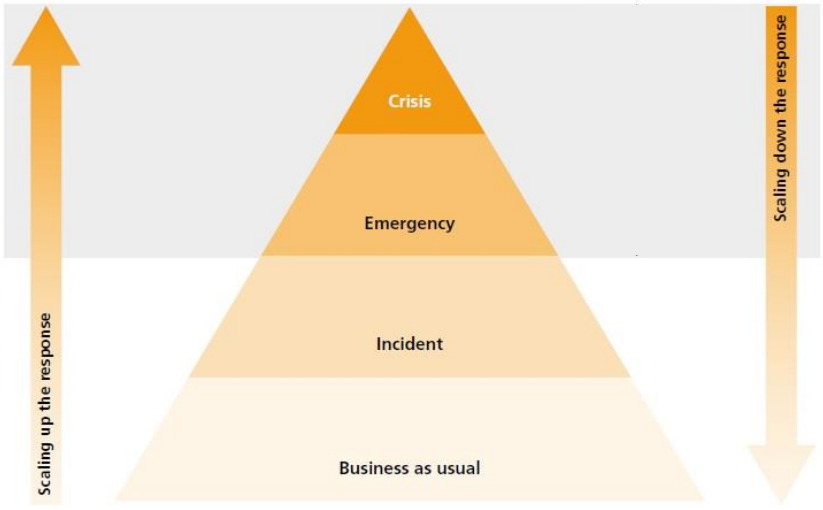


Figure 3: Scalability of responses to food safety events[10]

[9] Codex principles and guidelines for the exchange of information in food safety emergency situations (CAC/GL 19-1995, Rev.1-2004).

[10] FAO/WHO framework for developing national food safety emergency response plans 2010

2.2 Prioritising Nigeria Foodborne Diseases

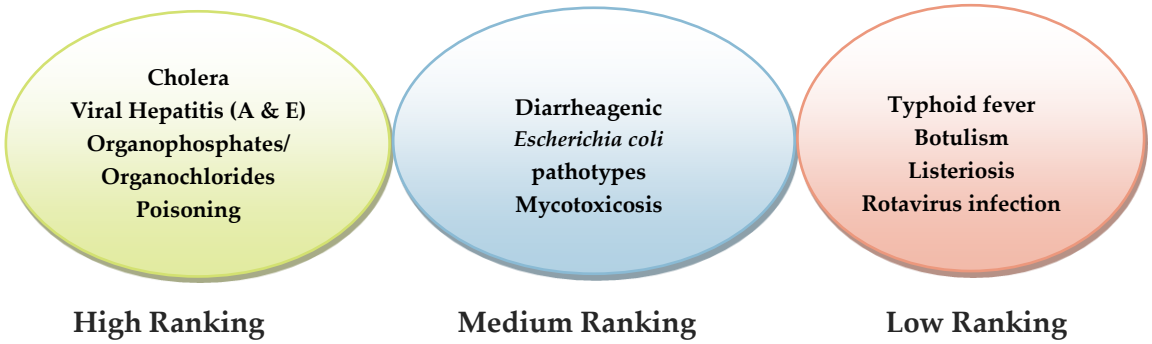
Many different disease-causing agents – biological and chemical – can contaminate foods and cause various types of infections. Research across the world has named over 200 foodborne diseases caused mostly by bacteria, viruses, and parasites[11]. However, toxins and hazardous chemicals can also contaminate foods and lead to foodborne diseases. Due to the high number of known foodborne diseases, countries are expected to rank and prioritise foodborne diseases based on their overall public health impact on the population.

The published report on the assessment of foodborne disease surveillance and response system in Nigeria[12] identified some priority biological foodborne diseases of utmost importance as well as the 2021 published prioritised zoonotic diseases of public health significance[13]. These recommended diseases have been prioritised in addition to known chemical foodborne diseases of importance in the country with consideration of the current food safety practices in the country.

A Multi-Criteria Decision Analysis (MCDA) adapted from the FSA 2021 prioritisation methodology[14] was used to rank twenty foodborne diseases. However, due to the paucity of data in the country on the number of annual cases/fatalities and quality of adjusted life years of known foodborne diseases, senior food safety stakeholders and professionals across the Health, Agriculture, Environment and Academia used four different weighted criteria to prioritise the foodborne diseases.

i. Severity
ii. Economic cost to society
iii. Public concern
iv. Scientist concern

The ranking result showed the following:



[11] See a list of some of the commonly known Foodborne Diseases in Annexe 6
[12] A Report of the Assessment of Foodborne Disease Surveillance and Response System in Nigeria, 2021
[13] Prioritization of zoonotic diseases of public health significance in Nigeria using the one-health approach
[14] Prioritising Foodborne Disease with Multi-Criteria Decision Analysis

2.3 Official List of Priority Foodborne Diseases in Nigeria

Table 1: Summarised ranking score for each of the priority foodborne diseases

S/N	Foodborne Disease	Severity	Economic Cost to Society	Public Concern	Scientist/ Stakeholder Assessment	Total Score	Final Ranking
1	Cholera (*Vibrio cholerae*)	5	5	5	4	19	1
2	Viral Hepatitis (A & E)	5	5	3	4	17	=2
3	Organophosphates/ Organochlorides Poisoning	4	4	4	5	17	=2
4	Diarrheagenic *Escherichia coli* pathotypes	5	4	3	4	16	=4
5	Mycotoxicosis	5	4	2	5	16	=4
6	Lassa Fever	5	4	4	3	16	=4
7	Typhoid fever (*Salmonella typhi* and *paratyphi*)	5	4	3	3	15	=7
8	Botulism (*Clostridium botulinum*)	5	5	1	4	15	=7
9	Listeriosis (*Listeria monocytogenes*)	5	5	1	4	15	=7
10	Rotavirus infection	5	4	2	4	15	=7

Ranking Legend

5 *- Very High* ***4*** *- High* ***3*** *- Moderate* ***2*** *- Low* ***1*** *- Very Low*

= indicates these FBDs all have the same score.

2.4 Priority Foodborne Disease Categorization

Biological

1. Cholera (*Vibrio cholerae*)
2. Viral Hepatitis (A & E)
3. Diarrheagenic *Escherichia coli* pathotypes
4. Lassa Fever
5. Typhoid fever (*Salmonella typhi* and *paratyphi*)
6. Botulism (*Clostridium botulinum*)
7. Listeriosis (*Listeria monocytogenes*)
8. Rotavirus infection

Chemical

9. Organophosphates/Organochlorides Poisoning
10. Mycotoxicosis (Mycotoxins)

These prioritisation lists should be reviewed and revised every three years to ensure the right foodborne diseases are listed in the country's surveillance system.

SECTION 3 – INTEGRATED FOODBORNE DISEASE SURVEILLANCE SYSTEM GUIDELINE

3.1 Introduction

In recent years, Nigeria has established a functional disease surveillance system for priority diseases within the human health sector. However, the diseases in the Technical Guideline on Integrated Disease Surveillance and Response produced by the Nigeria Centre for Disease Control (NCDC) and currently being used as a template for surveillance across the country do not specifically address foodborne diseases asides from Cholera and Typhoid fever. However, foodborne disease is mentioned in the document but not in the specificity required for foodborne disease surveillance and response.

The Integrated Disease Surveillance and Response (IDSR) system has two well-defined types of disease surveillance – indicator and event-based surveillance to ensure the early detection of priority diseases. Therefore, regarding foodborne disease surveillance in the human health sector, this document will leverage the existing surveillance system in NCDC to rapidly ensure that foodborne disease surveillance is strengthened in the country. This guideline document will also adopt both indicator and event-based surveillance systems as part of an integrated foodborne disease surveillance system that will maximise the amount of data generated and lead to actions that will control or prevent foodborne diseases.

In the animal health sector, there is a parallel surveillance system for priority animal diseases of public health concern. The Federal Ministry of Agriculture and Rural Development (FMARD), through the Department of Veterinary and Pest Control Services, receives periodic and monthly reports from all 36 States and FCT on animal disease surveillance. The reporting is mobile and web-based and has been validated and adopted by stakeholders, and is ready for deployment, though the National Animal Disease Information Service (NADIS) is expected to ensure a seamless transfer and analysis of animal health data[15].

The environmental health sector, domiciled in the Federal Ministry of Environment (FMEnv), has recently developed the Integrated National Environmental Health Surveillance System (INEHSS) for identifying key stressors on the environment, to assess the state of the environment, especially as it affects foodborne disease contamination.

Also, processed and packaged foods are currently being monitored periodically by the National Agency for Food and Drug Administration and Control (NAFDAC) through their Post Market Surveillance Programme.

[15] A Report of the Assessment of Foodborne Disease Surveillance and Response System in Nigeria, 2021

3.2 The Goal of Integrated Foodborne Disease Surveillance System[16]

The **main goal** of the integrated surveillance system is –

"To have a one-health centred integrated food chain surveillance for a foodborne disease that takes into account all stakeholders involved and the location of data sources."

The **specific objectives** are:

1. To create awareness of foodborne diseases,
2. To detect and respond to foodborne disease emergencies,
3. To help in the rapid implementation of control measures,
4. To monitor trends to understand the epidemiology of foodborne diseases (e.g., the geographical distribution of diseases, seasonality, and vulnerable populations),
5. To understand the impact and burden of foodborne disease in the country,
6. To improve research on foodborne diseases,
7. To link food sources to specific foodborne diseases,
8. To inform clinical management policy, where appropriate, e.g., on antimicrobial resistance,
9. To monitor and evaluate interventions and measures taken to control foodborne diseases, and
10. To collaborate with other relevant sectors, contributing and sharing data from the surveillance and response system to help generate risk profiles.

To ensure a one-health approach towards the integration of the food surveillance system for Nigeria, a multi-sectoral team that will include the human, animal, and environmental health systems must work together and share surveillance information. This information will help with conducting informed routine risk analysis to identify strategies for controlling and preventing foodborne diseases in humans.

Nigeria being a federated state, this guideline will propose a team of representatives from each of the relevant sectors – at the federal level – to form a team to lead the integrated food surveillance system. The organisational membership of the team is proposed as follows:

1. Health Sector
    a. Department of Food & Drug Services - Food Safety & Quality Programme
    b. Nigeria Centre for Disease Control and Prevention
    c. National Agency for Food and Drug Administration and Control

[16] Adapted from Strengthening surveillance of and response to foodborne diseases, WHO, 2017

2. Agriculture Sector
    a. Federal Department of Veterinary & Pest Control Services
    b. Federal Department of Agriculture
    c. Federal Department of Fisheries and Aquaculture
    d. Nigeria Agricultural Quarantine Services
    e. National Veterinary Research Institute
    f. Veterinary Council of Nigeria
3. Environment Sector
    a. Department of Pollution Control & Environmental Health
    b. Environmental Health Council of Nigeria
    c. Nigerian Environmental Standard Regulation Enforcement Agency
4. Science & Technology Sector
    a. Department of Health and Biomedical Sciences
    b. Nigerian Council of Food Science and Technology.
5. Trade Sector
    a. Federal Produce Inspection Service
    b. Standard Organisation of Nigeria
    c. Federal Competition and Consumer Protection Commission

The team should report its activities to the National Food Safety Management Committee (NFSMC) during its quarterly meetings.

Each State should establish a team with representatives from the relevant sectors who have detailed knowledge of how data is collected in human, animal, environmental, and food sectors. Appropriate trainings are recommended where subject knowledge is lacking.

3.3 Steps to Establish Coordination for Integrated Foodborne Disease Surveillance[17]

To achieve the main objectives of an integrated foodborne disease surveillance system, the following are the steps to adapt:

1. Determine the animal species and food types to be included;
2. Identify appropriate hazards for integrated foodborne disease surveillance;

[17] Adapted from WHO Stage 3 booklet on Strengthening surveillance of and response to foodborne diseases

3. Identify data sources;
4. Create a database within the human health, animal health, environmental health, and food control sectors;
5. Ensure multisectoral data analysis and interpretation;
6. Publish and/or disseminate periodic surveillance bulletin.

3.3.1 Step 1 – Determine the animal species and food types to be included.

Realistically, it is financially tough to include all animal species and all food types for surveillance. It is, therefore, important that the food surveillance team identify and justify the selection of food types (i.e., chicken, beef, milk, beans, rice etc.) to be included in the integrated foodborne disease surveillance. The same must be done for the animal species required for surveillance. The animal species should correspond to the retail meats that are part of food monitoring programmes (i.e., if **pork** is monitored, **pigs** are expected to be monitored as well).

The team should also determine if imported food should be monitored alongside locally made foods.

3.3.2 Step 2 – Identify appropriate hazards for integrated foodborne disease surveillance.

The hazards to be identified will be derived from the priority foodborne disease and hazard list in section 2. However, the team will be able to decide on the final list as applicable based on logistical and testing capabilities in the country. It is also important to note that the testing methods for food samples are quite different from those used for specimens from humans and animals. Therefore, isolates from all sectors should be further characterised using internationally recognised procedures that will allow for comparison of results between sectors. The table below is a tool to list each hazard and the laboratory methods used for testing in each sector. An SOP for harmonising methodologies should be developed.

Table 2: Tool for documenting hazards under surveillance in each sector

Pathogen/ Hazard	Testing Method	Human Health Sector		Food Sector		Animal Health Sector		Environmental Health Sector	
		Routine	Ad hoc	Routine	Ad hoc	Routine	Ad hoc	Routine	Ad hoc
Salmonella									
	Nucleic acid testing								
	Culture								
	Serotyping								
	Phage typing								
	etc.								
L. monocytogenes									
	Culture								
	Serotyping								
	Whole genome sequencing								
	etc.								
Aflatoxin									
	HPLC								
	Lateral flow tests								
	etc.								

3.3.3 Step 3 – Identify data sources.

For an integrated surveillance system, data will be received from the Integrated Disease Surveillance and Response (IDSR) system (inclusive of the priority foodborne diseases in section 2), the food monitoring system, the National Animal Disease Information Service (NADIS) system and the Integrated National Environmental Health Surveillance System (INEHSS).

Data from NADIS should specify the animal species, whether it is farmed, nomadic, or wild, sick, or dead, carcass at the slaughterhouse or the environment etc.

Data from food monitoring should specify the type of food, where the distribution chain was sampled (e.g., farm, retail, packing, distribution, market) and whether the food was locally produced or imported.

3.3.4 Step 4 – Create a database within the human, animal, and environmental health as well as food control sectors.

A secure central database should be created to house the data from each sector. All sectors involved must agree and document the following data transfer mechanisms:

1. The type of transfer (e.g., electronic, or paper-based);
2. Frequency of data transmission; and

3. The data fields to be sent to the database.

The following must be the minimum data requirements for each sector for the submission of data for an integrated food surveillance system.

1. Human health data to include:
    a. Unique identifier;
    b. Date of sample collection;
    c. Date of sample submission;
    d. Sample type (this should have a standard categorisation)
    e. Date of onset of illness;
    f. Details of the patient (e.g., age, address, gender);
    g. Type of case (e.g., sporadic or outbreak); and
    h. Appropriate laboratory testing characterisation.
2. Food monitoring data to include:
    a. Unique identifier;
    b. Date of sample collection;
    c. Date of sample submission;
    d. Food type (this should have a standard categorisation);
    e. Location of sample collection (e.g., open market, roadside, farm gate, store);
    f. Address of sample collection (specific address, may include GPS if available);
    g. Context for collection (e.g., routine monitoring or outbreak sample); and
    h. Appropriate laboratory testing characterisation;
3. Animal health data to include:
    a. Unique identifier;
    b. Date of sample collection;
    c. Date of sample submission;
    d. Type of sample (this should have a standard categorisation);
    e. Species of animal from which the sample was collected;
    f. Context for collection (e.g., routine monitoring, diagnostic samples for sick or dead animals, outbreak investigation);
    g. Location of sample collection (e.g., farm, domestic area, abattoir);
    h. Address of sample collection (specific address, may include GPS if available);
    i. Appropriate laboratory testing characterisation.
4. Environmental health data to include:
    a. Unique identifier;

b. Date of sample collection;
c. Date of sample submission;
d. Type of sample (this should have a standard categorisation);
e. Location in which the sample was collected (specific address, may include GPS if available);
f. Context for collection (e.g., routine monitoring, outbreak investigation);
g. Appropriate laboratory testing characterisation.

3.3.5 Step 5 – Ensure multisectoral data analysis and interpretation.

This is a vital stage in ensuring an integrated foodborne disease surveillance system. Multisectoral data and analysis may take some time to analyse and interpret to meet the goal of an integrated surveillance system. The team must look through the data together and analyse it to ensure that, over time, foodborne disease emergencies are detected in time or identify clusters that may need further investigation.

Other complex analyses should be conducted over time – when sufficient data analysis is available – such as source attribution (i.e., the proportion of illness due to a particular pathogen that can be attributed to food sources).

3.3.6 Step 6 – Publish and/or disseminate periodic surveillance bulletin.

Following all the above steps, it is important that the analyses done are published in surveillance bulletin periodically by responsible bodies with anonymised data available online – as listed in their roles and responsibilities in annexe 1 – and must include data from all sectors to show that the data from each sector are considered over the same period. The bulletin should also include the address and context of the sample collection.

SECTION 4 – GUIDELINE FOR PRIORITY FOODBORNE DISEASES SURVEILLANCE

4.1 Introduction

This section describes how to:

1. Take action to respond to alert and epidemic thresholds for the identified priority foodborne diseases in Section 2;
2. Identify surveillance goals and objectives for each priority foodborne disease; and
3. Identify data to analyse and interpret for each priority foodborne disease.

This guideline will cover the following areas:

4.1.1 Background – This gives the general information about:

1. The disease or event, the causative agent, geographic range affected, incubation period, and other epidemiological information.
2. Transmission routes such as person-to-person, unprotected contact with infectious body fluids or contaminated materials, vector-borne, and so on.
3. Why the disease is a priority disease for surveillance. For example, the disease is responsible for a high number of deaths, disabilities, and illnesses, especially in African countries.
4. Any additional background information that might serve the district surveillance team.

4.1.2 Surveillance goal – This area will state how the surveillance information should be used for action.

4.1.3 Standard case definition – This area will define what suspected and confirmed cases are for each priority disease.

4.1.4 Food Source – this area will list the most likely food sources associated with the disease. This will help clinicians, epidemiologists, and food regulators in ensuring that the diseases are appropriately linked to the food source and stop the spread of the disease in case of an outbreak.

4.1.5 Analyse and interpret data – This area contains generic information about the minimum data elements to collect, analyse and interpret. The key points to consider for analysing and interpreting data are time, place, and person.

4.1.6 Laboratory confirmation – In this area, guidelines on laboratory confirmation are provided, including relevant diagnostic tests, specimen types, how to collect, store and transport the specimens needed for lab confirmation, and information on the results of laboratory work.

4.2 Response to Alert and Action Threshold

4.2.1 Response to alert threshold

For priority Foodborne diseases, an outbreak or event is suspected when there is any unusual cluster, pattern, or increase in the number of cases when compared with previous periods. This should prompt a response such as investigating clusters and identifying what might have caused the unusual events. If laboratory confirmation is needed, specimens should be collected for laboratory confirmation.

4.2.2 Response to action threshold

For priority Foodborne diseases, a confirmed outbreak should prompt an appropriate response such as strengthening case management, providing information, education, and communication about preventing and controlling the disease, investigating to identify the source of the outbreak, activating the recall process (if appropriate), linking the foodborne disease to a particular food for destruction or repurposing for other use aside consumption by human or animal.

4.3 Cholera

Background
• Acute illness with profuse watery diarrhoea caused by *Vibrio cholerae* serogroups O1 or O139. The disease is transmitted mainly through the faecal-oral route, that is, through eating or drinking contaminated food or water. • Cholera causes over 100,000 deaths per year. It may produce rapidly progressive epidemics or worldwide pandemics. In endemic areas, sporadic cases (less than 5% of all non-outbreak related diarrhoea cases) and small outbreaks may occur. • The incubation period is from a few hours to 5 days, usually in the range of from 1 to 3 days. • There has been a resurgence of cholera in Africa since the mid-1980s, where over 80% of the world's cases occurred in 1999. Most cases occurred from January through April. In 2016, globally, 38 countries reported a total of 132 121 cases. Of cases reported globally, 54% were from Africa, 13% from Asia and 32% from Hispaniola. Imported cases were reported in 9 countries. • Cholera may cause severe dehydration in only a few hours. In untreated patients with severe dehydration, the case fatality rate (CFR) may exceed 50%. If patients present at the health facility and correct treatment is received, the CFR is usually less than 1%. At least 90% of the cases are mild, and they remain undiagnosed.
Surveillance goal
• Detect and respond promptly and appropriately to cases and outbreaks of watery diarrhoea. To confirm an outbreak, collect and transport stool specimens transported in Cary-Blair medium. • Do immediate case-based reporting of cases and deaths when an outbreak is suspected. • Identify the outbreak source and take the necessary regulatory process to remove the source from public access.
Food Source
Seafood, fruits, vegetables, water, cooked and contaminated food, ice cubes etc
Standard case definition
Suspected cholera case: In areas where a cholera outbreak has not been declared, any patient aged two years and older presenting with acute watery diarrhoea and severe dehydration or dying from acute watery diarrhoea. In areas where a cholera outbreak is declared, any person presenting with or dying from acute. watery diarrhoea.

Confirmed cholera case: A suspected case with *Vibrio cholerae* O1 or O139 confirmed by culture or polymerase chain reaction (PCR).	
Respond to the alert threshold.	
If cholera cases are suspected: Report case-based information to the appropriate levels. As necessary, treat and manage the patient(s) with supportive care. Collect specimens and send them to the laboratory to identify the aetiology of the illness.	
Respond to action threshold.	
If cholera cases are confirmed • Determine the mode of transmission. • Identify the population exposed to the risk of infection. • Eliminate common source(s) of infection. • Implement appropriate prevention and control interventions	
Analyse and interpret data	
Time: Graph weekly cases and deaths and construct an epidemic curve during outbreaks. Report case-based information immediately and summarise information monthly for routine surveillance. **Place:** Plot the location of case households. **Person:** Count weekly total cases and deaths for sporadic cases and during outbreaks—Analyse the distribution of cases by age and according to sources of drinking water. Assess risk factors to improve control of sporadic cases and outbreaks.	
Laboratory confirmation	
Diagnostic test	Isolate *V. cholerae* from stool culture and determine the O1 serotype using polyvalent antisera for V. cholerae O1. If desired, confirm identification with Inaba and Ogawa antisera. If the specimen is not serotypeable, consider *V. cholerae* O139 (see note in Results column).
Specimen	Liquid stool or rectal swab
References	
• National Technical Guideline for IDSR, 2019 • The Microbiology of Safe Food, 2010	

4.4 Viral Hepatitis A and Viral Hepatitis E

Background

- Enterically transmitted HAV and HEV are a global problem. Infection is common in low- and middle-income countries with poor sanitary conditions and hygienic practices,
- Common source epidemics have been related to contaminated water and contamination via infected food handlers. Genotypes 3 and 4 of the human pathogens of HEV are prevalent at a high level in swine herds globally, which can be the source of transmission through pork/pig handling and consumption.
- In general, both HAV and HEV are self-limiting viral infections; case fatality is normally low (0.1 – 0.3%).
- Women in the third trimester of pregnancy are especially susceptible to fulminant HEV disease, and research has shown that up to 20% - 25% may die from the infection.
- Both HAV and HEV are transmitted via the faecal-oral route.
- Symptoms of HAV range from mild to severe and can include fever, malaise, loss of appetite, diarrhoea, nausea, abdominal discomfort, dark-coloured urine, and jaundice.
- Symptoms of HEV include an initial phase of mild fever, anorexia, nausea and vomiting lasting for a few days; abdominal pain, itching, skin rash, or joint pain; jaundice, dark urine, and pale stools; and hepatomegaly.
- Prevention and control measures for hepatitis A and hepatitis E include adequate supplies of safe drinking water and improvement of sanitary and hygienic practices to eliminate faecal contamination of food and water.

Surveillance goal

- Detect hepatitis outbreaks.
- Identify the outbreak source and take the necessary regulatory process to remove the source from public access

Food Source

Raw vegetables, fruits, water, shellfish and uncooked or undercooked pork,

Standard case definition

Suspected case: Any person with acute illness typically includes acute jaundice, dark urine, anorexia, malaise, extreme fatigue, and right upper quadrant tenderness. (Note: infected children are often asymptomatic.)
Confirmed case: A suspected case that is laboratory confirmed

Respond to the alert threshold.

If hepatitis cases are suspected:
Report case-based information to the appropriate levels.
As necessary, treat and manage the patient(s) with supportive care.
Collect specimens and send them to the laboratory to identify the aetiology of the illness.

Respond to action threshold.

If hepatitis cases are confirmed

- Determine the mode of transmission.
- Identify the population exposed to the risk of infection.
- Eliminate common source(s) of infection.
- Implement appropriate prevention and control interventions

Analyse and interpret data

Time: Analysis of suspected and confirmed cases by week. Graph cases and deaths weekly. Construct an epidemic curve during outbreaks.
Place: Plot location of case households.
Person: Analyse by age and gender. Assess risk factors to plan and monitor prevention and control measures.

Laboratory confirmation

Diagnostic test	**Hepatitis A: IgM anti-HAV positive** **Hepatitis E:** IgM anti-HEV positive and/or IgG anti-HEV positive
Specimen	Serum, stool

References

- **National Technical Guideline for IDSR, 2019**

- **Krog Jesper S. et al. (2019) Tracing Hepatitis E Virus in Pigs from Birth to Slaughter, Frontiers in Veterinary Science, Vol 6. https://doi.org/10.3389/fvets.2019.00050**
- **The Microbiology of Safe Food, 2010**

4.5 Organophosphates/Organochlorides Poisoning

Background

- Organophosphates comprise a wide range of compounds, including insecticides, herbicides, fungicides, and others used worldwide in agriculture as well as for domestic purposes.
- Organochlorine pesticides are synthetic pesticides that belong to the group of chlorinated hydrocarbon derivatives and are widely used in the chemical industry and agriculture. These compounds are known for their high toxicity, slow degradation, and bioaccumulation.
- The persistent use of pesticides for subsistent agricultural production (at production and storage) has led to increased pollution of environmental compartments – soil, water, and air.
- Organophosphates include: *Dimefox, Mipafox, Methyl Parathion, Ronnel, enitrothion, Bidrin, Phorate, Fenthion, caumphos, Abate, Dichlorovas, Diptrex, Phosphomidon, Demetox, Oxydemeton-methyl, Malathion, Dimethoate, Trichlorofan* etc.
- Organochlorine includes *DDT, DDD, Dicofol, Eldrin, Dieldrin, Chlorobenziate, Lindane, BHC, Methoxychloro Aldrin, Chlordane, Heptachlor, Endosulfan, Isodrin, Isobenzan, Toxaphene, Chloro propylate.*
- A lot of these pesticides have been banned in the country but are still being used illegally as cheaper alternatives in agriculture production.
- Symptoms may consist of a cholinergic syndrome of excess respiratory and oral secretions, diarrhoea and vomiting, diaphoresis, convulsions, altered mental status, miosis, bradycardia, and generalised weakness that can progress to paralysis, respiratory arrest, and death.

Surveillance goal

- Detect OP/OC sporadic cases and/or outbreaks.
- Identify the outbreak source and take the necessary regulatory process to remove the source from public access

Food Source

Ingestion of contaminated fruit, flour, grains, vegetables, cooking oil etc.

Standard case definition

Suspected case: Any person with a history of exposure, clinical manifestations of OP/OC poisoning and low serum pseudocholinesterase activity or an epidemiologic link exists between this case and a laboratory-confirmed case.
Confirmed case: A suspected case that is laboratory confirmed

Analyse and interpret data

Time: Analysis of suspected and confirmed cases by day/week. Graph cases and deaths daily/weekly. Construct an epidemic curve during outbreaks.
Place: Plot location of case households.
Person: Analyse by age and gender. Assess risk factors to plan and monitor prevention and control measures.

Laboratory confirmation

Diagnostic test	Detection of red blood cell (RBC) acetylcholinesterase (AChE) and plasma (pseudo) cholinesterase (PChE) using **Test-mate ChE field test©**
Specimen	Whole blood or plasma

References

- Jayaraj, R., Megha, P., & Sreedev, P. (2016). Organochlorine pesticides, their toxic effects on living organisms and their fate in the environment. Interdisciplinary Toxicology, 9(3-4), 90-100.
- CDC (2018) Case Definition: Nerve Agents or Organophosphates.
- Medscape (2023) Organophosphate Toxicity Workup

4.6 Diarrheagenic *Escherichia coli* pathotypes

Background

- *Escherichia coli* (E. coli) is a bacterium commonly found in the lower intestine of humans and warm-blooded organisms. Most *E. coli* strains are harmless, but some can cause serious food poisoning.
- Pathogenic E. coli is a gram-negative, non-spore-forming facultative anaerobe from the family *Enterobacteriaceae*. There are six recognised pathogenic groups, namely: Enterohaemorrhagic *E. coli* (EHEC), Enterotoxigenic *E. coli* (ETEC), Enteropathogenic *E. coli* (EPEC), Enteroinvassive *E. coli* (EIEC), Enteroaggregative *E. coli* (EAggEC), and Diffusely adherent *E. coli* (DAEC).
- EHEC is associated causes bloody diarrhoea, haemolytic uraemic syndrome (HUS), and thrombic thrombocytopenia purpura (TTP). This group includes the Shiga-toxin-producing *E. coli* (STEC), serotypes O157:H7, O26:H11 and O111:NM.
- ETEC causes watery diarrhoea and a low-grade fever. ETEC occupies the proximal small intestine.
- EPEC also causes watery diarrhoea among infants, vomiting, fever, and sometimes watery diarrhoea with mucus but no blood. It occupies the microvilli of the entire intestine.
- EIEC causes fever and profuse diarrhoea containing mucus and streaks of blood. It occupies the colon.
- EAggEC causes persistent watery diarrhoea, especially in children that last for more than 14 days. It adheres to the intestinal mucosa resulting in secretory diarrhoea and mucosal damage. It is also associated with malnutrition and growth retardation.
- DAEC, in some literature, has been linked with diarrhoea. The pathogenesis and pathogenicity of the strains are still being debated. However, it is thought to be age-dependent and primarily in children of ages 2-6 years.

Surveillance goal

- Detect diarrheagenic *E. coli* pathotypes outbreaks.
- Identify the outbreak source and take the necessary regulatory process to remove the source from public access

Food Source

- All foods contaminated by human sewage or by infected food handlers.
- Beef, poultry, apple juice, raw milk, vegetables, cantaloupes (sweet melon), mayonnaise etc.

Standard case definition

Suspected case:

- Any person with an infection of variable severity characterized by diarrhoea (often bloody or mucosal) and/or abdominal cramps. Illness may be complicated by HUS/TTP.

Confirmed case: A suspected case that is laboratory confirmed

Analyse and interpret data

Time: Analysis of suspected and confirmed cases by week/month. Graph cases and deaths weekly/monthly. Construct an epidemic curve during outbreaks.
Place: Plot location of case households.
Person: Analyse by age and gender. Assess risk factors to plan and monitor prevention and control measures.

Laboratory confirmation

Diagnostic test	**EHEC:** • Identification of an elevated antibody titer against a known Shiga toxin-producing serogroup of E. coli, or • Detection of Shiga toxin or Shiga toxin genes. **EHEC, ETEC, EPEC, EIEC, EAggEC** • Detection of ETEC, EPEC, EIEC, and EAggEC in a clinical sample using a culture-independent diagnostic test (CIDT)such as PCR.
Specimen	Stool

References

- **CDC (2021) Shiga Toxin-producing *Escherichia coli* (STEC). 2018 Case Definition.**
- **The Microbiology of Safe Food, 2010**
- **WHO Factsheet on *E. coli* (2018)**

4.7 Mycotoxicosis (Mycotoxins)

Background

- Foodborne mycotoxicosis is an acute and chronic toxic disease caused by the consumption of foods contaminated with mycotoxins. There are more than 100 toxigenic fungi and more than 300 compounds now recognised as mycotoxins. The occurrence of mycotoxins in foods is most caused by preharvest contamination of plants by toxigenic fungi. In addition, stored grains affected by moisture may provide suitable habits for the growth of toxigenic fungi.
- Toxigenic fungi of the highest public health significance are *Aspergillus spp,* which produces aflatoxins (in maize, groundnuts, and milk) and cyclopiazonic acid (in cheese, maize, and groundnut).
- Other notable mycotoxins produced by *Penicillium sp.* and *Fusarium sp*. are fumonisin, ochratoxin, patulin and zearalenone.
- Mycotoxicosis targets organs, and the outcome depends on the intrinsic toxicity of the mycotoxin and the quantity and length of exposure, and the health status of the patient. There are four types of mycotoxin toxicity – acute (resulting in liver or kidney damage), chronic (resulting in liver cancer), mutagenic (causing DNA damage) and Teratogenic (causing cancer in unborn child).

Surveillance goal

- Detect mycotoxicosis sporadic cases and outbreaks promptly.
- Identify the outbreak source and take the necessary regulatory process to remove the source from public access.

Food Source

Maize, sorghum, wheat, millet, rice, coffee beans, apple juice, apples, nuts, tomato paste, and cheese

Standard case definition

Suspected case:
Any person who reports a suspected poisoning by a particular chemical agent but no specific credible threat exists.

Confirmed case:
Any patient meeting the suspected case and laboratory criteria

Analyse and interpret data

Time: Graph cases and deaths monthly.
Place: Plot distribution of case households and workplaces.
Person: Count monthly cases and deaths. Analyse age and sex distribution quarterly.

Laboratory confirmation

Diagnostic test	Advanced mass spectrometry
Specimen	Urine, nasal secretions, sputum, or tissue biopsy

References

- **WHO Factsheet on Mycotoxins (2018)**
- **The Microbiology of Safe Food, 2010**

4.8 Lassa Fever

Background

- Lassa fever is known to be endemic in Guinea, Liberia, Nigeria, and Sierra Leone but probably exists in other West African countries as well. Some studies indicate that 300,000 to 500,000. Lassa Fever cases with 5,000 deaths occur each year in West Africa
- The animal reservoir of the Lassa virus is a rodent of the genus *Mastomys*. *Mastomys* rats infected with the Lassa virus do not become ill but shed the virus in their excreta (urine and faeces), and humans usually become infected through aerosol or direct contact with the excreta of infected rodents. Lassa fever can also be spread between humans through direct contact with the blood, pharyngeal secretions, urine, faeces, or other body secretions of an infected person.
- About 80% of human Lassa fever infections are mild or asymptomatic; the remaining cases have severe multi-system disease. The onset of disease in symptomatic patients is usually gradual, starting with fever, general weakness, and malaise.
- The overall case fatality ratio among hospitalised patients may exceed 50% during outbreaks.

Surveillance goal

- Early detection of cases and outbreaks, rapid investigation, and early laboratory verification of the aetiology of all suspected cases.
- Investigation of all suspected cases with contact tracing.
- Assess and monitor the spread and progress of epidemics and the effectiveness of control measures.

Food Source

All Ready-to-Eat foods exposed to infected *Mastomys* rats' urine and faeces.

Standard case definition

Suspected case:
Any individual presenting with one or more of the following: malaise, fever, headache, sore throat, cough, nausea, vomiting, diarrhoea, myalgia, chest pain, hearing loss and either
a. History of contact with excreta or urine of rodents
b. History of contact with a probable or confirmed Lassa fever case within a period of 21 days of the onset of symptoms OR Any person with inexplicable bleeding/haemorrhage.

Confirmed case:
Suspected case with laboratory confirmation (positive IgM antibody, PCR, or virus isolation)

Analyse and interpret data

Time: Graph cases and deaths daily/weekly.
Place: Plot distribution of case households and workplaces.
Person: Count daily/weekly cases and deaths. Analyse age and sex distribution quarterly. Assess risk factors and plan disease control interventions accordingly.

Laboratory confirmation

Diagnostic test	Presence of IgM antibodies against Lassa Fever
Specimen	***For ELISA:*** Whole blood, serum, or plasma ***For PCR:*** Whole blood or blood clot, serum/plasma, or tissue ***For immunohistochemistry:*** Skin or tissue specimens from fatal cases

References

- **National Technical Guideline for IDSR (2019)**
- **WHO Factsheet on Lassa Fever (2017)**

4.9 Typhoid Fever

Background

- Typhoid fever is a bacterial disease caused by *Salmonella* Typhi. Symptoms usually develop 7 to 28 days after exposure and may be mild or severe. They include high fever, malaise, headache, body aches, constipation or diarrhoea, rose-coloured spots on the chest, and enlarged spleen and liver. A healthy carrier state may follow acute illness.
- Most *S.* Typhi infections are associated with foodborne transmission from meat and dairy products. However, they have been isolated in fruits and vegetables and fruit juices.
- In virtually all endemic areas, the incidence of typhoid fever is highest in children from 5–19 years old. The disease is almost exclusively transmitted by food and water contaminated by the faeces and urine of patients and carriers.
- People can transmit the disease if the bacteria remain in their body; most people are infectious before and during the first week of convalescence, but 10% of untreated patients will discharge bacteria for up to 3 months.
- Typhoid fever can be treated with antibiotics. However, resistance to common antimicrobials is widespread. Healthy carriers should be excluded from handling food.

Surveillance goal

- Detect Typhoid Fever sporadic cases and outbreaks promptly and seek laboratory verification.
- Identify areas/populations at high risk to improve the prevention of the disease by taking hygienic measures.
- Identify the outbreak source and take the necessary regulatory process to remove the source from public access.

Food Source

Raw poultry, water, meat, fish, shellfish, eggs, milk and dairy products, vegetables, fruits, chocolate, coconut, peanuts

Standard case definitions

Suspected case:
Any person with gradual onset of steadily increasing and then persistently high fever, chills, malaise, headache, sore throat, cough, and, sometimes, abdominal pain and constipation or diarrhoea.
Confirmed case:
The suspected case was confirmed by isolation of *Salmonella* Typhi from blood, bone marrow, bowel fluid or stool.

Respond to the alert threshold.

If Typhoid fever cases are suspected:

- Arrange for laboratory testing of stool specimens or rectal swabs of suspected cases, especially in situations where food- or waterborne transmission is suspected.
- Report and investigate all suspected outbreaks of typhoid. Search for a case/carrier that is the source of infection and for the vehicle (water or food) through which the infection is being transmitted.
- Treat typhoid fever patients with antibiotics. Severe cases should be provided with supportive measures such as oral or intravenous hydration, the use of antipyretics, and appropriate nutrition.

Respond to action threshold.

If Typhoid Fever cases are confirmed

- Initiate a line list/register for cases.
- Identify areas/populations at high risk to identify the source(s) and mode(s) of transmission to prevent and control the disease.
- Conduct health education programmes on hygiene with simple messages on safe water, safe food handling practices, hygiene, and hand washing.
- Work with water authorities to support the provision of clean water and proper sanitation to affected population(s). Chlorinate suspected water supplies. All drinking water should be chlorinated or boiled before use.
- More than 90% of patients can be managed at home with oral antibiotics, reliable care and close medical follow-up for complications or failure to respond to therapy. Patients with persistent vomiting, severe diarrhoea and abdominal distension may require hospitalisation and parenteral antibiotic therapy.

Analyse and interpret data	
Time: Graph cases and deaths weekly. Construct an epidemic curve during outbreaks. **Place:** Plot location of case households with precise mapping. **Person:** Report immediate case-based information for cases and deaths. Report summary totals monthly. During an outbreak, count cases and deaths weekly. Analyse by age. Assess risk factors to improve the prevention of outbreaks.	
Laboratory confirmation	
Diagnostic test	Culture: Isolation of *salmonella spp.* from stool or blood of a patient. The WIDAL Test should not be used for diagnostic purposes.
Specimen	Blood/Stool
When to collect	Collected samples, preferably before antibiotics are administrated
How to prepare, store, and transport	5-10 ml of blood is distributed in a blood culture bottle. Stool in stool container. Store specimens at 4-8 C or ambient temperature away from heat and direct sunlight.
Results	**Blood culture:** 4 days to 2 weeks. **Stool:** 3-4 days.
References	
• **National Technical Guideline for IDSR, 2019** • **The Microbiology of Safe Food, 2010**	

4.10 Botulism

Background	
• Foodborne Botulism is caused by a botulinum toxin that is produced by *Clostridium botulinum.* Symptoms usually develop between 12 – 3 hours after ingestion of preformed neurotoxins. The illness may last for 2 hours to 14 days, depending on the dose and vulnerability of the host. • The incidence of botulism is low, but the mortality rate is high if diagnosis and appropriate, immediate treatment are not given. Case fatality is approximately 10%. • Botulinum toxins block nerve functions and can lead to respiratory and muscular paralysis. Symptoms of botulism include blurred or double vision, nausea, vomiting, fatigue, dizziness, headache, dryness in the throat and nose and difficulty in swallowing. • Foodborne botulism is an intoxication usually caused by ingestion of potent neurotoxins, the botulinum toxins, formed in contaminated foods. Person-to-person transmission of botulism does not occur. • There are 7 types of botulinum toxin, types A–G. Types A, B, E and F cause human botulism. Types C, D and E cause illness in animals • *C. botulinum* forms spores that are heat-resistant and exist widely in the environment, and in the absence of oxygen, they germinate, grow, and then excrete toxins and usually contaminate food jars and cans.	
Surveillance goal	
• Detect Botulinum sporadic cases and outbreaks promptly and seek laboratory verification. • Identify the outbreak source and take the necessary regulatory process to remove the source from public access.	
Food Source	
Canned low-acid foods, vegetables, fish and meat products, milk, and milk products etc.	
Standard case definitions	
Suspected case: Any person with acute onset of double vision and nausea with fatigue and nausea who has consumed low-acid canned meat or fish within the last 48 hours. **Confirmed case:** The suspected case is laboratory confirmed or occurs among persons who ate the same food as persons who have laboratory-confirmed botulism.	
Analyse and interpret data	
Time: Graph cases and deaths weekly. Construct an epidemic curve during outbreaks. **Place:** Plot location of case households with precise mapping. **Person:** Report immediate case-based information for only confirmed cases and deaths. Report summary totals monthly. During an outbreak, count cases and deaths weekly. Analyse by age. Assess risk factors to improve the prevention of outbreaks.	
Laboratory confirmation	
Diagnostic test	Detection of botulinum toxin in serum, stool, or food
Specimen	Serum, Stool, or Food
References	
• **WHO Factsheet on Botulism, 2018** • **Lindström, M., & Korkeala, H. (2006). Laboratory diagnostics of botulism. Clinical microbiology reviews, 19(2), 298–314. https://doi.org/10.1128/CMR.19.2.298-314.2006** • **The Microbiology of Safe Food, 2010**	

4.11 Listeriosis

Background

- Listeriosis is one of the most severe foodborne diseases. It is caused by the bacteria *Listeria monocytogenes*. It may also be acquired by the foetus in utero or during delivery.
- Pregnant women, the elderly, children under 5 or individuals with a weakened immune system are at the greatest risk of severe listeriosis.
- *L. monocytogenes* can survive and multiply at refrigeration temperatures. Eating contaminated food with high numbers of *L. monocytogenes* is the main route of infection. Infection can also be transmitted between humans, notably from pregnant women to unborn babies.
- Symptoms usually develop within a few days to 3 weeks after exposure and may be acute or chronic. They include influenza-like symptoms, fever, severe headache, vomiting, nausea, delirium or coma, septicaemia in pregnant women, foetuses' meningitis, sepsis, and internal or external abscesses.
- Pregnant women are about 20 times more likely to contract listeriosis than other healthy adults. It can result in miscarriage or stillbirth.

Surveillance goal

- Detect Listeriosis sporadic cases and outbreaks promptly and seek laboratory verification.
- Identify the outbreak source and take the necessary regulatory process to remove the source from public access.

Food Source

Ready-to-eat foods, soft-ripened cheese, ground meat, poultry, dairy products, chicken, seafood, vegetables, cold chain foods and smoked fish.

Standard case definition

Suspected case:

Invasive listeriosis:

Systemic illness caused by *L. monocytogenes* manifests most commonly as bacteraemia or central nervous system infection. Other manifestations can include pneumonia, peritonitis, endocarditis, and focal infections of joints and bones.
Pregnancy-associated listeriosis has generally been classified as an illness occurring in a pregnant woman or an infant aged ≤ 28 days. Listeriosis may result in pregnancy loss (foetal loss before 20 weeks gestation), intrauterine foetal demise (≥20 weeks gestation), pre-term labour, or neonatal infection while causing minimal or no systemic symptoms in the mother. Pregnancy loss and intrauterine foetal demise are maternal outcomes. Neonatal listeriosis commonly manifests as bacteraemia, central nervous system infection, and pneumonia and is associated with high fatality rates. Transmission of Listeria from mother to baby transplacentally or during delivery is almost always the source of early-onset neonatal infections (diagnosed between birth and 6 days) and the most likely source of late-onset neonatal listeriosis (diagnosed between 7–28 days).

Non-invasive Listeria Infections:

Listeria infection manifesting as an isolate from a non-invasive clinical specimen suggestive of a non-invasive infection; includes febrile gastroenteritis, urinary tract infection, and wound infection.

***Confirmed case*:** A suspected case that is laboratory confirmed.

Analyse and interpret data

Time: Analysis of suspected and confirmed cases by week. Graph cases and deaths weekly. Construct an epidemic curve during outbreaks.
Place: Plot location of case households.
Person: Analyse by age and gender. Assess risk factors to plan and monitor prevention and control measures.

Laboratory confirmation

Diagnostic test	Culture-Independent Diagnostic Testing (CIDT)
Specimen	Sterile sites (e.g., blood or cerebrospinal fluid)
	For maternal isolates Products of conception (e.g., chorionic villi, placenta, foetal tissue, umbilical cord blood, and amniotic fluid) were collected at the time of delivery.

	For neonatal isolates Non-sterile neonatal specimen (e.g., meconium, tracheal aspirate)
References	
• **WHO Factsheet on Listeriosis (2018)** • **CDC (2019) Listeriosis (*Listeria monocytogenes*) Case Definition** • **The Microbiology of Safe Food, 2010**	

4.12 Rotavirus Infection

Background	
• Rotaviruses are classified with the Reoviridae family with six serological identified groups. Three of which infect humans – Groups A, B and C. They are quite stable in the environment. • Group A rotavirus is endemic worldwide and the leading cause of diarrhoea among children. Group B rotavirus (adult diarrhoea rotavirus) affects thousands of persons of all ages. While Group C rotavirus has been associated with sporadic cases in children across the world. • Symptoms of rotavirus infection are characterised by mild to severe vomiting, watery diarrhoea, and fever. However, it is the leading cause of severe dehydrating diarrhoea in children aged 5 years and under. Most severe infections are seen in children aged between 6-24 months. • In developing countries, three out of every four children are infected with rotavirus before the age of 12 months.	
Surveillance goal	
• Detect rotavirus infection outbreaks. • Identify the outbreak source and take the necessary regulatory process to remove the source from public access	
Food Source	
Ready-to-eat foods, vegetables, salads, fruits, contaminated water etc.	
Standard case definition	
Suspected case: Any person 8 months of age or older who reports gastroenteritis symptoms (such as nausea, vomiting, watery diarrhoea) with severe dehydration. *Confirmed case:* • Any patient meeting the suspected case and definitive laboratory evidence. • Any patient meeting the suspected case, laboratory suggestive evidence AND epidemiological evidence.	
Specific Symptoms	Vomiting, watery diarrhoea for three to eight days, fever, abdominal cramps, dizziness
Analyse and interpret data	
Time: Graph cases and deaths weekly/monthly. **Place:** Plot distribution of case households and workplaces. **Person**: Count weekly/monthly cases and deaths. Analyse age and sex distribution quarterly.	
Laboratory confirmation	
Diagnostic test	• Conduct nucleic acid detection PCR assays (for rotavirus alone or in multi-pathogen panels) or antigen-detection immunoassays on stool specimens. • Further characterize strains by nucleic acid sequencing.
Specimen	Stool sample
References	
• **Centre for disease control and Prevention (2021). Rotavirus. Clinical Information** • **The Microbiology of Safe Food (2010)** • **WHO Factsheet on Listeriosis (2018)** • **CDNA surveillance case definitions (2016). Rotavirus – Surveillance case definition**	

SECTION 5 – GUIDELINE FOR INVESTIGATION, RESPONSE, AND MANAGEMENT OF FOODBORNE DISEASE EMERGENCIES

5.1 The Goal of Investigating Foodborne Disease Emergency

A successful investigation and management of any public health emergency depend on how fast and responsibly the investigation and management were conducted. Therefore, the goal of investigating any foodborne disease emergency is:

> *"To minimise and control the spread of foodborne disease in ways that will prevent further illnesses and death."*

5.2 Foodborne Disease Emergency Control (FDEC) Team

For the control of any foodborne disease event, a multisectoral response team at the Federal and State Government levels are essential. The team must be multisectoral, i.e., include relevant stakeholders from the Health, Agriculture, Environment, Information, Science and Technology and Innovation and Education Sectors to ensure a One-Health approach to investigating Foodborne Outbreak and contribute different knowledge and skills. The team may include epidemiologists, laboratory scientists, environmental health officers, food safety control officers/inspectors, food science professionals, clinicians/veterinarians, meat inspectors, toxicologists, press officers etc. the criteria for convening the team will vary according to the seriousness of the illness, geographical spread, available resources, nature of the foodborne disease. In smaller investigations, individuals may fulfil multiple roles concurrently.

The responsible authority in the area should initiate the establishment of the FDEC team. The team members are expected to be:

1. Adequately trained in foodborne disease emergency investigation;
2. Available at a moment's notice; and
3. Have requisite knowledge of the foodborne disease, if known.

5.3 Shared Responsibilities

In an investigation of any suspected foodborne disease outbreak, investigators need to be able to identify their roles and responsibilities as well as those of other MDAs or responsible authorities. Nigeria being a federated state, ensures that powers concerning food control are divided amongst the three tiers of government. At the federal level, every MDA has a different mission and legislative mandate that impacts before, during, and after a foodborne disease emergency. The responsibilities of the federal agencies involved in foodborne outbreak investigations are listed in Annexe 1. A similar list should be developed within each

state/locality by the State Ministry of Health, describing state and local agency roles and responsibilities.

For example, if a bottled fruit drink is suspected or implicated in an outbreak, FMOH, NCDC and NAFDAC should be notified. NAFDAC has regulatory jurisdiction over processed and packaged food products. In cases of an outbreak associated with high levels of pesticide in food products such as beans, FMARD should be notified, as well as FMOH, NCDC and NAFDAC.

5.4 Steps in Investigating a Foodborne Disease Event

Foodborne disease event investigations shall be done following the National Technical Guidelines for Integrated Disease Surveillance and Response, 2019. However, due to the specificity of foodborne disease event investigations, the following 7 steps[18] should be considered when investigating a suspected or confirmed case of FBD outbreak:

1. Detect or establish a possible event;
2. Define and find cases;
3. Generate hypotheses about likely sources;
4. Test hypotheses;
5. Investigating point of contamination and source of the food;
6. Implement control and prevention measures; and
7. Decide if the outbreak is over.

Please note that the steps listed are not separate entities and can be intertwined and done simultaneously depending on the specific foodborne disease event.

5.4.1 Step 1 – Detect or establish a possible event.

Establishing if a foodborne disease event or an outbreak must be done using the available tools for surveillance as described in Section 4. A foodborne disease surveillance system is critical to ensure that all cases – even if spread across a wider area – are captured sufficiently. This is especially important when investigating a multi-state foodborne disease event.

5.4.2 Step 2 - Define and find cases.

To ensure that all cases have been noted or recorded, sick persons must be found to ensure that the full picture of the event is captured. Disease Surveillance and Notification Officers (DSNOs) are expected to actively find cases using developed case definitions – including reviewing emergency room records for similar illnesses – and plot epidemic (epi) curves for case tracking.

STEPS TO FIND CASES

1. Develop case definition;
2. Use case definition to find cases;
3. Communicate with community links to find cases; and
4. Plot cases on an epi curve.

[18] Adapted from the US Centers for Disease Control and Prevention model

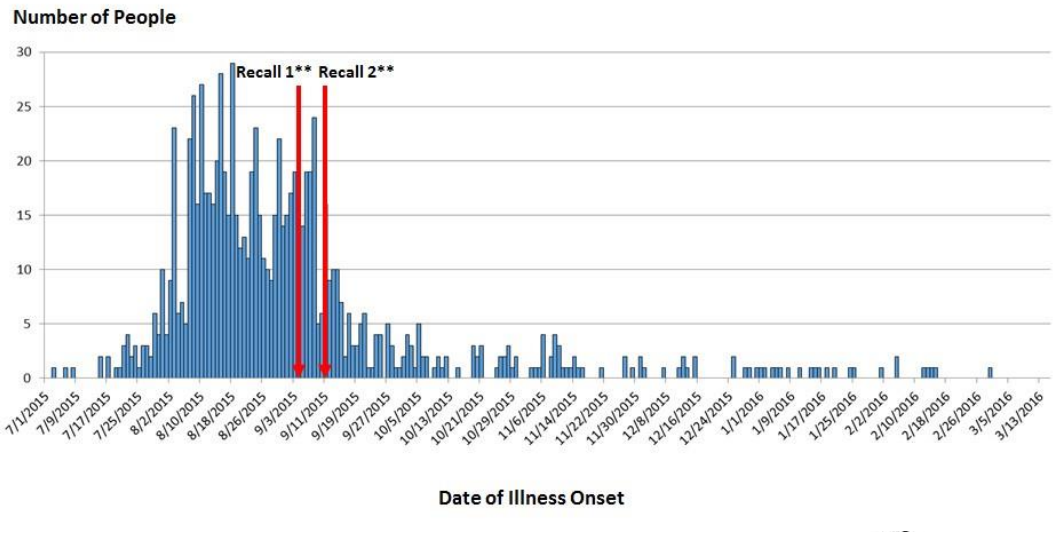


Figure 4: Example of an epi curve tracking cases and events during a foodborne disease outbreak

5.4.3 Step 3 - Generate hypotheses about likely sources.

This step in the investigation is usually subjective and ongoing as the hypotheses generated about the likely source of the event may prove not to be the main source as more information is known. There may also be one or more sources of the event. Therefore, investigators need to keep their options open, especially if cases continue, see Figure 4. It is also important that investigators conduct interviews of patient history and consumption patterns to gather more information about the possible source(s) of the event. The source may include consumer, retailer, restaurant or food service, water source, farm, farm equipment, transporter, producer, processor, or manufacturer.

STEPS TO GENERATE HYPOTHESES

1. Adapt the questionnaire;
2. Interview and administer the questionnaire to patients, patient families, medical officers, etc.
3. Find as many cases as possible.

5.4.4 Step 4 - Test hypotheses.

This step is critical in ensuring that the hypotheses generated fit the ongoing foodborne disease event and that the outbreak source is correctly identified. Laboratory analysis of samples is the main system for testing your hypotheses. Two main methods for testing hypotheses are analytic epidemiological studies (i.e., to quantify the association between exposures and outcomes) as well as food and human sample testing.

5.4.5 Step 5 – Investigate the point of contamination and source of the food.

This step involves using data generated in the steps above to link illnesses to contaminated foods by conducting epidemiological, traceback and food and environmental testing to try to find the likely source of the event. If following this step and no statistical association between food and illness is found, it does not mean the event was not foodborne. Rather, it should be

classified as an "**Unknown Source**." Investigators should also keep in mind that contamination can happen at any point in the food supply chain. Therefore, investigators from all relevant sectors must be carried along during the investigation to ensure a holistic investigation is conducted.

5.4.6 Step 6 – Implement control and prevention measures.

Once the source of the outbreak is identified, control measures must be taken to remove the source from public access. Few actions can be taken as control measures for a foodborne disease event.

1. Temporarily closing a restaurant, food vendor or food processing plant and disinfecting facility
2. Recalling food items.
3. Inform the public on how to make the food safe or to sanitarily dispose of the food.

Risk communication to the public is critical in preventing further illness and complications. This should be done when there is clear and convincing information linking the illness to a portion of contaminated food, and it must be **specific, clear, and actionable** for the consumers to use to protect themselves.

5.4.7 Step 7 – Decide if the outbreak is over.

An event or outbreak is deemed to have ended when the number of newly reported illnesses drops back to the background levels (i.e., the number normally expected). However, with if the number of illnesses rises again, the investigation should be continued or restarted. As part of this step, it is also important that the FDEC team identify what went wrong across the food supply chain and put in place control measures to prevent future occurrences.

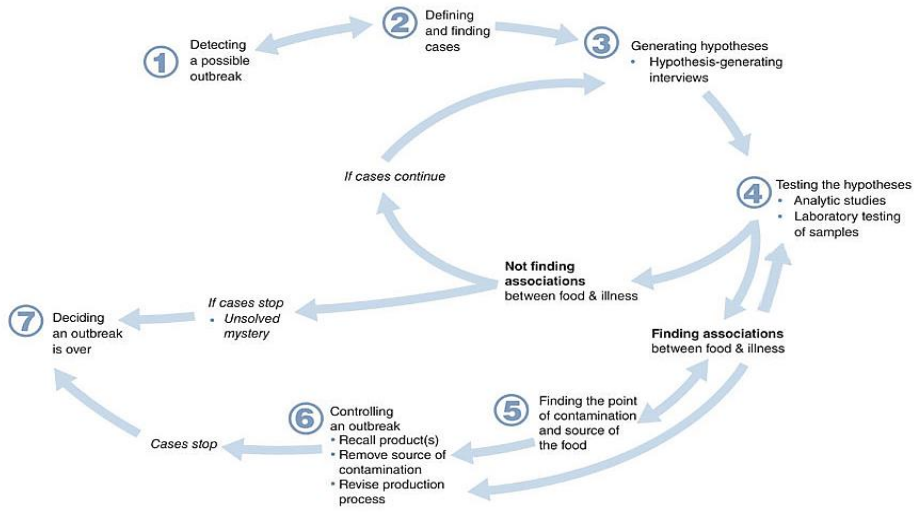


Figure 5: Steps in investigating a foodborne disease event[19]

[19] Adapted from the Centers for Disease Control and Prevention model

5.5 Protocol for Collecting & Testing Specimen for Priority Foodborne Diseases

The type of specimen collected, the transport medium and its packaging depend on the suspected disease. Specimens should be collected in adequate quantity into appropriate containers, labelled appropriately and delivered to the laboratory as quickly as possible, under approved conditions.

To ensure that the specimen is collected and transported appropriately, healthcare facilities must have trained personnel, equipment as well as adequate reagents and consumables. This will help increase the reliability and interpretation of laboratory test results. The disease-specific guideline tables in Section 4 list recommended samples to collect and diagnostic tests to confirm the priority of foodborne disease.

After specimen collection, a completed form must accompany each specimen upon submission. The required information includes the following:

1. Date, time, and place of the collection;
2. Description of sample;
3. Source of the sample. If human, provide name, age, and sex;
4. Type of specimen;
5. Analysis required;
6. Name and signature of the collector;
7. Unique ID (same as epid no. on reporting form);
8. Location address; and
9. Telephone contact.

5.6 Protocols for Case Reporting

Prompt case reporting is essential in reducing the impact of a potential foodborne disease emergency. For each new case found in the health facility register or through searches in the community which fit the surveillance case definition, record the collected information on a line list, register and in the case-based reporting form. Where possible, include geo-coordinate. The line list will keep track of pertinent basic data for cases and potential cases as they are identified (see a sample of the line list in Annexe 3). All healthcare providers[20] should familiarise themselves with the Health Care Provider Guidelines for Reporting Suspected Foodborne Disease Emergencies in Annexe 5.

[20] Health care providers in this case may include physicians; nurses; medical laboratory scientists; community health extension workers (CHEWs); community pharmacists; and traditional, complementary, and alternative medicine (TCAM) practitioners.

5.7 Protocols for Verification of Diagnosis

During an investigation, the investigating team must review clinical findings and laboratory tests to verify the diagnosis and determine the specific nature of the disease. Annexe 7 gives a condensed classification by symptoms, incubation periods, and types of agents for common foodborne diseases. In the case of an infectious disease outbreak, additional laboratory tests may be needed to identify the microbial strain causing the outbreak.

5.8 Protocols for Product Investigation

When a specific food is suspected of having caused a foodborne disease outbreak, the product should be investigated, and this may involve facility checks, a food preparation check, and environmental investigations; traceability and recall processes may also be set into motion. Usually, due to the proximity of the event, LGA and state government authorities will conduct the initial product investigations. However, if the product falls under the federal government jurisdiction/authority, FMARD or NAFDAC (depending on the product) will coordinate the product investigation with the local and state authorities.

5.9 Protocols for Traceback Investigations

Traceback investigations can be very useful in identifying the source of the product associated with the outbreak, identifying issues within the distribution and production chain of the product, and identifying the likely points of contamination. A traceback investigation may lead to the identification of the source of the outbreak to be a consumer, retailer, restaurant or food service, water source, farm, farm equipment, transporter, producer, processor, or manufacturer. Therefore, traceback investigations help to:

1. Identify the source of the outbreak;
2. Alert the public on the right safety measures to take;
3. Remove the contaminated product from the marketplace;
4. Distinguish between two or more vehicles;
5. Compare the distribution of illnesses and the distribution of the product to strengthen the epidemiologic association; and
6. Reduce the risk of ongoing exposure.

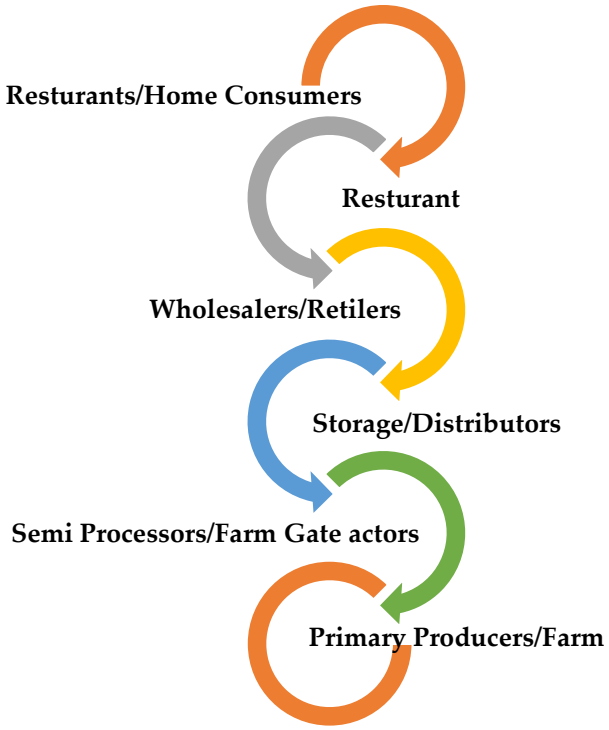


Figure 6: Diagram tracing the movement of food from the consumer back to the retailers, restaurants, distributors, processors, and producers.

5.10 Protocols for Initiating Food Recall(s)

A food recall is an action taken to remove from distribution, sale, and consumption unsafe food. This makes food recall a vital control measure during foodborne disease emergencies. Although there are various reasons to recall food products, the most important are those that can lead to foodborne disease emergencies.

In the instance that the Manufacturing industry is aware of a safety issue with a batch of their food product, NAFDAC's Good Manufacturing Practice (GMP) guidelines for food products[21] give guided steps in which to conduct a product recall and what needs to be present to conduct such. However, for this document, the following steps should be adopted:

1. Notify the appropriate regulatory agencies, and in case of a serious or potentially life-threatening situation, all concerned local and national authorities must be informed of the problem associated with the food product;
2. Identify all products that need to be recalled;
3. Separate and put on hold all affected products that are in your control;
4. If the source of contamination is a raw material, traceback information must be given to the appropriate authorities;
5. Prepare a press release (if required);
6. Notify customers (advise them what to do with recalled food);

[21] Good Manufacturing Practice (GMP) Guidelines for food and food products, 2018

7. Control recalled products and decide what to do with them;
8. Dispose of recalled products, where applicable;
9. Fix the cause of the recall;
10. Provide a report to multisectoral regulatory MDAs stating the action taken to preclude a recurrence of the problem.

If the product was identified during a foodborne disease investigation, the following steps should be taken to recall the product:

1. Identification of the public health issue in the product;
2. Notification of the food industry or food service establishment of the issue;
3. Conduct a facility inspection with a view to:
    a. Identifying all implicated batches;
    b. Identifying the source of the contamination if it is within the facility or from raw material;
    c. Temporarily close the food service establishment or food manufacturing industry and disinfect the facility;
4. Prepare a press release (if required);
5. Food industry to notify customers (advise them what to do with recalled food);
6. Control recalled products and decide what to do with them;
7. Dispose of recalled products, where applicable;
8. Fix the cause of the recall;
9. Provide a report to multisectoral regulatory MDAs stating the action taken to preclude a recurrence of the problem.

Please note that the food businesses (food manufacturers, importers, and wholesalers) are primarily responsible for removing the unsafe food product from the market. If the recalled food product reaches consumers, they have a responsibility to notify the public.

5.11 Protocol for Risk Communication and Community Engagement

Good communication is a vital factor in ensuring a successful foodborne disease emergency investigation and control. In responding to any foodborne disease event, the right information must be passed across to all stakeholders at the appropriate time and feedback to the risk communicator must be to ensure that the right messages are passed and the purpose of the information is met. At some point during a foodborne disease emergency, direct intervention and resources may be scarce. Therefore, communicating effectively with all stakeholders is

essential in ensuring that public health tools for managing the foodborne disease emergency are transmitted to all parties.

Risk communication and community engagement activities must begin in the affected community as soon as a possible foodborne disease emergency is identified. In ensuring proper risk communication and community engagement is done, the foodborne disease emergency investigators should engage the State and LGA risk communicators on time to ensure that the right messages are passed to the following target stakeholders:

1. Community: All people at risk of acquiring the foodborne disease or in need of health services within the context of the emergency;
2. Healthcare providers and first responders;
3. Private hospitals and clinic staff;
4. Community Pharmacies/drug dispensaries;
5. Surveillance officers/epidemiologists;
6. Laboratory personnel;
7. Abattoir workers;
8. Farmers;
9. Points of entry and exit stakeholders and other relevant personnel;
10. Transporters and travellers;
11. Security agencies;
12. Policymakers, Government Ministries, Departments, Agencies, partners, civil society organisations, community organisations, etc.;
13. Media as a channel to reach these audiences;
14. Schools and workplaces;
15. Traditional and religious leaders.

For a more detailed risk communication and community engagement guideline, the National Technical Guidelines for IDSR (2019)[22] give a breakdown of what needs to be done before, during and after an outbreak.

[22] National Technical Guidelines for IDSR (2019)

ANNEXE 1 – RESPONSIBILITIES OF STAKEHOLDERS BEFORE, DURING AND AFTER A FOODBORNE DISEASE EMERGENCY

Health Care Providers[23]

1. Order relevant diagnostic tests, including Microscopy, Culture and Sensitivity (MCS) testing, and collect specimens on suspected cases of foodborne disease.
2. Fill summarised foodborne disease reporting form (Annexe 2) on suspected cases and submit this to the relevant authorities when due.
3. Contact the local health department concerning any person with a communicable enteric disease who is employed in the food service industry.
4. Familiarise yourself with Health Care Provider Guidelines for Reporting Suspected Foodborne Disease Emergencies in Annexe 5.

State Ministry of Health – Food Safety Division/Unit

1. Maintain an ongoing foodborne disease complaint file or log.
2. Establish a schedule to review the foodborne disease complaint log for commonalities (person, place, time).
3. Provide education to healthcare providers on detecting and reporting foodborne outbreaks and appropriate specimen collection.
4. Ensure that Food Safety Unit staff are routinely trained in foodborne outbreak investigation. Request assistance from the Federal Ministry of Health or NCDC for training as needed.
5. Provide capacity building for food handlers regarding proper food handling and personal hygiene.
6. Establish a network of accredited food testing laboratories that can inform and correlate clinical results during Foodborne disease emergencies.
7. Establish a network of accredited clinical foodborne disease/hazard testing laboratories within the state and ensure appropriate referral pathways to support the identification and antimicrobial susceptibility profile of pathogens in clinical specimens during emergencies.
8. Maintain a memorandum of understanding (MOU) with the laboratory network for food testing during an emergency.

State Ministry of Agriculture – Veterinary Division/Unit

1. Establish a network of accredited food animal testing laboratories under Veterinary Services and any other relevant organisation within the state.
2. Maintain memorandum of understanding (MOU) with the laboratory network for food-animal testing during an emergency.

[23] Health care providers, in this case, may include physicians; nurses; medical laboratory scientists; community health extension workers (CHEWs); community pharmacists; and traditional, complementary, and alternative medicine (TCAM) practitioners.

3. Conduct/lead investigations in veterinary-regulated facilities that are implicated as a possible source of a foodborne outbreak.
4. Cooperate and provide communications with other agencies and all organisations working with animal health care workers, animal owners/producers, retailers, transporters, and processors should collaborate and share disease surveillance and response information regularly.
5. Report spikes in cases of priority zoonotic and foodborne diseases at farms, abattoirs, veterinary clinics, and animal markets to veterinary departments, State Ministry of Health – Food Safety Division/Unit, State Emergency Operations Centre (EOC), FMARD and NAFDAC State office for proper surveillance.

Local/State Emergency Operations Centre (EOC)

1. Establish a schedule to routinely monitor enteric disease data (incidence & prevalence) to identify trends and detect increases in the number of cases that may indicate an outbreak or cluster.
2. Initiate and activate a multisectoral Foodborne Disease Emergency Control (FDEC) team that includes the NAFDAC state office.
3. Lead the investigation of suspected foodborne disease emergencies with the support of the food safety unit.
4. Immediately notify NCDC of any suspected outbreak. INFOSAN Emergency Contact Point and Focal Points should also be immediately notified.
5. Conduct interviews, compile line lists, and record onset dates and times and other important epidemiological data. Request assistance, as needed, from NCDC and FMoH/FMARD/FMEnv.
6. Obtain clinical specimens from symptomatic individuals/animals and refer them to laboratory for analysis.
7. Conduct a complete environmental investigation (not routine inspection) of the facility or site of a suspected outbreak.
8. Collect food, water, and other samples as needed and refer them to the relevant laboratory for analysis.
9. Develop a final outbreak report to be shared with stakeholders and forward a copy along with all supporting documentation to the State Ministry of Health – Food Safety Unit.
10. Conduct after-action reviews to improve investigation effectiveness and prevent future outbreaks of the same causes.

Federal Ministry of Health – Food Safety & Quality Programme

1. Establish and implement the protocol for multisectoral analysis of food surveillance data from relevant sectors to ensure an integrated food surveillance system.
2. Routinely review the Integrated Disease Surveillance and Response (IDSR) data in collaboration with NCDC to identify foodborne disease outbreaks or clusters.

3. Conduct after-action reviews.
4. Coordinate communication and exchange information with states and other federal MDAs during foodborne outbreak investigations.
5. Establish a schedule to use the data generated for policy decision-making.
6. Support after-action reviews to improve investigation effectiveness and prevent future outbreaks from the same causes.
7. Develop and implement short- and long-term control measures and follow-up activities as needed to protect public health consistent with regulatory authorities.
8. Ensure that Food Safety Unit staff are routinely trained in foodborne outbreak investigation in collaboration with development partners.
9. Provide capacity building to food handlers regarding proper food handling and personal hygiene (GHP).
10. Continue to improve foodborne disease emergency recognition and response in the Country using FAO Food Safety Assessment Tool & WHO IHR benchmark.

Federal Ministry of Agriculture and Rural Development

1. Routinely monitor foodborne disease pathogen data in the animal health sector to establish trends and identify outbreaks or clusters.
2. Maintain and routinely share animal health surveillance information and summary reports relating to foodborne pathogens to State/LGAs, Veterinarians and other stakeholders.
3. Guide the epidemiological investigation and control of a specific outbreak consistent with national protocols, current policy, and current scientific literature, such as developing questionnaires, conducting data analysis, etc.
4. Guide proper collection and handling of crop and animal /animal product samples.
5. Support with communication and exchange of information with states and other federal MDAs during foodborne outbreak emergencies.
6. Coordinate and lead the response to multi-state animal disease emergencies with support from the FMOH and the INFOSAN ECP and FP.
7. Ensure that FMARD Food Safety Unit and other relevant staff are routinely trained in foodborne outbreak investigation with collaboration from development partners.
8. Suspend operations in any farm implicated in a foodborne outbreak or emergency.

Federal Ministry of Environment

1. Routinely monitor foodborne disease pathogen data in the environmental health sector to establish trends and identify outbreaks or clusters.
2. Maintain and routinely share environmental health surveillance information and summary reports relating to foodborne pathogens to State/LGAs, EHOs and other stakeholders.

3. Guide the epidemiological investigation and control of specific outbreaks consistent with national objectives, current policy, and current scientific literature, such as developing questionnaires, conducting data analyses, etc.
4. Carry out proper collection, handling and testing of environmental media.
5. Ensure that FMEnv Food Safety Unit staff are routinely trained in foodborne outbreak investigation, with collaboration from Request assistance from development partners.
6. Detect environmental nuisance and serve abatement notices and prosecute if necessary to preserve food safety.

Nigeria Centre for Disease Control

1. Routinely monitor foodborne disease complaint data to establish trends and identify outbreaks or clusters.
2. Routinely monitor foodborne disease surveillance data to establish a trend and detect increases in the number of cases that may indicate an outbreak or cluster.
3. Maintain and routinely share and distribute surveillance information and summary reports relating to foodborne outbreaks to State/LGAs, physicians and other stakeholders.
4. Guide the epidemiological investigation and control of a specific outbreak consistent with national objectives, current policy, and current medical and scientific literature, such as developing questionnaires, conducting data analysis, etc.
5. Coordinate resource mobilisation for additional resources if the outbreak exceeds the resource capacity of the State.
6. Coordinate and lead the response to multi-state foodborne disease emergencies with support from the FMOH, FMARD and the INFOSAN ECP and FP.
7. Guide proper collection and handling of clinical specimens.

NAFDAC – Food Safety & Applied Nutrition Directorate

1. Provide timely laboratory testing for food samples implicated during foodborne disease emergencies at **no cost;** and ensure preliminary and full reports of laboratory analysis are released to the Foodborne Disease Emergency Control (FDEC) team **immediately** to help control the outbreak.
2. Lead the implementation of necessary control measures (within mandate) during emergencies such as:
    a. temporarily closing a restaurant or food processing plant and disinfecting facility;
    b. recalling food items.
3. Guide proper collection and handling of food samples.
4. Maintain and improve capacity for food specimen testing.
5. Provide capacity building for food handlers regarding proper food handling and personal hygiene (GHP).

6. Routinely share and publish periodic reports of commonly found biological and chemical hazards in staple foods in the country to improve the linkage between food sources and specific foodborne diseases.
7. Establish a schedule to routinely conduct food monitoring for priority foodborne diseases/hazards and publish such findings.

Food Industry and Services Establishments

1. Communicate with employees, suppliers, government agencies, and customers during outbreaks.
2. Implement control measures that can stop the current outbreak and prevent reoccurrence.
3. Provide expertise on food standards, i.e., how the food commodities/products are grown, processed, manufactured, packed, distributed, and served.
4. Support in consensus building regarding changes needed to protect public health and consumer confidence in their products.
5. Ensure that qualified Food Professionals are employed in the food industry and services establishments.
6. Establish and review minimum specifications for Nigerian Industrial Standard.
7. Capacity building for manufacturers, distributors, retailers, and other relevant stakeholders on the application of food standards/code of practice.
8. Maintain a register /data of all food establishments in the country for routine checks.

Academia

1. Conduct applied food safety research to expand the results of investigations.
2. Publishing research results to help inform future outbreak investigations and implement control measures.
3. Conduct special/specific laboratory analyses and provide additional expertise.
4. Maintain strong partnerships for data sharing with MDAs, the food industry and service establishments.

INFOSAN Emergency Contact Point

1. Report urgent foodborne disease emergencies of potential international significance to the INFOSAN Secretariat.
2. Respond to requests for assistance by the INFOSAN Secretariat in the verification and assessment of events by providing all necessary information and reviewing INFOSAN alert messages about an event in their country.
3. Request international assistance through the INFOSAN Secretariat to respond to a foodborne disease emergency, where necessary.
4. Act on INFOSAN Alerts and disseminate information accordingly.
5. Collaborates with the National IHR Focal Point on foodborne disease emergencies.

INFOSAN Focal Points

1. Collaborate with and provide technical support to the INFOSAN Emergency Contact Point on foodborne disease emergencies involving their respective agency.
2. Engage in sharing information with the INFOSAN Secretariat and other members on food safety issues that may be relevant at the international level and beneficial to all members, such as but not limited to risk assessments on emerging hazards, lessons learnt, identified good practices, etc.
3. Disseminate INFOSAN resources, FAO/WHO guidelines, and other important food safety information from INFOSAN within their agency, as appropriate.
4. Provide comments to INFOSAN on products disseminated to the Network.
5. Collaborates with the National IHR and WOAH Focal Points at FMARD on foodborne disease emergencies.
6. Establish and/or strengthen both formal and informal relationships with relevant MDAs, international agencies, particularly FAO and WHO and their subsidiary bodies (including CAC) and relevant expert groups regarding animal production food safety.

ANNEXE 2 – FOODBORNE DISEASE REPORTING FORM/QUESTIONNAIRE

ABC State Government

Foodborne Disease Reporting Form

Form No:_____ Date:____/____/ ____ dd mm yy	*Please Complete and send to:* State Ministry of Health ABC State Email: abcstate@abcstate.com	*Questions? Call* **ABC** State Emergency Operations Control +234… +234…

A Patient/Client

Surname:_____First Name:_____Middle Name:_____Tel No: ( )_____

LGA: _____Ward_____House No/Street:_____

Occupation:_____Age(yrs):_____Age(months): Sex: Male Female

Suspected Food:_____Date Consumed:_____/_____/_____ Time Consumed:_____ Am Pm
dd mm yy

Source of Water: Tap Stream Bore Hole Pond Sachet Water Well

Source of Food Home Informal Canteen Restaurant Other: _____

B Illness Information

Symptoms:(*tick all applicable)*

Abdominal Cramps	Dehydration	Fever	Nausea
Bloody stool	Diarrhoea	Headache	Numbness
Chills	Dizziness	Jaundice	Vomiting
Haematuria	Excessive sweating	Muscle aches	Weakness

Other Symptoms: _____

Onset of Symptoms: Date: / / Time:_____ Am Pm Duration**:** Less than 12hrs 12-24hrs More than 24hrs.
dd mm yy

Symptoms Ongoing: Yes No Did you seek medical attention? Yes No If yes, name of Health Facility: _____

Location of Facility:_____Date of visit to Health Facility: / /
dd mm yy

Hospitalised: Yes No. If yes, name of Physician:_____Contact No: _____

Laboratory test conducted? Yes, No Type of sample: _____Agent Identified: _____

C Food History

Obtain history back 72hrs prior to symptoms.

Date& Time B- Breakfast L- Lunch S- Supper	Total # persons (both ill and well)	Food(s) consumed	Source(s) of Food (***Bottle beverage Vegetables, Kunnu, Local salad, Egg, Rice, Suya***) (***Restaurant etc.***)	Consumed at place purchased or received
0-24hrs (Day 1) B				Yes No
L				Yes No
S				Yes No

25-48hrs (Day 2)	B				Yes	No
	L				Yes	No
	S				Yes	No
49-72hrs (Day 3)	B				Yes	No
	L				Yes	No
	S				Yes	No

D

No. of persons who ate implicated food: **Other persons in your household/community affected No. affected:**

	Name of Affected Person	Tel. No	Date &Time	Age(yrs)/(months)
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

E Risk Factors

Does the household prepare water before drinking? Yes No

If yes, how does the household prepare water for drinking? Boiling Chlorination

In the last 3 days before this illness, how does the household store drinking water? Container with cover Container without cover

Do you always wash your hands with soap/ash before eating? Yes No

Do you always wash your hands with soap/ash after use of the toilet? Yes No

Does the household have a toilet facility? Yes No

If yes, what type? Pit-latrine with cover Pit-latrine without cover

If no, where do you defecate? Backyard farm bush drainage/gutter Others (specify)_____

How does household dispose of refuse? Burning Burying throwing to the backyard Throwing to the bush Throwing into a stream

Exposure History Within the Past 2 Months

International Travel? Yes No
If yes, please specify countries: Date of Departure: Date of Arrival:

Domestic Travel? Yes No If yes, please specify locations: Date of Departure: Date of Arrival:

Contact with the ill person? Yes, if yes, when: Please specify illness if known:

F Person Completing Form

Surname:_____ **First Name:**_____ **Middle Name:**_____

Tel No.:(**)**_____ **Date of Completion of Form:** _____

Name of Facility: _____

ANNEXE 3 – INVESTIGATION LINE LISTING

ID	Name	Age	Sex	Date & time of illness onset	Major signs and symptoms	Location	Food(s) consumed (including water) 48 hours prior	Laboratory tests	
								Specimen	Result
1	FS	25	M	20/07, 15:00		Jabi, Abuja		ND[24]	
2	JK	76	F	20/07, 19:00		Utako, Abuja		Blood	*L. mono*
3	AJ	4	M	21/07, 03:00		Lugbe, Abuja		Blood	Pending
4	MA	17	F	21/05, 09:00		Asokoro, Abuja		Blood	Pending

[24] Not Done

ANNEXE 4 – MODEL PRESS RELEASE

PRESS RELEASE

Yola, Adamawa sees a rise in foodborne illness caused by Listeria.

Thu 26 August 2021 | Residents reminded to follow food safety guidelines.

Adamawa State Ministry of Health (AdSMoH)) is urging residents of Yola to practice safe food handling practices following an increase in reported infections of Listeria, a foodborne disease known as listeriosis that causes symptoms such as fever, severe headache, vomiting, and nausea, that can sometimes be severe in pregnant women, children, and immunocompromised adults. Listeria is usually acquired by consuming one or more of these food products - Soft-ripened cheese, deli meat, smoked salmon, ground meat, poultry, dairy products, chicken, seafood, and vegetables.

Insert full details of the foodborne disease emergency here.

To best prevent all foodborne illnesses, consumers and retailers should always follow these six keys to safe food:

- Keep Hands and cooking surfaces clean and dry,
- Separate raw and cooked foods,
- Cook food thoroughly, especially meat and poultry,
- Keep food at safe temperatures – either refrigerate at $<5^0$C or keep piping hot at $>60^0$C,
- Use clean and safe water,
- Purchase only fresh and wholesome foods/vegetables.

For more information or to report suspected cases, you can call the AdSMoH – State Epidemiologist at 08012345678 or the Food Safety Division at 08098765432

ANNEXE 5 – HEALTH CARE PROVIDER GUIDELINES FOR REPORTING SUSPECTED FOODBORNE DISEASE EMERGENCY

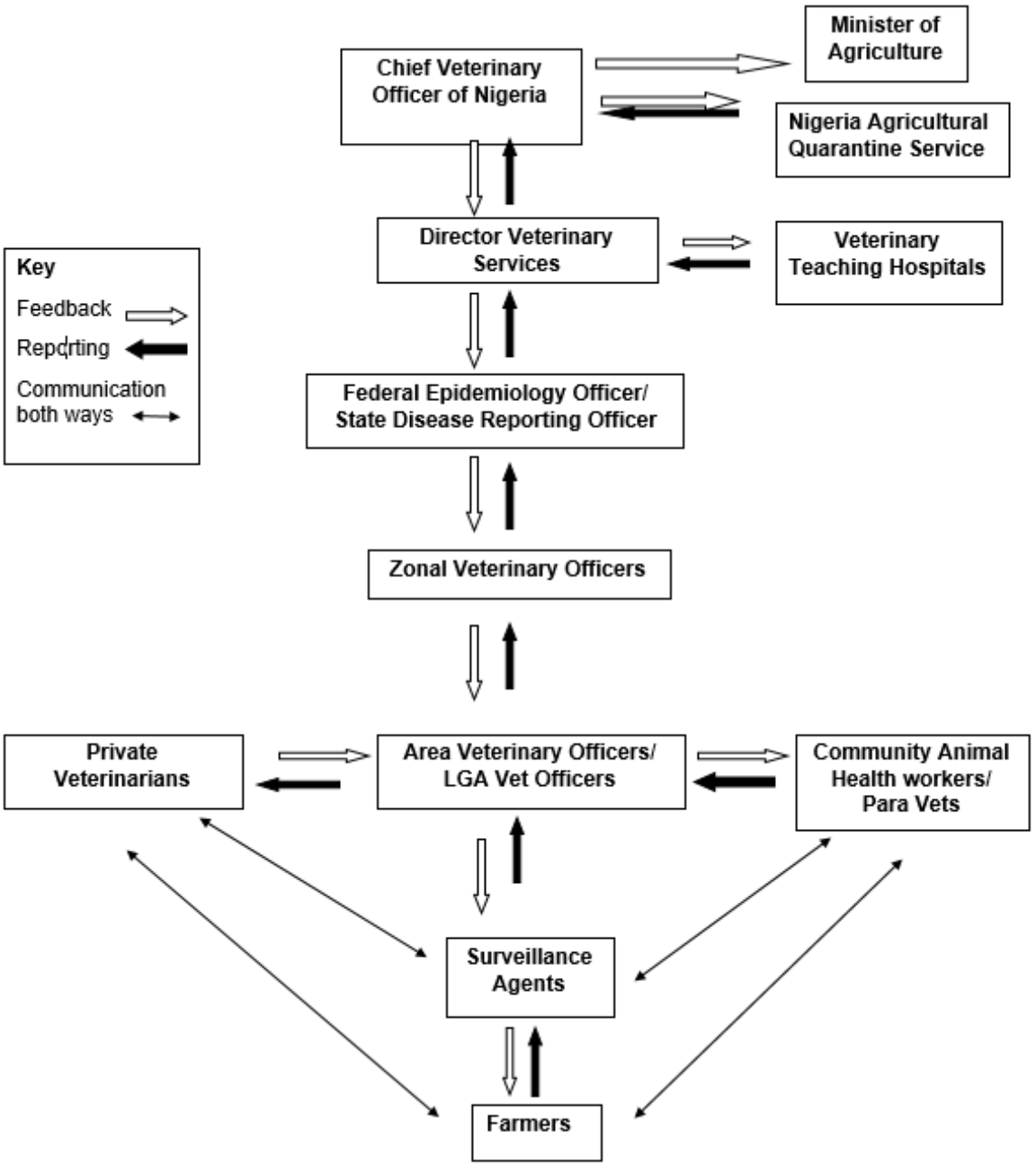
If two or more persons are suspected of having a foodborne disease with a common source, the healthcare provider should:

1. Inquire whether there are other ill persons.
2. Immediately contact the LGA, State health department or the Nigeria Centre for Disease Control and Prevention (NCDC) through the local and state disease surveillance and notification officer (DSNO).
3. Collect clinical samples for laboratory analysis.
4. If suspected food items are available, instruct the individual not to ingest or discard food but to keep it refrigerated.
5. Arrangements should be made to collect and analyse the food samples pending further investigation. Questions regarding food sample collection/testing of food samples should be directed to the NAFDAC state office.
6. Please provide the following information:
    a. Brief description of the situation;
    b. Name of patient(s);
    c. Full contact address with a landmark and telephone number;
    d. Age, sex;
    e. The onset of symptoms (date, time);
    f. Description of symptoms;
    g. Hospitalisation status, whether dead or alive;
    h. Number of other ill persons with similar symptoms;
    i. Food history (obtain history back 72 hours before symptoms);
    j. If the patient works in a food service establishment;
    k. Name and designation of the reporter (if different from the physician), address, telephone number.
    l. Complete the case investigation form in annexe 2.

ANNEXE 6 – A-Z OF COMMON FOODBORNE DISEASES

1	**Amebiasis**
2	**Angiostrongyliasis (Rat lungworm)**
3	**Anisakiasis**
4	**Anthrax**
5	**Ascariasis (*Ascaris lumbricoides*)**
6	**Botulism**
7	**Brainerd diarrhoea**
8	**Brucellosis (*Brucella spp.*)**
9	**Campylobacteriosis (*Campylobacter jejuni and C. coli*)**
10	**Cholera (*Vibrio cholerae*)**
11	**Ciguatera (fish poisoning)**
12	**Clonorchiasis (*Clonorchis sinensis*)**
13	**Creutzveld Jacob Disease**
14	***Cronobacter spp.* Infection**
15	**Cryptosporidiosis (*Cryptosporidium spp.*)**
16	**Cyclosporiasis (*Cyclospora spp.*)**
17	**Cysticercosis (*Taenia solium*)**
18	**Cystoisosporiasis (formerly known as Isosporiasis)**
19	**Diphyllobothriasis (*Diphyllobothrium* infection)**
20	**Dysentery (*Shigella sp.* and *Entamoeba histolytica*)**
21	**Echinococcosis**
22	***Escherichia coli* O157:H7 and diarrheagenic *E. coli* pathotypes**
23	**Fascioliasis (*Fasciola hepatica*)**
24	**Giardiasis *(Giardia)***
25	**Haemorrhagic Colitis**
26	**Hepatitis A**
27	**Hepatitis E**
28	**Lassa Fever**
29	**Leptospirosis**
30	**Listeriosis (*Listeria monocytogenes*)**
31	**Liver Cancer**
32	**Mycotoxicosis**
33	**Norovirus Infection (aka Norwalk virus, calicivirus, viral gastroenteritis)**
34	**Opisthorchiasis (*Opisthorchis viverrini* and *O. felineus*)**
35	**Paragonimiasis (*Paragonimus westermani*)**
36	**Rotavirus Infection (aka Baby virus)**
37	**Salmonellosis (*non-typhoidal*)**
38	**Scombroid Fish Poisoning**
39	**Staphylococcal (Staph) food poisoning (*Staphylococcus aureus*)**
40	**Taeniasis (*Taenia solium* and *T. saginata*)**
41	**Toxoplasmosis (*Toxoplasma gondii*)**
42	**Trichinellosis/Trichinosis (*Trichinella spp*)**
43	**Typhoid *(Salmonella typhi* and *paratyphi*)**
44	**Vibriosis (*Vibrio parahaemolyticus* gastroenteritis)**
45	***Vibrio vulnificus* infection**
46	**Yersiniosis (*Yersinia enterocolitica* infection)**

ANNEXE 7 – FLOWCHART FOR ANIMAL DISEASE REPORTING IN NIGERIA



ANNEXE 8 – CONDENSED CLASSIFICATION OF COMMON FOODBORNE DISEASES

Table 3: Foodborne infections, causative agents, symptoms, and commonly affected foodstuffs.[25][26]

DISEASE CATEGORY	DISEASE	CAUSATIVE AGENT(S)	SYMPTOMS	FOODS COMMONLY INVOLVED
Bacterial	Typhoid fever	*Salmonella typhi*	Typhoid-like fever, malaise, headache, abdominal pain, body aches, diarrhoea, or constipation.	Raw vegetables and fruits, salads, pastries, unpasteurised milk and milk products, meat.
	Shigellosis	*Shigella* species	Abdominal pain/cramps, stool with mucus or blood, fever, vomiting, diarrhoea.	All foods handled by unhygienic workers, including potato or egg salad, lettuce, and raw vegetables.
	Cholera	*Vibrio cholerae*	Profuse watery diarrhoea.	Fruits and vegetables were washed with contaminated water, seafood, cooked rice, and ice.
	Non-typhoid salmonellosis	*Salmonella* species, e.g., *Salmonella typhimurium*	Bloody diarrhoea, cramps, and fever, dehydration, cold chills, reactive arthritis.	Eggs, poultry, undercooked meals, unpasteurised dairy products, sea foods, and sausages.
	Brucellosis	*Brucella* species, mostly *Brucella melitensis*	Sweating, headache, lack of appetite, fatigue, fever.	Milk and dairy products from infected animals.
	Anthrax	*Bacillus anthracis*	Nausea, vomiting, abdominal pain, headache, loss of appetite, fever, bloody diarrhoea, sore throat, and swollen neck.	Contaminated raw and undercooked meat from sick and dying cows, sheep, goats, camels, etc.
	Bovine tuberculosis	*Mycobacterium bovis*	Fever, chills, night sweats, weight loss, loss of appetite, tiredness.	Unpasteurised milk, dairy products, or meat from tuberculosis-infected cows.
	Diarrheagenic *Escherichia coli* pathotypes	*Escherichia coli*	Abdominal pain, diarrhoea, fever, malaise, HUS, TTP, chronic kidney disease.	Beef, dairy products, fresh products, raw produce (potatoes, lettuce, apples), salads.

[25] The Open University (2023) Hygiene and Environmental Health Module: 9. Foodborne Diseases and the Investigation of Disease Outbreaks

[26] Forsythe S. J. (2010) The microbiology of safe food, 2nd ed. Wiley-Blackwell, West Sussex

DISEASE CATEGORY	DISEASE	CAUSATIVE AGENT(S)	SYMPTOMS	FOODS COMMONLY INVOLVED
	Campylobacteriosis	*Campylobacter jejuni, C. coli*	Nausea, vomiting, watery diarrhoea (sometimes bloody), and fever typically appear within 2 to 5 days and may last up to 10 days, colitis.	Raw chicken, beef, milk, mushroom, cheese, pork, shellfish, egg, cake icing.
	Listeriosis	*Listeria monocytogenes*	Influenza-like symptoms, nausea, vomiting, aches, fever, septicaemia in pregnant women, foetuses, and abscesses.	Milk, cheese, ice cream, poultry, red meat.
Viral	Viral gastroenteritis (VGE)	Rotavirus, Norovirus, and Astrovirus	Projectile vomiting, diarrhoea, cramps, mild headache, mild fever, and muscle aches.	Any food contaminated with the virus.
	Viral Hepatitis	Hepatitis A and E virus	Fever, low appetite, nausea, vomiting, diarrhoea, muscle aches, and yellowing in the whites of the eyes and the skin.	Raw shellfish from polluted water, sandwiches, salads, and desserts.
	Rift valley fever	Rift Valley fever virus	Fever, dizziness, weakness, back and muscle pains.	Any food contaminated with blood or aerosols from infected domestic animals or their aborted foetuses.
	Lassa fever	Lassa fever virus	Fever, general weakness, malaise, chest, and back pain.	Any food contaminated with urine or stool from infected rodents.
Parasitic	Taeniasis (tapeworm infection)	*Taenia* species	Nervousness, insomnia, anorexia, weight loss, abdominal pain.	Raw beef, raw pork.
	Amoebiasis	*Entamoeba histolytica*	Abdominal cramps, bloody diarrhoea, or diarrhoea with mucus, nausea and vomiting, loss of weight, intermittent fever, and rectal bleeding.	Any food soiled with faeces.
	Trichinosis	*Trichinella spiralis*	Enteritis, irregular fever (39-41^{0}C), muscle pain, difficulty breathing, talking, or moving swollen eyelid.	Insufficiently cooked pork and pork products.

DISEASE CATEGORY	DISEASE	CAUSATIVE AGENT(S)	SYMPTOMS	FOODS COMMONLY INVOLVED
	Ascariasis	*Ascaris lumbricoides*	Cough, wheezing, chest pain, abdominal pain and distention, nausea, vomiting, diarrhoea, malnutrition, and weight loss.	Foods contaminated with soil, especially foods that are eaten raw, such as salads and vegetables.
	Giardiasis	*Giardia lamblia*	Watery diarrhoea, greasy and foul-smelling stool, fatigue, nausea/vomiting, loss of appetite, bloating and abdominal cramps, weight loss, excessive flatulence, and headaches.	Any contaminated food item.
	Toxoplasmosis	*Toxoplasma gondii*	Abortion or stillbirth, brain damage.	Raw or undercooked meat and any food contaminated with cat faeces.
	Cryptosporidiosis	*Cryptosporidium parvum*	Watery diarrhoea, dehydration, stomach pain and cramps, lack of appetite, loss of weight, fatigue, low-grade fever, nausea, and vomiting.	Any contaminated food item.
	Diphyllobothriasis	*Diphyllobothrium latum*	Abdominal pain, loss of appetite, sudden weight loss, diarrhoea or constipation, vomiting, nausea, fatigue, deficiency of vitamin B12, Anaemia.	Raw or uncooked fish.
	Trichuriasis	*Trichuris trichuria*	Abdominal pain, diarrhoea due to irritation of the intestines by worms, anaemia, pile or haemorrhoid, weight loss.	Any food contaminated with soil.

Table 4: Food poisoning, toxin type, causative agents, symptoms, and commonly affected foodstuffs[27][28]

DISEASE CATEGORY	DISEASES	TOXIN TYPE AND CAUSATIVE AGENT	SYMPTOMS	FOODS COMMONLY INVOLVED
Natural toxins in foods	Mushroom poisoning	Phalloidin and alkaloids found in some poisonous mushrooms	Vomiting, diarrhoea, abdominal pain, jaundice, seizures, decreased blood pressure, impaired consciousness.	Poisonous mushrooms such as species of *Amanita phalloides* and *Amanita muscaria.*
Bacterial toxins	Staphylococcal food poisoning	Entero-toxins from *Staphylococcus aureus*	Sudden start of nausea, vomiting, and stomach cramps.	Milk and milk products, sliced meat, poultry, and legumes.
	Botulism food poisoning	The toxin of *Clostridium botulinum*	Double vision, nausea, vomiting, fatigue, dizziness, headache, respiratory failure.	Improperly canned foods, low-acid vegetables or fermented foods, corn, and peas.
	Perfringens food poisoning	Strain of *Clostridium welchii/ C. perfringens*	Intense abdominal cramps, diarrhoea, nausea, Gas gangrene, necrotising enteritis.	Meat, meat stews, meat pies, poultry, legumes, and seafood.
	Escherichia coli food poisoning	Enterohaemorrhagic *Escherichia coli* O157:H7	As seen in Table 3 above.	Ground beef, dairy products, and raw beef.
	Bacillus cereus food poisoning.	Enterotoxins of *Bacillus cereus*	Watery diarrhoea, abdominal cramps, and pain.	Cereals, milk and dairy products, vegetables, meats, cooked rice.
Fungal toxins	Mycotoxicosis	Aflatoxin is produced by some groups of fungi (e.g., *Aspergillus flavus, Aspergillus parasiticus*)	Chronic carcinogenic effects on the liver.	Cereal grains, groundnuts, peanuts, cottonseed, sorghum.
Chemical toxins	Chemical poisoning	Heavy metals (e.g., lead, mercury, cadmium)	Migraines or headaches, both acute and chronic, nausea and stomach cramps, diarrhoea, abdominal pain, vomiting, shortness of breath, arrhythmia, and anaemia.	Fish, canned food, and foods contaminated by utensils or coated with heavy metals.

[27] The Open University (2023) Hygiene and Environmental Health Module: 9. Foodborne Diseases and the Investigation of Disease Outbreaks

[28] Forsythe S. J. (2010) The microbiology of safe food, 2nd ed. Wiley-Blackwell, West Sussex

DISEASE CATEGORY	DISEASES	TOXIN TYPE AND CAUSATIVE AGENT	SYMPTOMS	FOODS COMMONLY INVOLVED
		Pesticides and insecticides	Headache, nausea, vomiting, sweating, tightness of the chest, stomach cramps, loss of muscle coordination, trembling, confusion, difficulty breathing, flushed or yellow skin, pinpoint pupils, weakness, dizziness, elevated blood pressure, excessive salivation, constriction in throat and chest, perspiration, and muscle in-coordination.	Residues on crops, vegetables, and fruits. Accidental poisoning where some chemicals may be mistaken for food ingredients. When contaminated containers are used to hold stored foods.
		Additives	They are varied depending on specific additive(s).	Various food items where unauthorised additives may be added as colouring agents, sweeteners, preservatives, flavouring agents, etc.

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ANNEXE 10 – OTHER REFERENCES

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