FOOD POISONING

Epidemiology, outbreak investigation and prevention



Fourth-year community medicine ·
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Learning outcomes

- Distinguish infection from intoxication.
- Use onset time and symptoms to develop hypotheses.
- Investigate a suspected outbreak and calculate attack rates.
- Interpret Iraqi records and select effective controls.

What is food poisoning?

Illness following consumption of contaminated food or drink.

Hazards include microorganisms, their toxins and chemicals.

Gastroenteritis is common, but neurological or systemic disease can occur.

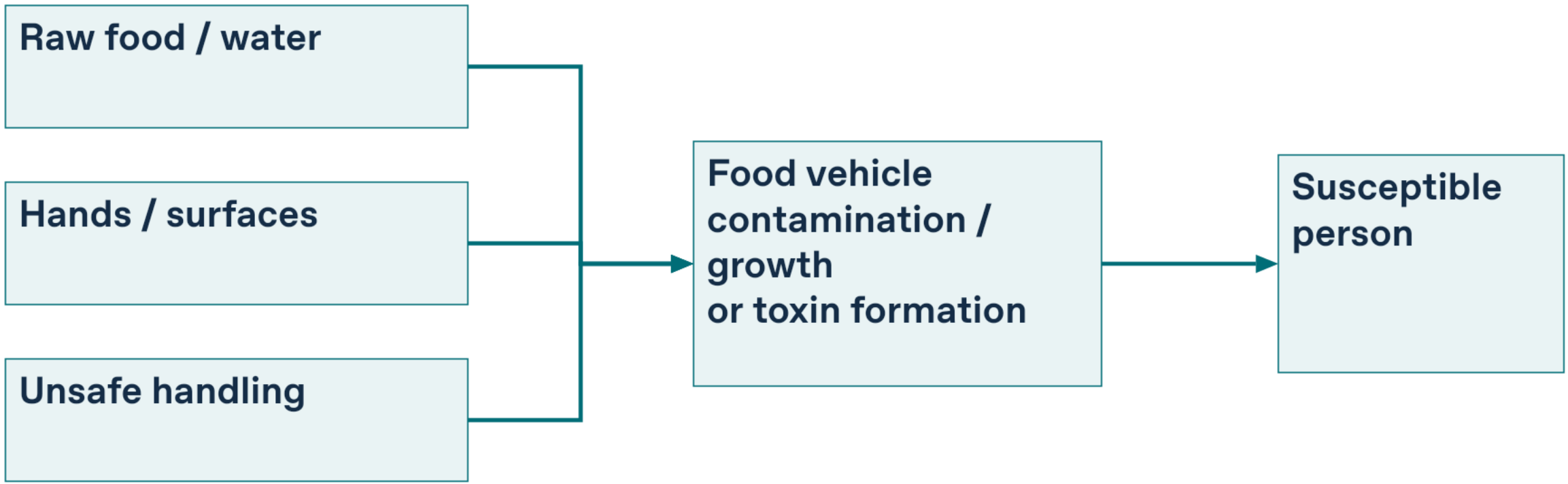
A shared meal alone does not prove that food caused illness.

Three mechanisms of illness

Mechanism	What is ingested?	Examples
Infection	Viable organisms	Salmonella; norovirus
Intoxication	Toxin already in food	S. aureus; botulinum toxin
Toxin-mediated infection	Organisms produce toxin in intestine	C. perfringens; diarrhoeal B. cereus

Timing helps distinguish mechanisms, but laboratory and epidemiological evidence remain essential.

How contamination reaches a person



Control the entry route, handling process and exposure to the food.

Global burden: the estimate has changed

866 million

illnesses

1.52 million

deaths

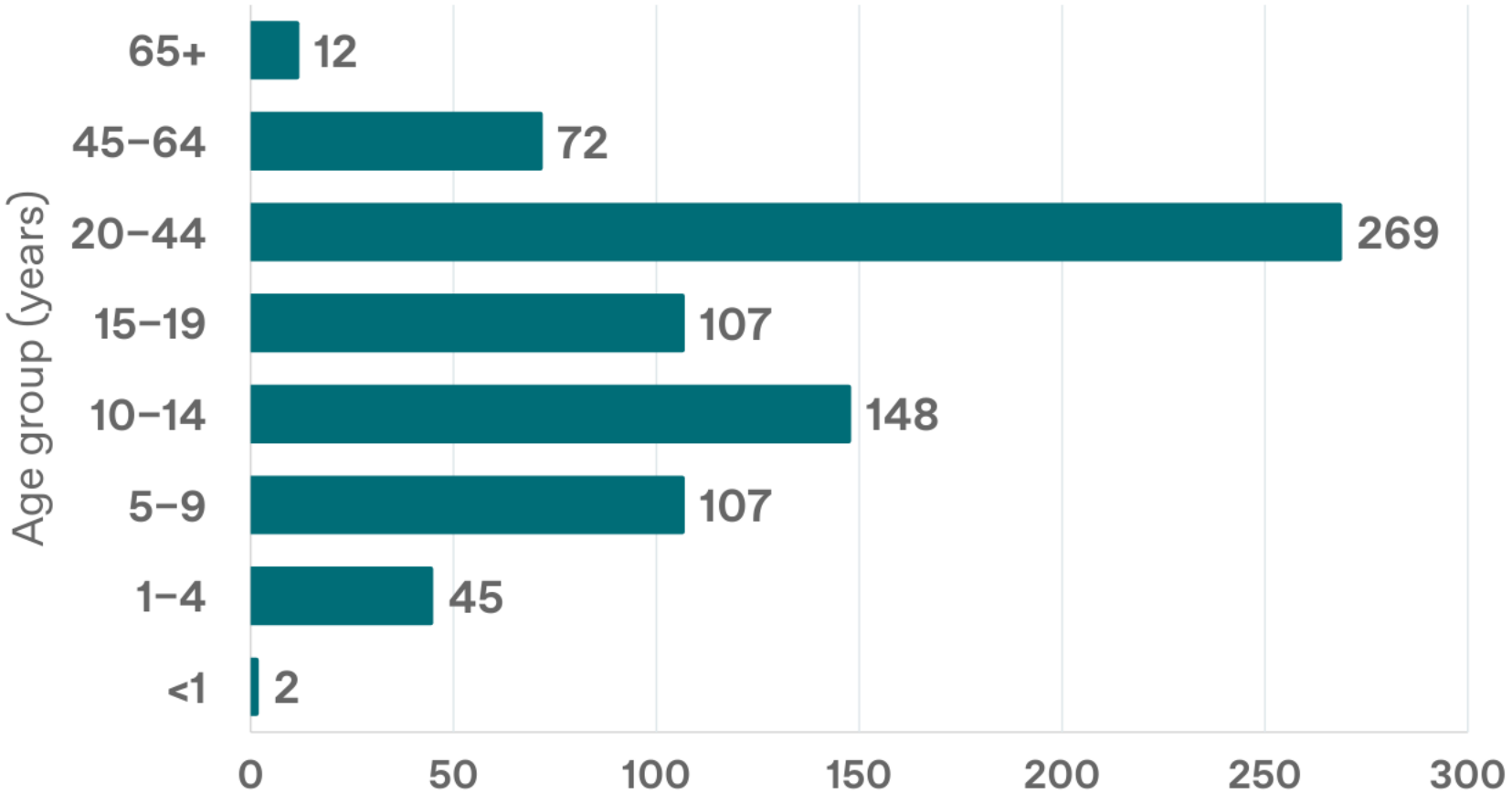
42

biological and chemical hazards

Modelled burden across infectious and chemical hazards, including long-term effects.

WHO 2026 estimates refer to 2021. They cover more than acute gastroenteritis.

Iraq: recorded food-poisoning cases, 2024



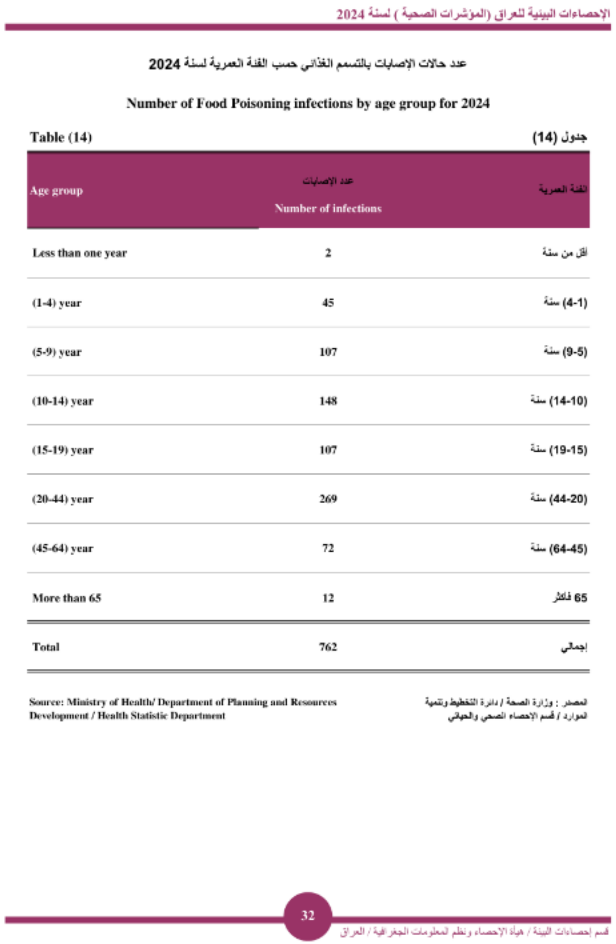
762

recorded cases in Table 14

Counts show reporting distribution, not age-specific risk.

Source: official Health Indicators 2024, Table 14, printed p.32.

Reading an Iraqi health record



عدد حالات الإصابات بالتسمم الغذائي حسب الفئة العمرية لسنة 2024

Number of Food Poisoning infections by age group for 2024

Table (14) جدول (14)

Age group	عدد الإصابات Number of infections	الفئة العمرية
Less than one year	2	اقل من سنة
(1-4) year	45	(4-1) سنة
(5-9) year	107	(9-5) سنة
(10-14) year	148	(14-10) سنة
(15-19) year	107	(19-15) سنة
(20-44) year	269	(44-20) سنة
(45-64) year	72	(64-45) سنة
More than 65	12	65 فاكثر
Total	762	إجمالي

Source: Ministry of Health/ Department of Planning and Resources Development / Health Statistic Department

المصدر : وزارة الصحة / دائرة التخطيط وتنمية الموارد / قسم الاحصاء الصحي والحياتي

The table records 762 cases; it does not measure all community illness.

A larger age-group count does not establish a higher age-specific risk.

Check case definition, reporting coverage, year and denominators.

Do not infer a national trend from one annual table.

Sources: I1, I2, C3 · Food poisoning / Community medicine

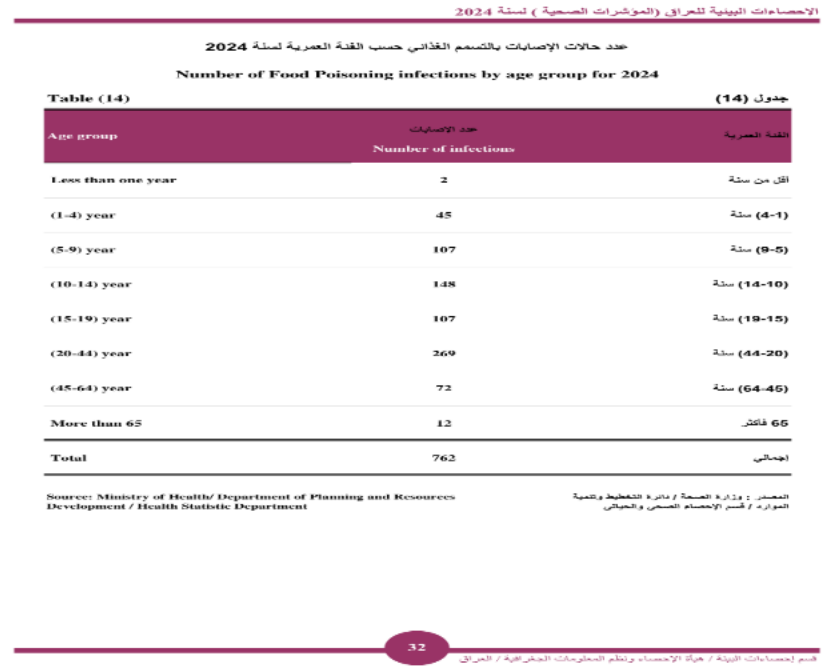
Foods and practices that warrant attention

Raw or undercooked animal foods and unpasteurized dairy.

Ready-to-eat foods contaminated after cooking.

Large batches cooled slowly or held without temperature control.

Interview about ingredients, water, ice and food handlers.



الاحصاءات البيئية للعراق (المؤشرات الصحية) لسنة 2024

عدد حالات الإصابات بالتسمم الغذائي حسب الفئة العمرية لسنة 2024

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قسم إحصاءات البيئة / هيأة الإحصاء ونظم المعلومات الجغرافية / العراق

Separate raw and ready-to-eat foods.

Who is more likely to become severely ill?

Young children, especially those under 5 years.

Older adults.

Pregnant people and their fetuses.

People with weakened immune systems.

Prioritize hydration assessment, appropriate testing and early clinical review.

Symptoms that guide the first assessment

Common: diarrhoea, cramps, nausea, vomiting and fever.

Urgent review: bloody stools, marked dehydration or persistent vomiting.

Also escalate prolonged diarrhoea, high fever or neurological symptoms.



Clinical severity determines urgency.

Rapid onset: toxin-related hypotheses

Agent / syndrome	Typical onset after eating	Useful clue
S. aureus	30 min–8 h, often 2–4 h	Abrupt vomiting; handled ready-to-eat food
B. cereus, emetic	1–6 h	Vomiting; starchy foods held unsafely
C. perfringens	6–24 h	Cramps and diarrhoea; bulk meat or gravy
B. cereus, diarrhoeal	6–24 h	Diarrhoea and cramps

Ranges overlap. Incubation is a clue, not laboratory confirmation.

Later onset: bacterial infection hypotheses

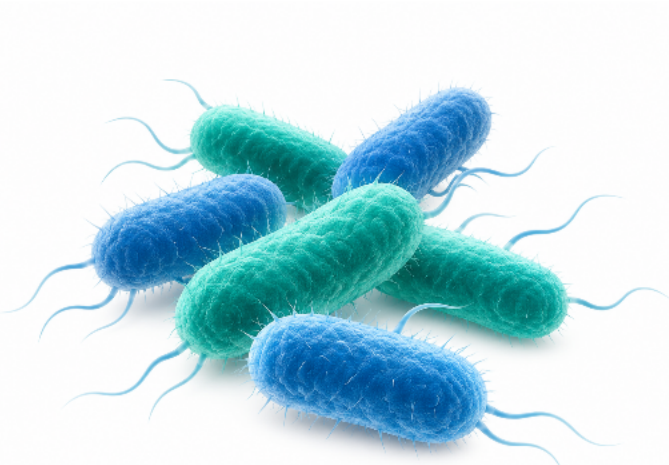
Agent	Usual clinical onset	Features / exposures
Nontyphoidal Salmonella	6 h–6 d	Diarrhoea, fever, cramps; diverse foods
Campylobacter	Usually 2–5 d	Often febrile or bloody diarrhoea; poultry
STEC	Usually 3–4 d	Severe cramps; bloody diarrhoea; HUS risk
Shigella	Usually 2–4 d	Fever, diarrhoea; faecal contamination

The suspected meal may have been several days before illness.

What does STEC stand for?

STEC

Shiga toxin-producing Escherichia coli



Can cause severe abdominal cramps and bloody diarrhoea.

Some patients develop haemolytic uraemic syndrome (HUS), which can damage the kidneys.

Example: E. coli O157:H7 is one type of STEC.

Source: WHO, E. coli fact sheet

Viruses and parasites also matter

Hazard	Epidemiological clue	Investigation implication
Norovirus	Vomiting / diarrhoea, often 12–48 h	Food handlers and person-to-person spread
Hepatitis A	Longer delay; systemic illness or jaundice	Extend the exposure-history window
Foodborne parasites	May cause persistent or delayed illness	Request appropriate tests and exposure history

An outbreak can start with food exposure and continue through secondary transmission.

What is an exposure window?

The period when a person could have consumed the contaminated food or drink that caused illness.

Example: symptoms begin at 8 p.m.
Suspected incubation period: 6–12 hours.

Earliest possible exposure: 8 p.m. – 12 hours = 8 a.m.

Latest possible exposure: 8 p.m. – 6 hours = 2 p.m.

Estimated exposure window: 8 a.m.–2 p.m. that day

Investigate food and drink consumed during this period.
Incubation period = the delay from exposure to symptoms.

Source: CDC, Using an Epi Curve to Determine Most Likely Period of Exposure

Chemical and natural-toxin hazards

Consider pesticides, cleaning chemicals and toxic metals.

Natural toxins include poisonous mushrooms and marine toxins.

Very rapid unusual symptoms or neurological signs broaden the differential.

Protect responders and seek toxicology / public-health advice.



Chemical hazards can cause acute or long-term illness.

Botulism: recognize the emergency

Diplopia, ptosis, dysphagia or dysarthria after a food exposure.

Symmetric descending weakness may progress to respiratory failure.

Arrange emergency assessment and urgent specialist consultation.

Do not delay indicated antitoxin while awaiting laboratory confirmation.

Foodborne botulism is an intoxication, not ordinary gastroenteritis.

Clinical response and public-health response

Assess severity
and hydration

↓

Rehydrate / refer
Treat the specific syndrome

Ask about other ill people
and common exposures

↓

Notify public health
Collect linked evidence

Avoid routine antibiotics. Suspected STEC needs special caution.

Specimens and laboratory evidence

Collect clinical specimens early, coordinated with the laboratory.

Use stool culture, molecular assays or targeted tests as indicated.

Preserve implicated food and environmental samples safely.

Document collection time, storage, transport and chain of custody.



A negative food sample does not exclude an outbreak.

When should an outbreak be suspected?

Two or more similar illnesses linked to a common food exposure.

An unusual increase over expected illness or a compatible cluster.

A single severe unusual event may still require urgent investigation.

Notify the responsible local public-health team promptly.

Verify the signal, but begin proportionate control while investigating.

An integrated outbreak investigation



Control and communication run throughout. The sequence is iterative.

A useful case definition

Clinical criteria: specify symptoms and, where relevant, laboratory findings.

Person and place: identify the population under investigation.

Time: define the onset window and revise it when evidence changes.

Keep the suspected food out of the analytical case definition.

Example: a guest with ≥3 loose stools in 24 h, onset 6–24 h after the lunch.

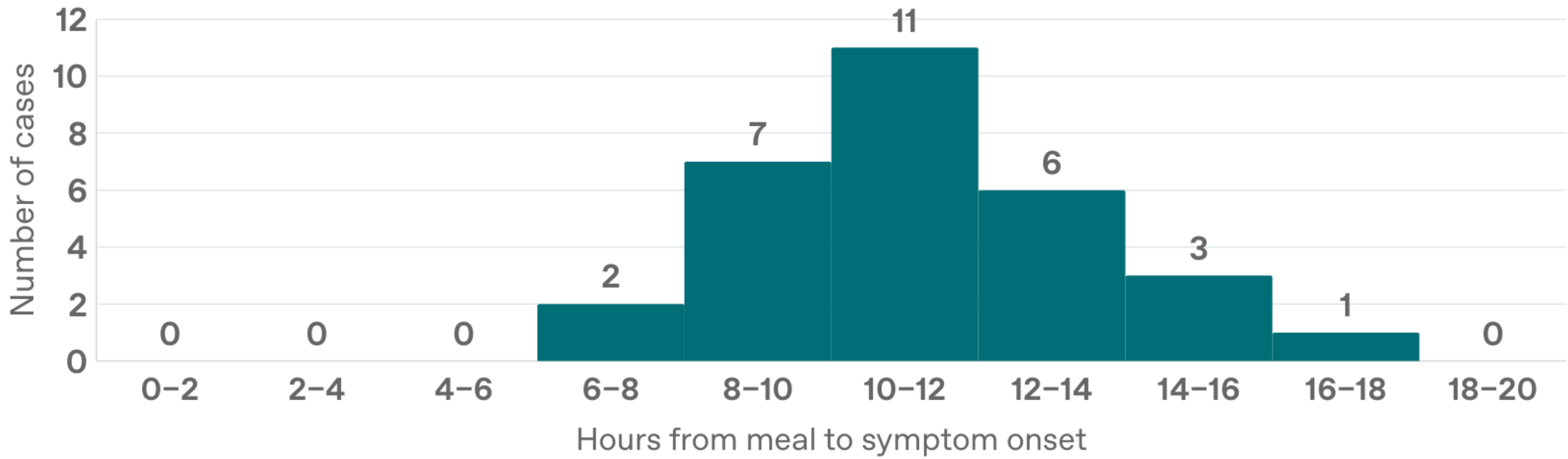
Line list: one row per person

ID	Onset after meal	Symptoms	Chicken	Specimen
01	6 h	Diarrhoea + cramps	Yes	Stool taken
02	8 h	Diarrhoea + cramps	Yes	Pending
03	10 h	Diarrhoea	No	Not taken
04	12 h	Diarrhoea + cramps	Yes	Pending

Hypothetical teaching data. Record contacts securely and prevent duplicate records.

Epidemic curve: onset time matters

Hypothetical cafeteria outbreak: 30 cases after one lunch



A compact peak supports a point-source hypothesis; it does not identify the organism.

Retrospective cohort: compare each food

Ate chicken?	Ill	Not ill	Total	Attack rate
Yes	24	16	40	60%
No	6	54	60	10%
Total	30	70	100	30%

Hypothetical event with a complete guest list. Attack rate is an incidence proportion.

From attack rates to a testable inference

Attack rate among eaters = 24/40 = 60%.

Attack rate among non-eaters = 6/60 = 10%.

RR = 60% / 10% = 6.0.

Risk difference = 60% – 10% = 50 percentage points.

Chicken is associated with illness. Correlated foods, bias and uncertainty still need assessment.

When no complete guest list exists

Chicken exposure	Cases	Controls
Yes	24	12
No	6	18

Hypothetical case–control sample: OR = (24 × 18)/(12 × 6) = 6.0.

When is a food convincingly implicated?

Epidemiology
Exposure–illness association

Laboratory
Compatible organism / toxin

Environmental assessment and traceback
A plausible failure and a linked food chain

Concordant evidence supports action. Assess alternative explanations.

Control begins before every result is ready

Immediate action	Purpose
Stop serving the suspected batch	Prevent continued exposure
Preserve food, labels and supplier records	Support testing and traceback
Assess food handlers and hygiene	Interrupt contamination / secondary spread
Correct cooling, holding and water problems	Address the mechanism of failure
Communicate and monitor new onsets	Check whether risk persists

Choose proportionate actions through the responsible health and food-safety authorities.

WHO Five Keys to Safer Food



Keep clean.

Separate raw and cooked.

Cook thoroughly.

Keep food at safe temperatures.

Use safe water and raw materials.

Time and temperature: practical controls

Control	WHO teaching guidance
Cold storage	Preferably below 5°C
Hot holding	Above 60°C
Room-temperature holding	Do not leave cooked food out for >2 h
Thorough cooking	70°C is a WHO teaching benchmark
Verification	Use a thermometer and validated food-specific procedures

Refrigeration slows growth; it does not sterilize food. Reheating may not destroy preformed toxins.

Iraq: mass gatherings and community kitchens

A Baghdad study sampled 100 Mawakib and 500 food handlers in 2014.

Observed practices showed gaps despite food-safety knowledge.

Translate training into handwashing, safe water and temperature checks.

Plan surveillance and referral before high-volume food service begins.



Historical findings cannot describe all Iraqi kitchens today.

Apply the evidence: a cafeteria cluster

Thirty of 100 guests develop diarrhoea and cramps, mostly 6–18 h after lunch.

Chicken attack rates are 60% in eaters and 10% in non-eaters.

Which mechanism and agent are plausible? What evidence is missing?

Working hypothesis: toxin-mediated illness, including C. perfringens. RR = 6 supports investigating chicken, but does not confirm the agent or vehicle.

Hypothetical exercise, not an actual Iraqi outbreak.

Key messages for clinical and field practice

Recognize severity and dehydration early.

Use incubation and symptoms to generate, not prove, hypotheses.

Compare exposure-specific attack rates with the correct denominator.

Triangulate evidence and control the mechanism of contamination.

Treat the patient. Investigate the cluster. Prevent the next case.

Textbook framework and WHO references

Park K. Preventive and Social Medicine. 28th ed. 2025.

Celentano DD, Szklo M, Farag Y. Gordis Epidemiology. 7th ed.

WHO. Food safety fact sheet and 2026 burden estimates.

WHO. Investigating foodborne disease outbreaks. Stage 1B. 2025.

WHO. Five keys to safer food manual (2006) and poster.

Textbooks guide further reading. Full textbook editions were not supplied; no page-specific quotations are claimed.

Iraqi records and supplementary sources

Iraqi health indicators 2024: Table 14, printed p.32.

Iraqi MoH communicable-disease dashboard: verify coverage.

Lami F et al. JMIR Public Health Surveill. 2019;5:e10922.

CDC: symptoms, outbreak etiology and investigation guidance.

CDC: clinical overview, STEC treatment and botulism guidance.

Exact URLs and source details are in slide notes. Teaching datasets are explicitly hypothetical.