Unsafe Food
and
Foodborne Enteric Diseases

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June 6, 2023
Overview

• Enteric pathogens commonly transmitted by consumption of unsafe food
• It is an important public health issue in industrialized and LMICs
• Disproportionally affect children, pregnant women, elder, immunocompromised,
• The pathogens cause acute gastroenteritis and diarrhoea, and other serious long term outcomes, such as Guillain-Barré syndrome, Reactive arthritis, stunting
• Ensuring food safety is a public health priority and an essential step to achieving food security
• Effective food safety is not only relevant to ensure the health and well-being of people, but also to fostering economic development
Causes of unsafe food

• **Food production process**
  • Natural reservoir in animals,
  • Contaminated environment, soil
  • Unsafe water use for irrigation,

**Food practices (in the food chain)**

• Unsafe food handling practices from farm to fork
• Unhygienic conditions,
• Unsafe food additives
• Lack of awareness among food handlers, in the community

**Applications of food safety system**

• Inadequate food mg’t system
• Week monitoring system, poorly enforced regulatory standards
• Lack of resources, capacity

**Other contributing factors**

• Poor infrastructure of the storage, distribution channels
• Domestic local market, open markets, street foods,
Burden of enteric disease estimates

• In 2010, WHO estimated 22 enteric foodborne diseases
  • 2.0 billion (95% UI 1.5–3.0 billion) illnesses, 39% in children < 5 years

• Among the 1.9 billion (95% UI 1.4–2.8 billion) cases of diarrheal diseases,
  • Norovirus was responsible for 684 million (95% UI 491–1,112 million) illnesses; the largest number of cases for any pathogen

• ETEC, Shigella spp., G. lamblia, Campylobacter spp. and NTS—next largest cases

• 29% (95% UI 23–36%) of all 22 diseases were estimated to be transmitted by contaminated food
  • 582 million (95% UI 400–922 million) foodborne cases, 38% (95% UI 24–53%) in children <5 years of age

• The pathogens resulting in the most foodborne cases were norovirus, Campylobacter spp., ETEC, NTS, and Shigella spp.

• EPEC, Cryptosporidium spp., and Campylobacter spp. occurred in high proportion among children <5 years of age
Deaths due to foodborne enteric diseases

• 1.09 million (95% UI 0.89–1.37 million) deaths, 34% (95% UI 29–38%) in children <5 years

• Among the diarrheal diseases, norovirus was responsible for the most deaths

• EPEC, V. cholerae, and Shigella spp. -- large numbers of deaths

• 351,000 (95% UI 240,000–524,000) deaths due to contaminated food, 33% (95% UI 27–40%) in children <5 years of age

• Salmonella Typhi, EPEC, norovirus, iNTS, NTS, and hepatitis A. --- responsible for most foodborne deaths

• The mortality rates highest in the African region and South Eastern Asian region
The Long-Term Health Outcomes

• Most foodborne illnesses result in acute symptoms including diarrhea, vomiting, abdominal pain, cramps, and sometimes fever and jaundice, and are self-limiting.

• However, for some pathogens can result in sequelae, which can be severe, require multiple hospitalizations, and be costly to society.
### The Long-Term Health Outcomes

<table>
<thead>
<tr>
<th>Health outcomes</th>
<th>Bacterial pathogens</th>
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| **Guillain-Barré syndrome**                                                    | • a rare but serious autoimmune illness, affects the nervous system and causes acute flaccid paralysis.  
• 10 days–3 weeks after gastrointestinal illness                                | • *Campylobacter* spp. infection                                                  |
| **Hemolytic uremic syndrome**                                                  | • can affect all body organs, resulting in: kidney failure; hypertension; neurological problems; diabetes; digestive problems; gallstones; irritable bowel syndrome,  
• 4–10 days after onset of gastroenteritis                                         | • infection with Shiga toxin–producing *Escherichia coli* (STEC)                 |
| **Irritable bowel syndrome**                                                   | • is a gastrointestinal disorder that causes abdominal pain and bowel dysfunction.  
• It is not life threatening, but it can cause substantial health effects          | • *Campylobacter* spp.,  
• Non typhoidal *Salmonella enterica* serotypes or *Shigella* spp.               |
| **Reactive arthritis**                                                         | • a type of spondyloarthritis that can developed upto 4 weeks after the infection  
• Case reports and outbreak investigations have demonstrated an association between reactive with a frequency of reactive arthritis ranging from 1% to 21% | • enteric infection from *Campylobacter* spp., non typhoidal *Salmonella* spp., *Shigella* spp., or *Yersinia enterocolitica* |
The Long-Term Health Outcomes ...

<table>
<thead>
<tr>
<th>Health outcomes</th>
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<tbody>
<tr>
<td>Neurological dysfunctions</td>
<td>• Long-term neurological damage</td>
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<td>• Infants who survive a <em>Listeria</em> infection</td>
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<td>may experience long-term neurological damage</td>
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<td>and delayed development.</td>
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<td>• Adults aged over 60 years can also be</td>
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<td>seriously affected by listeriosis.</td>
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<td>Cholangitis –</td>
<td>• Infection/inflammation of common bile duct</td>
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<td></td>
<td><em>Yersinia</em></td>
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<td>Epididymo-orchitis –</td>
<td>• Inflammation of one or both of the testicles</td>
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<td></td>
<td><em>Brucella</em></td>
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<td>Malnutrition, stunting</td>
<td>• Is a major contributor to mortality and is</td>
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<td>increasingly recognized as a cause of,</td>
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<td>potentially lifelong, functional disability</td>
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<td></td>
<td>• Enteric infections and malnutrition: a</td>
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<td></td>
<td>vicious cycle</td>
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<td>• Higher proportion of death of &lt; 5 children</td>
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<td>are associated with malnutrition</td>
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<td>• due to multiple repeated enteric infections,</td>
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<td></td>
<td>diarrhea</td>
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Antimicrobial resistance (AMR)

• Currently, foodborne illness caused by bacterial contamination is one of the foremost threats of public health

• These bacterial pathogens are recognized as concern due to the emergence and rapid transmission of AMR in humans, animals, and the environment

• Antibiotic resistance has led to adverse consequences such as prolonged hospitalization, increased medical expenses, overburdened public health system, and even increased mortality rates

• WHO lists AMR as one of the top ten public health threats in the world
Antimicrobial resistance ...

• A global AMR meta analysis, the prevalence of AMR foodborne pathogens in human clinical specimens was greater than 19% (Tao Q. et al., 2022)

• AMR in Ethiopia, the pooled prevalence of AMR in bacteria from food producing live animals was 20% (Gemeda et al., 2021)
  • The overall pooled multi-drug resistance (MDR) prevalence was 74% among AMR positive samples
  • Higher MDR pattern were reported from
    • *Staphylococcus* spp. (96%),
    • *Salmonella* spp. (81%) and
    • *Escherichia coli* (77%)
Efforts made to improve food safety

• Globally considerable efforts were made to improve food safety and prevention of enteric diseases
  • Sustainable Development Goals (SDGs)- food safety
  • WHO global strategy for food safety 2022-2030
• Despite these advances, food safety remains a challenge due to multifaceted reasons
• Thus, national and global efforts should be continued to ensure food safety at local and global levels
Conclusion

• Food safety remains as a challenge globally, particularly in LMICs
• Unsafe food has severe health, social and economic consequences
• There are multifaceted challenges to ensure food safety at local, national and global levels
• Enteric foodborne disease disproportionally affect disadvantages segment of the populations
• Continuous estimation of enteric foodborne disease is very crucial to prioritize the problems and to adequately inform policy-makers
• Effective and sustainable interventions are necessary for long-term improvement of food safety
• Collaboration and communication is needed among stakeholders and partners to alleviate the problem
Thank you