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CASE STUDY

Foodborne Illness and Environmental Health: Global Burden and Kosovo Surveillance Gaps

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Abstract

Foodborne illness is a critical environmental and public-health challenge, shaped by host immunity, ecological conditions, and contaminated food sources. Globally, millions of cases occur annually, with substantial morbidity and mortality [1,2]. Contaminants include microbial agents—bacteria, viruses, parasites, fungi—and non-microbial agents such as plant toxins, animal toxins, and chemicals. Clinical manifestations typically resemble gastroenteritis, with diarrhea, nausea, vomiting, and abdominal pain. Diagnosis is primarily clinical, supported by stool cultures, microscopy, and molecular techniques [3]. Treatment emphasizes rehydration, symptomatic management, and pathogen-specific antimicrobial therapy when indicated [2]. Environmental determinants—unsafe food handling, poor sanitation, contaminated water, and inadequate storage—are central to outbreaks [4]. In Kosovo, surveillance data highlight recurring incidents, including the July 2026 Salmonella outbreak in Prishtina affecting 74 individuals [5]. This review synthesizes global evidence and critically analyses the Kosovo case study within an environmental and One Health framework, underscoring the urgent need for strengthened surveillance, integrated policy responses, and preventive strategies.

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Introduction

Foodborne illness remains one of the most frequent global public-health problems, with transmission via contaminated food, water, or poor hygiene [1]. In industrialized countries, up to 30% of the population experiences foodborne illness annually [2]. In Kosovo, surveillance data highlight recurring outbreaks, including the July 2026 Salmonella incident in Prishtina, which affected 74 individuals and required hospitalization for 29 patients [4,5]. This review integrates global insights with a Kosovo-specific case study,

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emphasizing environmental determinants and One Health perspectives.

Materials and Methods

This work was conducted as a narrative review with case-study integration, combining global evidence on foodborne illness with a focused analysis of surveillance and outbreak data from Kosovo. The design was chosen to allow synthesis of diverse sources (systematic reviews, surveillance reports, outbreak investigations, and policy documents) while situating findings within an environmental and One Health framework.

Literature Search Strategy. A comprehensive search was performed across multiple databases: PubMed, Scopus, Web of Science, and Google Scholar, supplemented by national epidemiological bulletins and official reports from WHO, FAO, CDC, ECDC, and EFSA. Search period: January 2005 – July 2026. Keywords and Boolean operators: “foodborne illness” OR “food poisoning” OR “foodborne infection” AND “environmental determinants” OR “surveillance” OR “Kosovo” OR “Balkan outbreaks.” Language restriction: English and Albanian publications were included. Grey literature: National surveillance bulletins, EFSA zoonoses reports, and ECDC country visit documents were reviewed to capture regional data.

Inclusion and Exclusion Criteria. Inclusion: Peer-reviewed articles, systematic reviews,

meta-analyses, outbreak investigations, surveillance reports, and international guidelines (WHO, FAO, CDC, ECDC, EFSA), [1,4]. Exclusion: Publications older than 20 years (unless landmark studies), non-peer-reviewed opinion pieces, and reports lacking methodological transparency. Final selection: 87 articles and reports met criteria after screening. Screening and Data Extraction. Two reviewers independently screened titles and abstracts. Full texts were retrieved for eligible studies. Data extraction focused on: Pathogen type and epidemiological characteristics, Environmental determinants (sanitation, water, food handling, and climate), Surveillance and outbreak response mechanisms, Kosovo-specific outbreak data and lessons learned, Discrepancies were resolved by consensus.

Quality Assessment. Systematic reviews: Evaluated using AMSTAR-2 [6]. Observational studies: Assessed with the Newcastle–Ottawa Scale. Policy and surveillance reports: Appraised for transparency, completeness, and alignment with international standards.

Case study integration

The Kosovo case study was developed using outbreak data from the Institute of Public Health of Kosovo, EFSA zoonoses monitoring, and ECDC country visit reports. The July 2026 Salmonella outbreak in Prishtina was analyzed in detail, including case counts, hospitalization rates, suspected food sources, and surveil-

Table 1: Major Foodborne Pathogens and Epidemiological Characteristics.

Pathogen	Main Source	Incubation	Main Syndrome	Complications	Prevention
<i>Clostridium botulinum</i>	Improperly canned foods	12-36 h	Vomiting, blurred vision, respiratory difficulty	Respiratory paralysis, death	Proper canning
<i>Escherichia coli</i> (STEC)	Undercooked beef, raw vegetables	72-120 h	Diarrhea (bloody), cramps	Hemolytic uremic syndrome	Cook meat, wash produce
<i>Campylobacter</i> spp.	Poultry, milk, water	2-5 days	Fever, diarrhea, cramps	Guillain-Barré syndrome	Cook poultry, pasteurize milk
<i>Shigella</i> spp.	Contaminated food/water	1-2 days	Diarrhea (blood/mucus), fever	Severe dehydration	Hand hygiene, safe water
Norovirus	Shellfish, water	12-48 h	Vomiting, diarrhea	Severe dehydration	Hygiene, safe food handling



Table 2: Environmental and Food-Chain Determinants of Foodborne Illness.

Determinant	Impact
Sanitation	Poor sanitation increases fecal–oral transmission
Water quality	Contaminated water spreads pathogens
Food handling	Unsafe practices cause cross-contamination
Storage	Inadequate refrigeration promotes bacterial growth
Climate change	Rising temperatures increase pathogen survival

Table 3: Major Foodborne Outbreaks in Kosovo (2000-2026).

Outbreak	Year	Pathogen	Cases	Hospitalizations	Key Lessons
Salmonella outbreak, Prishtina	2026	Salmonella spp.	74	29	Need for stronger surveillance, food-source tracing
Norovirus outbreak, Gjakova	2022	Norovirus	112	18	Importance of water sanitation
Campylobacter outbreak, Peja	2019	Campylobacter	56	12	Poultry hygiene and monitoring

lance gaps. Comparative analysis was performed against regional outbreaks (Norovirus 2022, Campylobacter 2019) to highlight systemic challenges.

Results and Discussion

Causes and Clinical Features

Foodborne illness arises from microbial and non-microbial contaminants. Vulnerable groups include children, the elderly, and immunocompromised individuals [2] (Table 1).

Environmental Determinants

Environmental drivers such as sanitation, water quality, food handling, storage, and climate change are central to foodborne illness [1,4,6] (Table 2).

Kosovo Case Study

The July 2026 Salmonella outbreak in Prishtina affected 74 individuals, with 29 hospitalizations. Surveillance reports identified gaps in outbreak detection, food-source tracing, and antimicrobial susceptibility testing [4,5] (Table 3).

Treatment

Treatment emphasizes oral rehydration therapy, symptomatic management, and guide-

line-based antibiotic use when indicated [2,3]. Antibiotics are avoided in Shiga toxin–producing *E. coli* but recommended for invasive *Salmonella* or *Campylobacter* infections [7].

Prevention

Preventive strategies include safe cooking, refrigeration, hand hygiene, and industrial measures such as wastewater treatment and food-chain monitoring [1,4]. Policy priorities include strengthening surveillance, outbreak detection, and One Health integration [5,6].

Conclusion

Foodborne illness remains a pervasive global and environmental public-health challenge, with profound implications for health systems, food safety, and community resilience. This review demonstrates that microbial and non-microbial contaminants, combined with environmental determinants such as sanitation, water quality, and food handling, drive recurrent outbreaks worldwide and in Kosovo [1,4]. The July 2026 Salmonella outbreak in Prishtina illustrates both the vulnerability of local surveillance systems and the opportunity to strengthen outbreak detection, laboratory capacity, and food-chain monitoring [5]. Moving beyond descriptive accounts, the evidence highlights the need for integrated One Health approaches that



address zoonotic reservoirs, antimicrobial resistance, climate change, and globalization of food supply chains. Policy priorities should include investment in surveillance infrastructure, harmonization with international food-safety standards, and community-level education to reduce risks. By situating Kosovo's experience within a global framework, this review contributes to a sharper understanding of foodborne illness as an environmental public-health challenge and calls for coordinated interventions to reduce its burden [8–10].

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