

IN THE NAME OF GOD



Epidemiology, Etiology and Clinical Classification of common Gastrointestinal Infections in Children

Global and Iran perspective

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Global History of Pediatric Gastrointestinal Infection

- 1.The Pre-Vaccine Era (1990s–2000s)
- **High Absolute Burden:**
- Diarrheal disease was **one of the leading causes of under-5 mortality worldwide, accounting for millions of child deaths annually.**
- **Rotavirus Dominance:**
- Rotavirus was the single most common and severe viral cause of acute gastroenteritis (AGE) in both high- and low-income countries
- **Key Interventions:**
- Early reductions in mortality were primarily driven by the scale-up of Oral Rehydration
- Therapy (ORT/ORS), improved maternal-child nutrition, and basic **water, sanitation, and hygiene (WASH)**



Global History of Pediatric Gastrointestinal Infection

- 2.The **Vaccine Era & Epidemiologic Shift (2006–Present)** **Rotavirus Vaccines (2006):**
- Global introduction of rotavirus vaccines led to a **dramatic fall in severe diarrhea hospitalizations and deaths** (preventing hundreds of thousands of child deaths globally).
- **The Rise of Norovirus:**
- In countries with high rotavirus vaccine coverage, **norovirus emerged as the leading cause of viral pediatric gastroenteritis.**
- **Diagnostic Evolution:**
- The shift from traditional culture/microscopy to highly sensitive **molecular diagnostics (multiplex PCR)** revealed a **high prevalence of co-infections and atypical viral/bacterial pathogens.**



Global History of Pediatric Gastrointestinal Infection

- **3. Current Trends & Remaining Challenges**
- **79% Decline in Mortality:**
- Between 1990 and 2021, under-5 diarrheal deaths dropped by ~79% globally, though it still **causes over 440,000 deaths annually**.
- **High-Burden Pathogens:**
- Shigella, rotavirus, adenovirus, Cryptosporidium, and enterotoxigenic E. coli (ETEC) remain the leading causes of diarrheal deaths.
- **Emerging Threats:**
- Multidrug-resistant bacterial strains (especially Shigella resistant to azithromycin and ciprofloxacin) and persistent vaccine coverage gaps in resource-limited regions (sub-Saharan Africa and South Asia).



Diarrhea turns preventable exposure into deaths and resource use

Why pediatric GI infection remains a systems problem

—
~1.7B

childhood episodes / year

WHO global estimate

—
443,832

deaths in children <5

WHO estimate

—
3rd

cause of death,
age 1–59 mo

WHO classification

—
25%

shorter duration with zinc

WHO summary of evidence

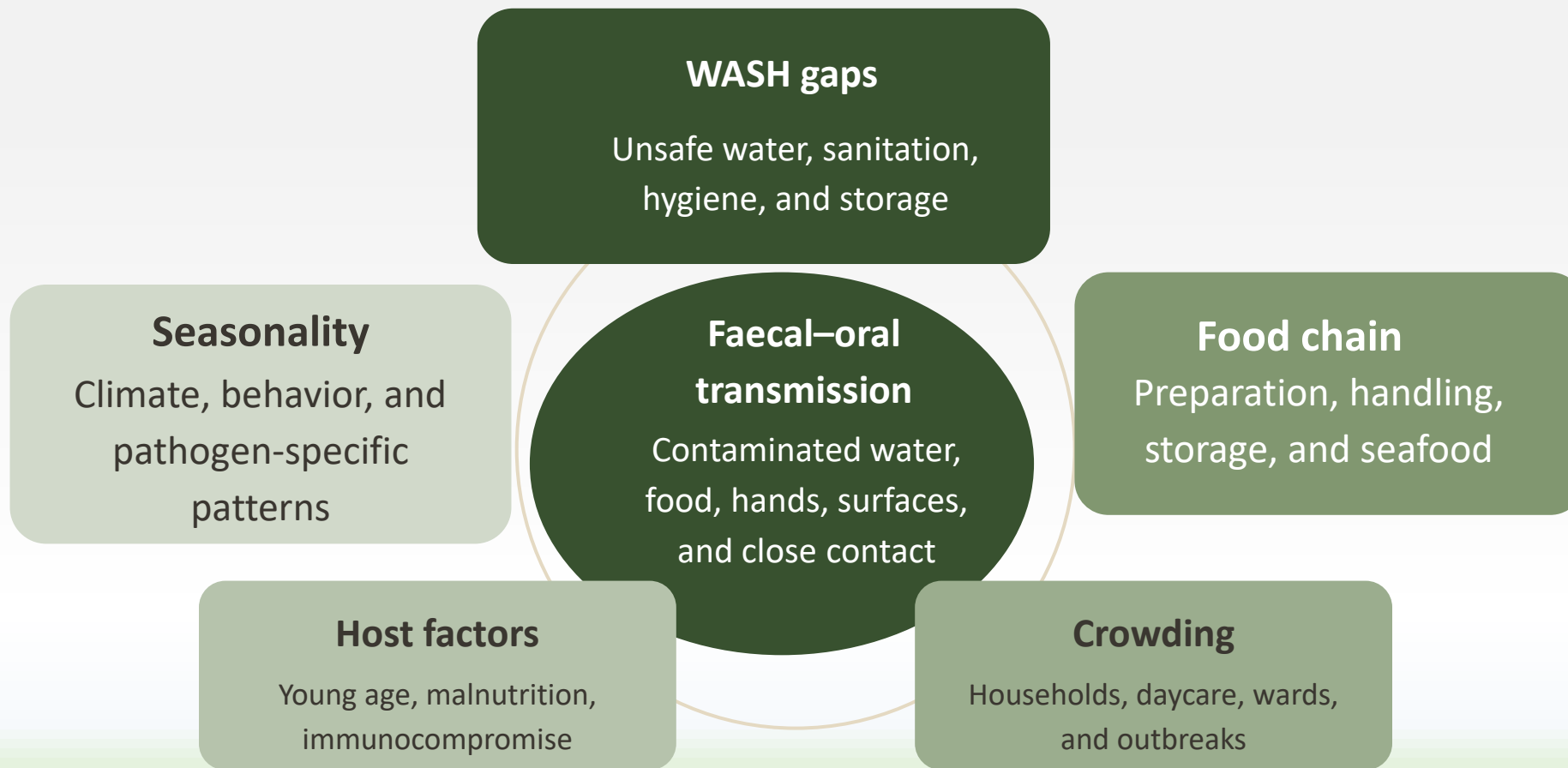


The emergency is dehydration; the longer cycle is diarrhoea ↔ malnutrition.



The faecal–oral pathway links exposure, behavior, host, and institutions

Risk is produced by interacting exposures



Context reshapes pediatric GI syndromes

Higher-resource settings

- Safer water and sanitation
- Broader vaccine coverage
- Seasonal viral peaks

Lower-resource settings

- Unsafe WASH increases exposure
- Limited care raises severity
- Seasonality interacts with access

The same syndrome can carry very different risks.



The **Global Epidemiology** of infectious acute gastroenteritis in children **is shifting due to widespread rotavirus vaccination**, the rising prominence of norovirus, and shifts in pathogen circulation tracked by the World Health Organization.

Overall mortality has dropped, but viral pathogens remain the leading cause of young child hospitalizations



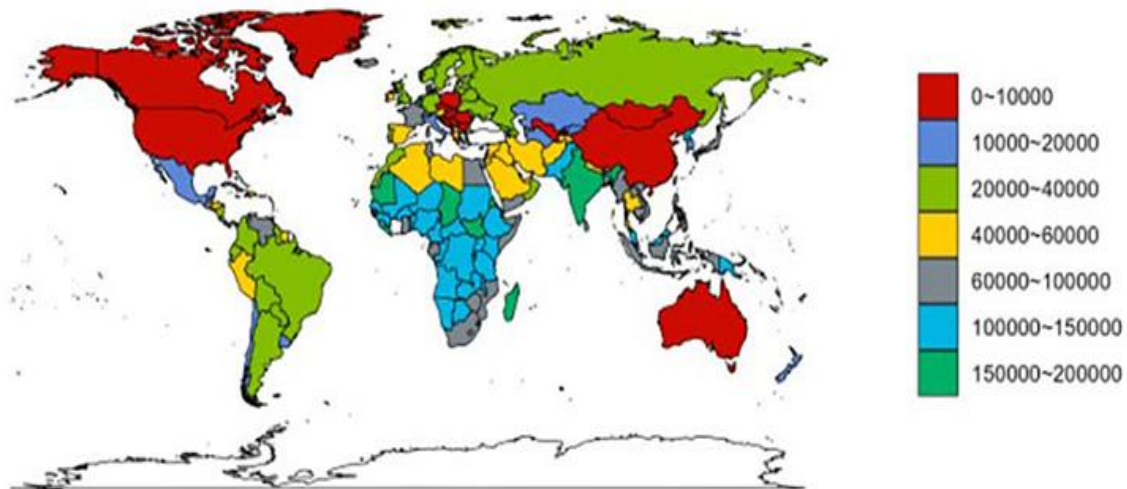
The global burden of childhood diarrhea and its epidemiological characteristics from 1990 to 2021(2025)

Epidemiological situation of children diarrhea diseases in 204 countries and regions in 2021

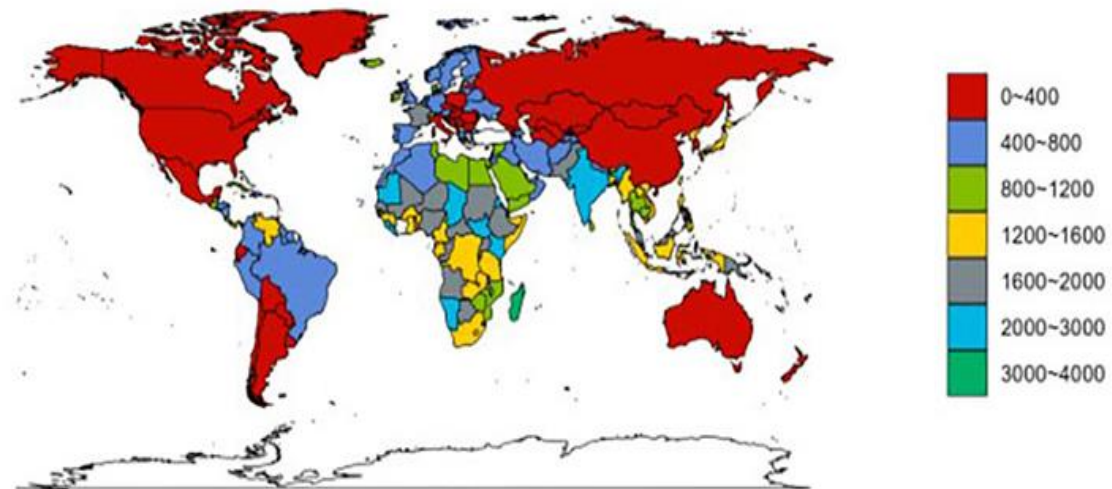
- August 2025 [Frontiers in Pediatrics](#) 13
DOI: [10.3389/fped.2025.1656234](https://doi.org/10.3389/fped.2025.1656234)



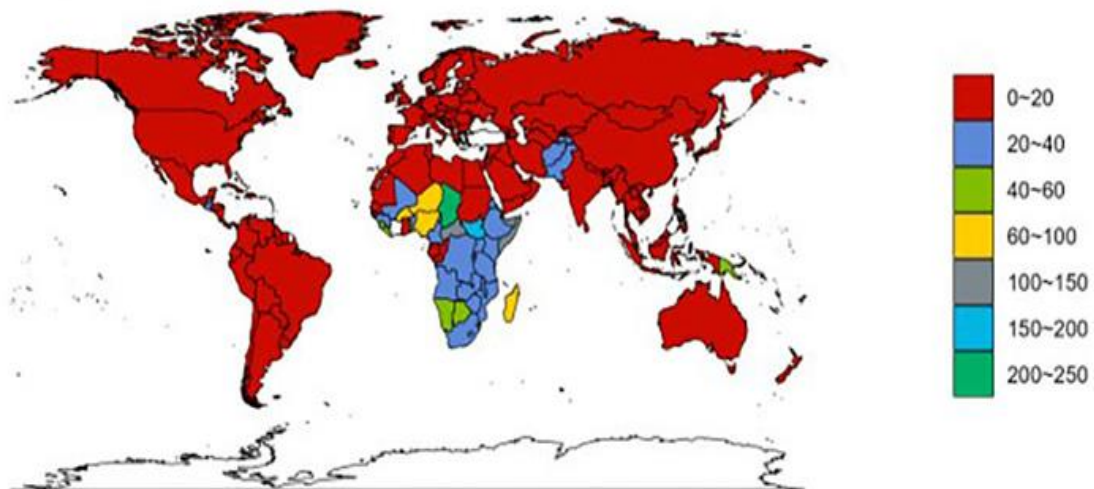
A Incidence rate



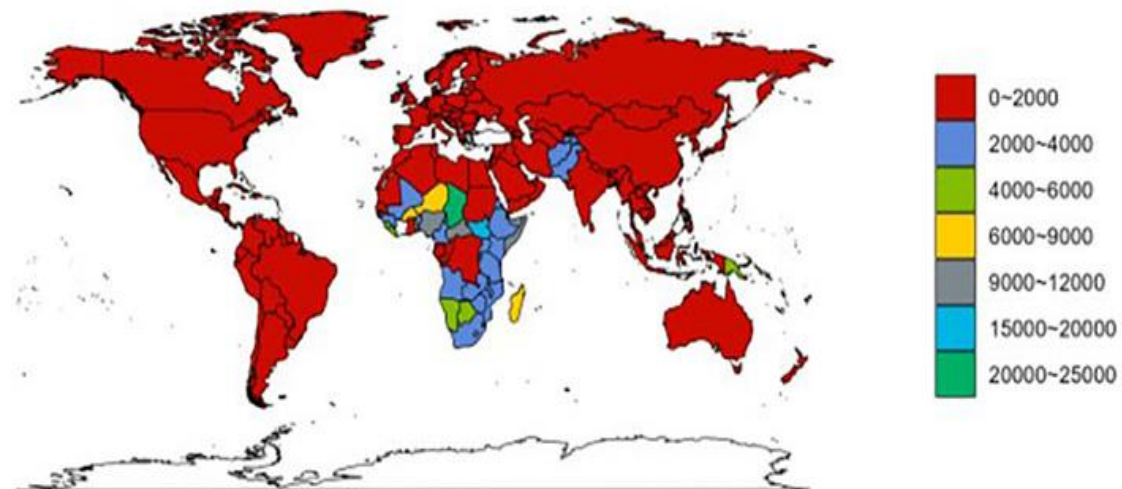
B Prevalence rate



C Deaths rate



D DALYs rate DALY, disability-adjusted life-year.



(A–D) incidence, prevalence, mortality and DALYs rate of childhood diarrhea in 204 countries and regions.

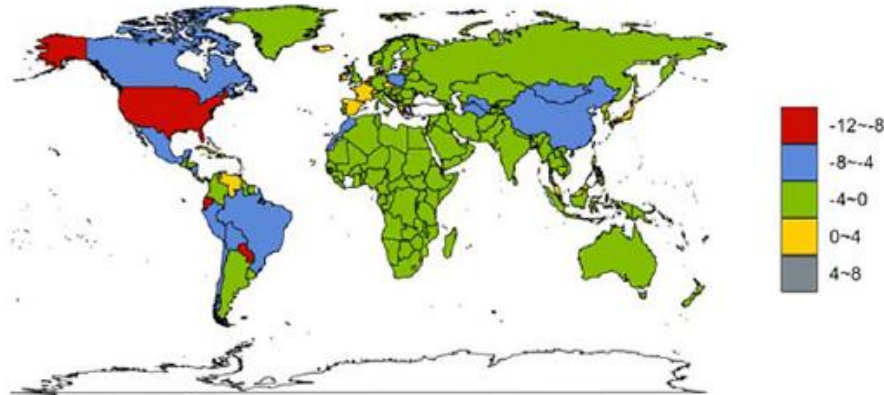
- **Prevalence:** the proportion of a population that **has a disease** at a specific time (existing cases).
- *Example: 10% of children currently have diarrhea.*
- **Incidence:** the number or rate of **new cases** occurring during a defined period.
- *Example: 50 new diarrhea cases occurred during one month.*

**In short: Prevalence = all existing cases;
Incidence = new cases only.**

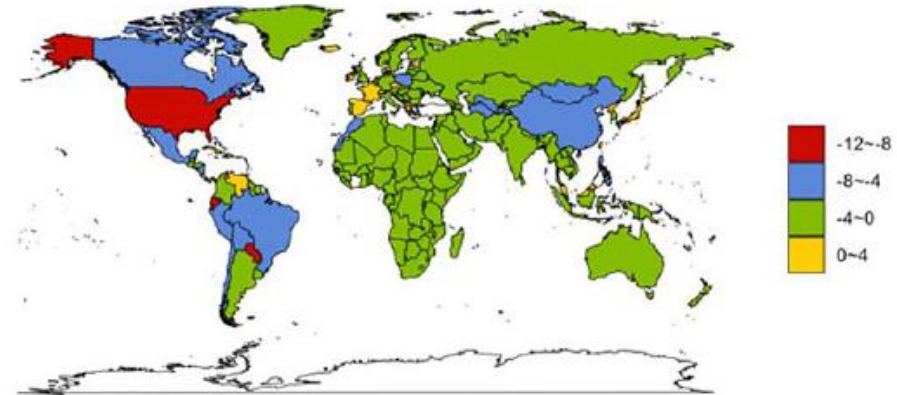


EAPC means Estimated Annual Percentage Change.

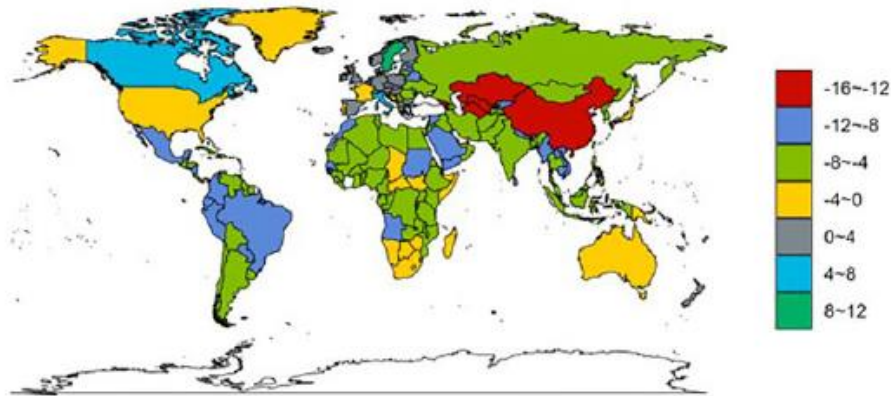
A EAPC for the incidence rate



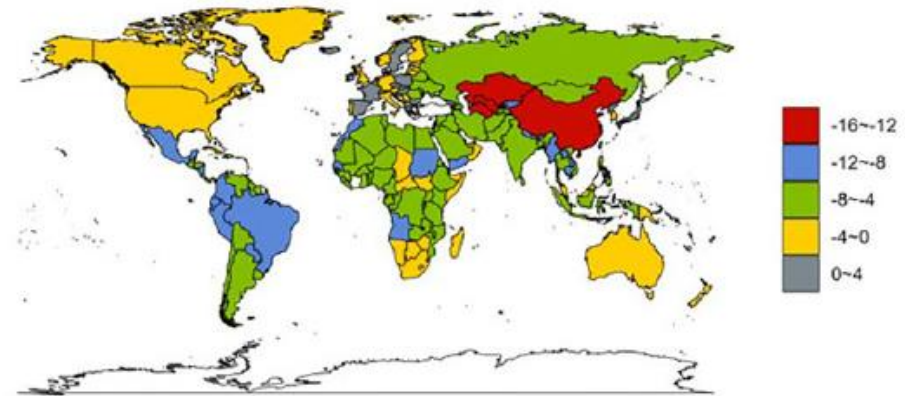
B EAPC for the prevalence rate



C EAPC for the deaths rate



D EAPC for the DALYs rate



DALY, disability-adjusted life-year.

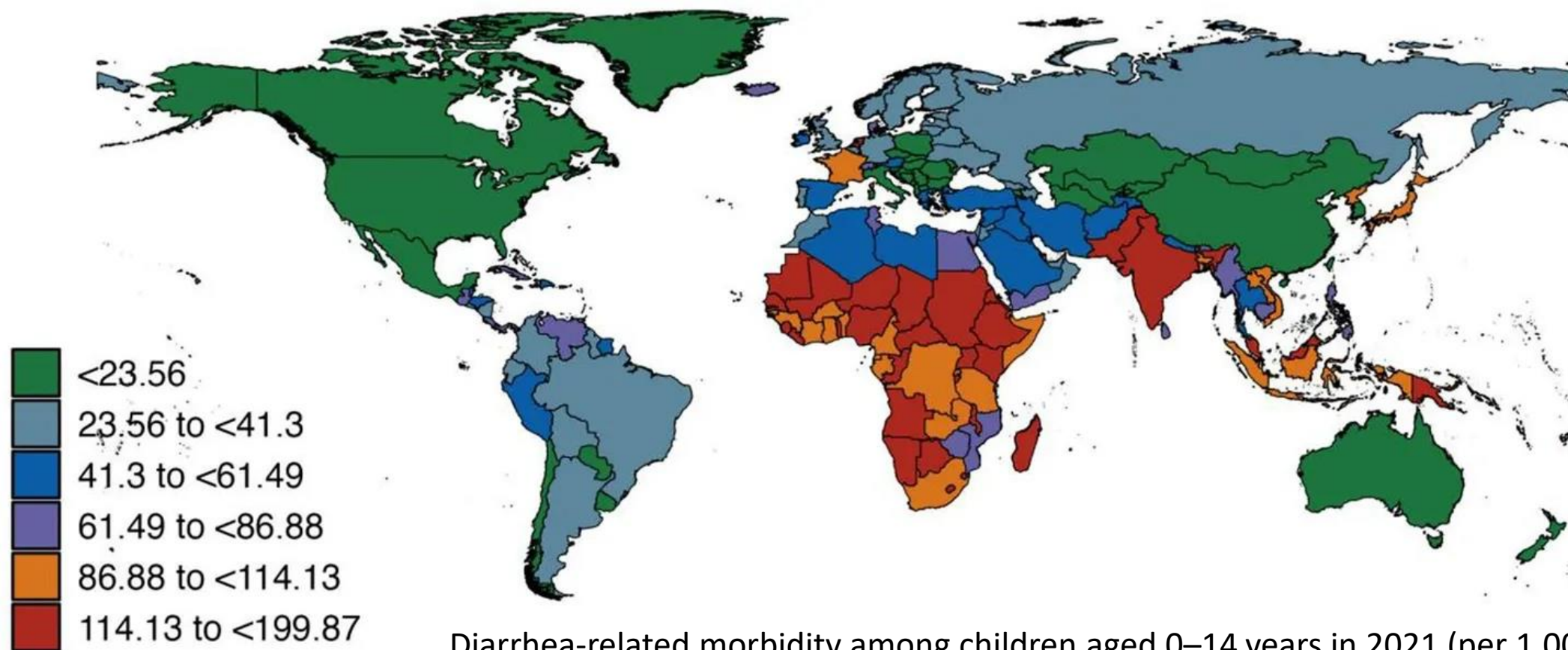
FIGURE 5

The EAPC of incidence, prevalence, mortality and DALYs rate of childhood diarrheal diseases in 204 countries and regions. (A) EAPC of incidence. (B) EAPC of prevalence. (C) EAPC of mortality. (D) EAPC of DALYs rate.

Regional and Age-specific global trends associated with infectious diarrhea in children under 14 years old caused by pathogenic microorganisms in 2021

Frontiers in Medicine. 2025 Oct 20;12:1676249.
doi: [10.3389/fmed.2025.1676249](https://doi.org/10.3389/fmed.2025.1676249)





Diarrhea-related morbidity among children aged 0–14 years in 2021 (per 1,000,000,000).

Caribbean and Central Americ

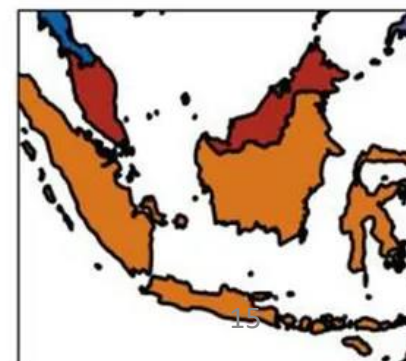
Persian Gulf

Balkan Peninsula

Southeast Asia

West Afri

Eastern
Mediterran



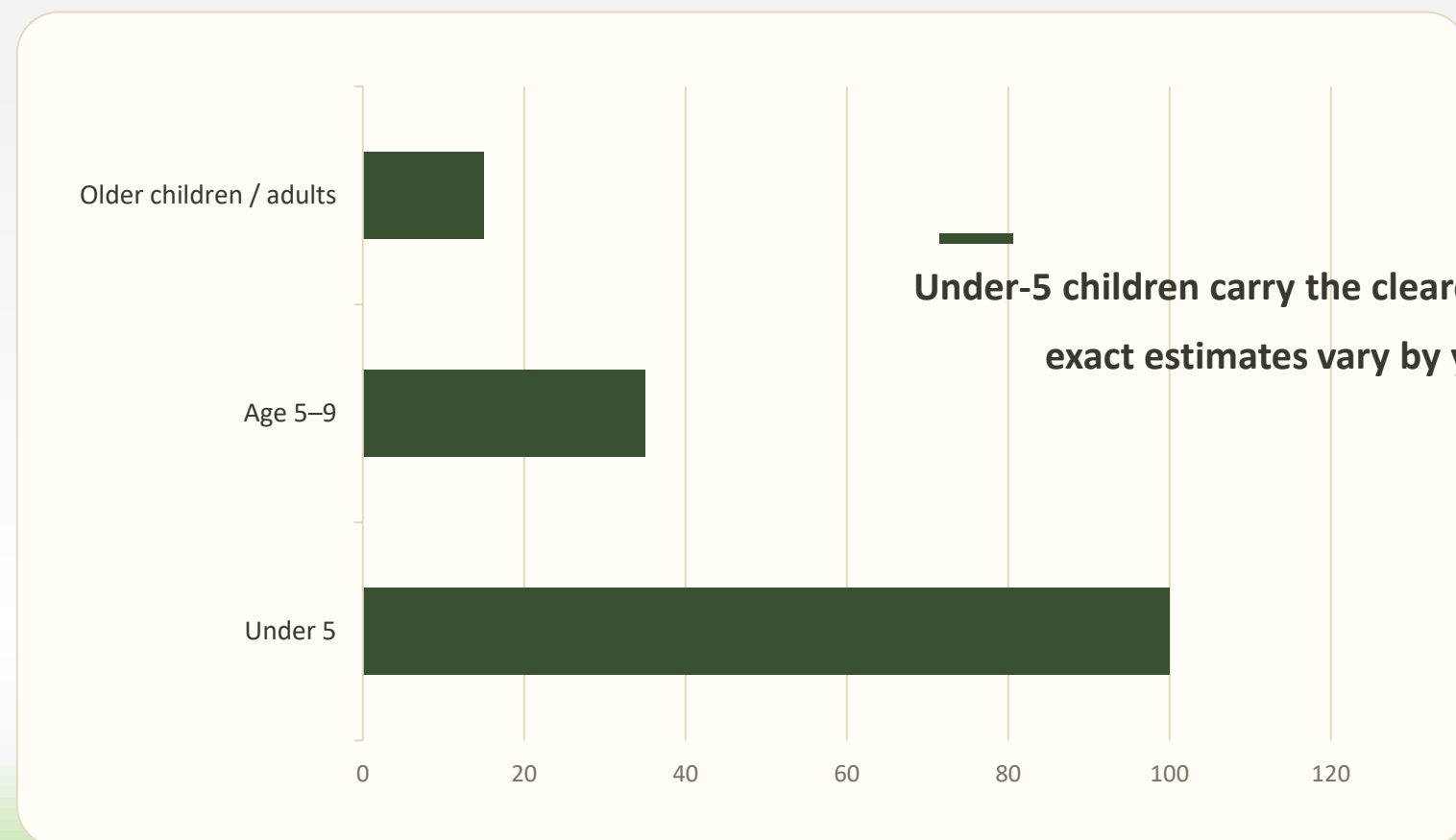
Northern Europe



The burden concentrates in early childhood and lower-resource settings

How to read the global burden

Interpret the gradient, not false precision



Under-5 children carry the clearest mortality and nutrition signal;
exact estimates vary by year, model, and location.



Viruses lead many pediatric cases; bacteria and parasites shape severity

Aetiology is age-, geography-, and assay-dependent



Viral

Rotavirus, norovirus, adenovirus 40/41, astrovirus



Bacterial

Diarrhoeagenic E. coli, Shigella, Salmonella, Campylobacter



Parasitic

Cryptosporidium, Giardia, Entamoeba;
important in some preschool groups



Interpretation

Detection is not always causation; use clinical context



Infection is a syndrome pattern, not a single diagnosis

Use the clinical clue to decide which pathogen group deserves attention.

1

Viral

Watery diarrhea, vomiting,
sick contacts, outbreaks

2

Bacterial

Fever, blood, tenesmus,
severe pain, food exposure

3

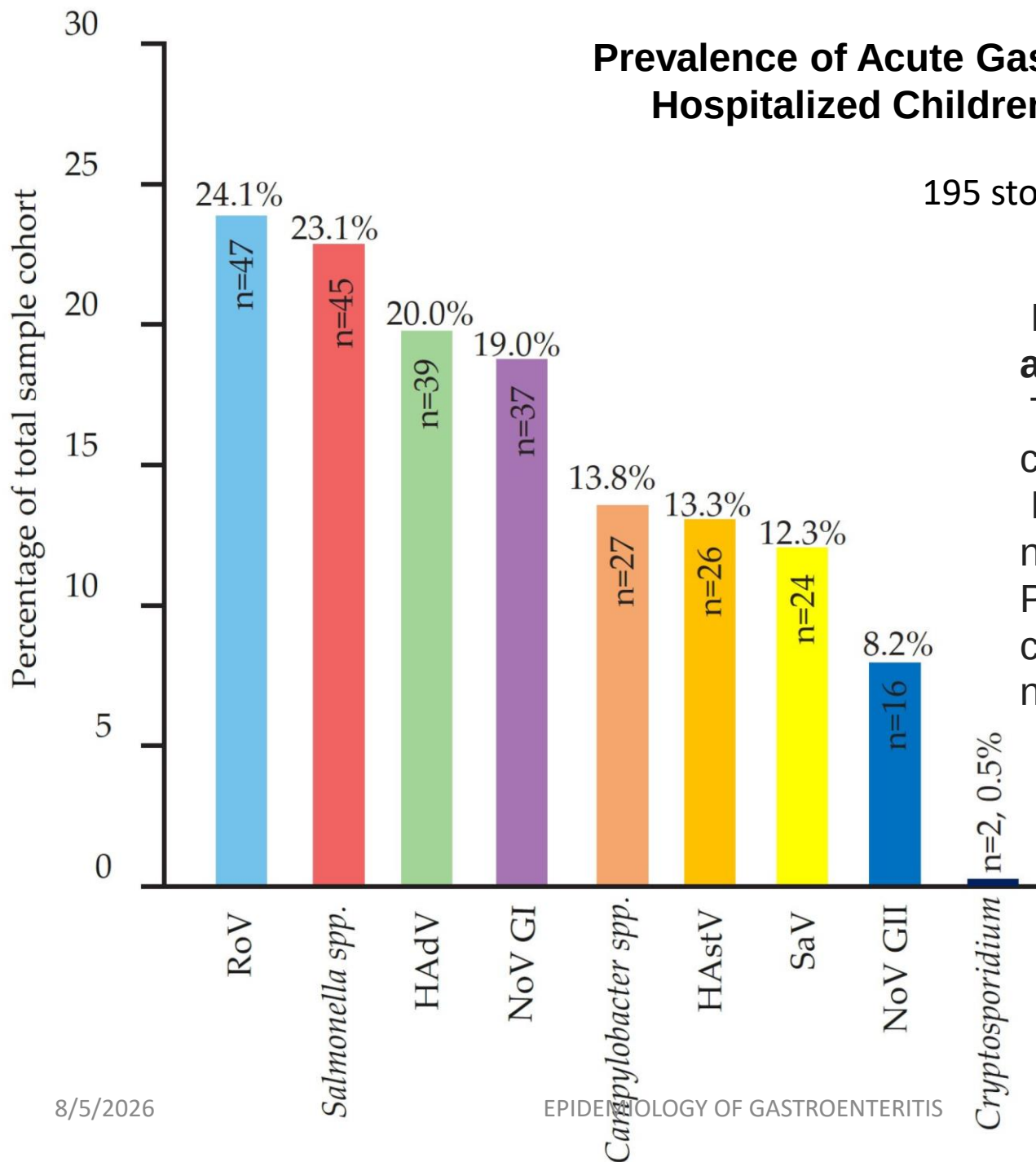
Parasitic

Prolonged course, travel or
water exposure, malabsorption



Prevalence of Acute Gastroenteritis Enteropathogens Among Hospitalized Children in Jordan: A Single-Center Study

195 stool samples

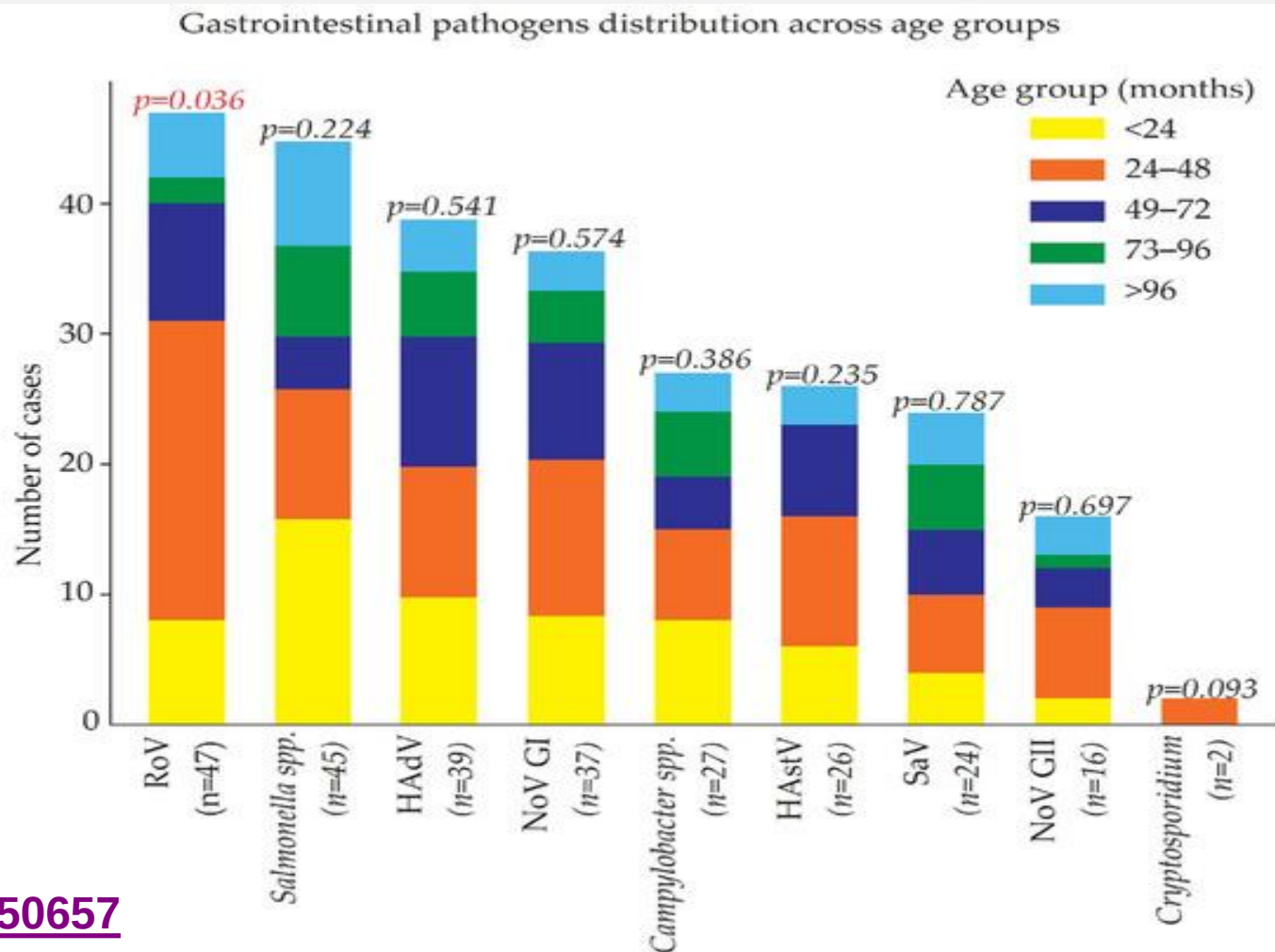


Prevalence of **gastrointestinal pathogens detected among tested cases.**

The figure shows the number and percentage of positive cases for each pathogen.

RoV: rotavirus; HAdV: human adenovirus; NoV: norovirus; HAstV: human astrovirus; SaV: sapovirus. Pathogens with no positive cases are listed for completeness. Percentages are based on the total number of samples tested. JORDAN 2025

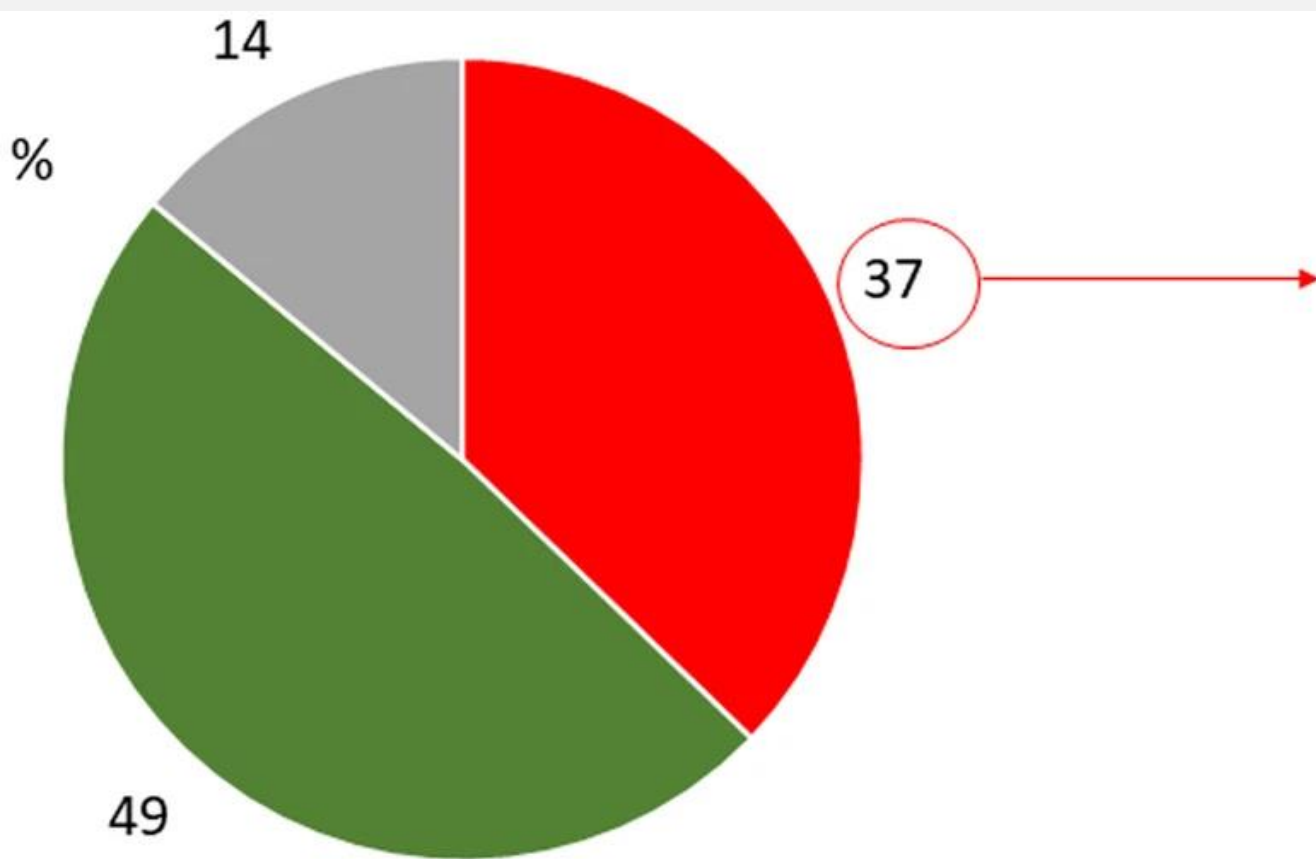




Viruses 2025, 17(5), 657; <https://doi.org/10.3390/v17050657>

Age distribution of gastrointestinal pathogens among children. The table shows the frequency of cases caused by each pathogen across different age groups and the corresponding *p*-values to indicate statistical significance. JORDAN 2025





- Positive stool tests
- Negative stool tests
- Not tested

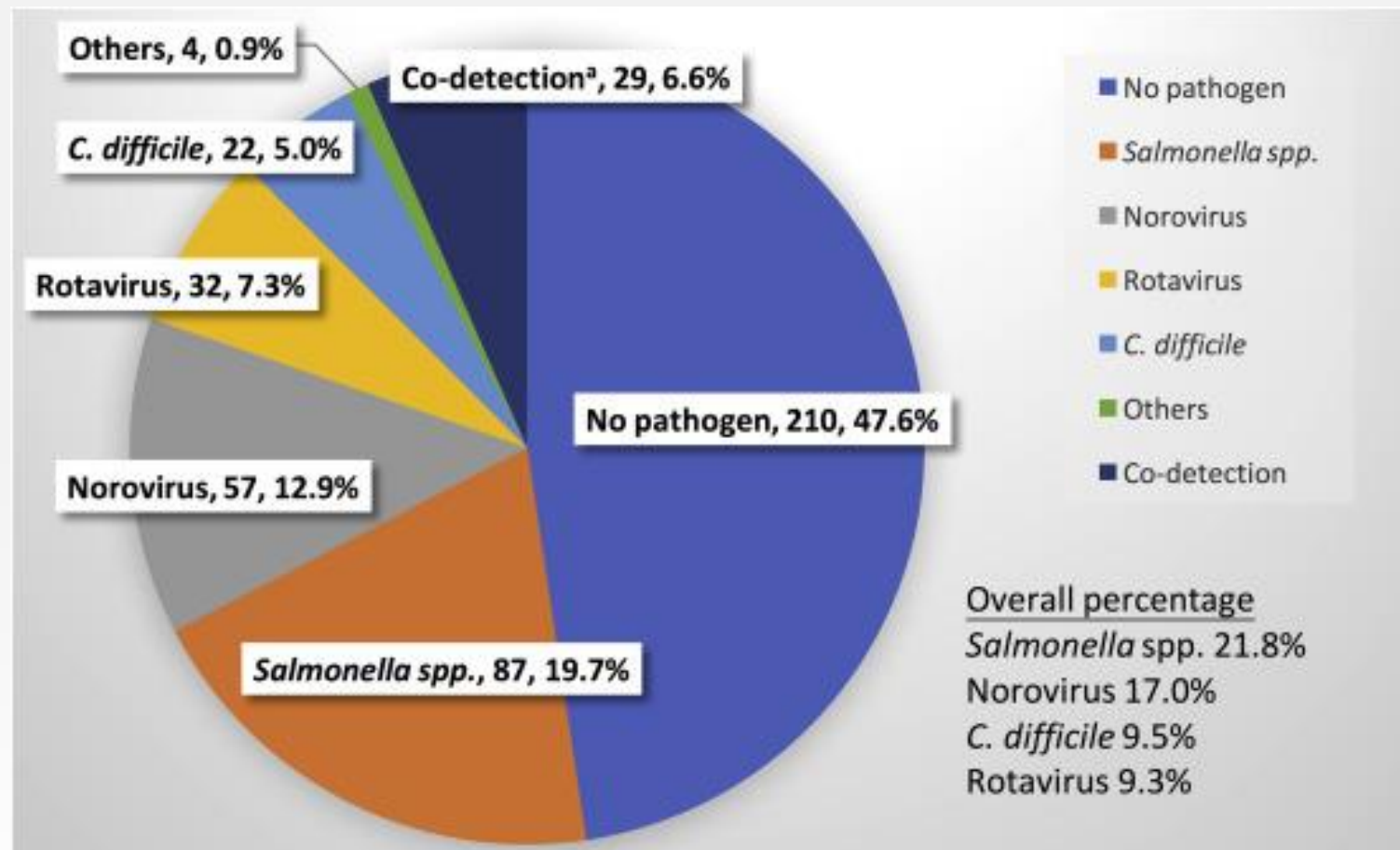
Viruses (n=18)	Bacteria (n= 12)
Adenovirus (n= 9)	Campylobacter j. (n= 6)
Rotavirus (n= 4)	Salmonella non t. (n= 4)
Norovirus (n= 4)	Yersinia e. (n= 1)
Astrovirus (n= 1)	STEC (n= 1)
Coinfections (n= 2)	
Astrovirus + Salmonella non t.	

The evolving epidemiology of acute gastroenteritis in hospitalized children in Italy 2019

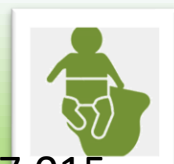
<https://doi.org/10.1007/s00431-021-04210-z>



Patients aged less than 5 years who was hospitalized due to AGE in National Cheng Kung University Hospital were enrolled from July 2014 to June 2016.



Distribution of detected pathogens in the patients with acute gastroenteritis in NCKUH (N = 441)TAIWAN. ^aTwenty-nine co-detection patients included 13 norovirus + *C. difficile*, 6 rotavirus + *C. difficile*, 4 *Salmonella* spp. + norovirus, 2 *Salmonella* spp. + rotavirus, 1 norovirus + rotavirus, 1 *Salmonella* spp. + *Clostridium perfringens*, 1 *Salmonella* spp. + *C. difficile*, 1 *Salmonella* spp. + *Giardia lamblia*.



Geographical distribution of Rotavirus G and P genotype combinations in the MENA region.

Other include rare genotypes (overall proportion < 1%).

Mixed represent infections with multiple G and/or P genotypes.

Untypable: include untypable samples for G and/or P genotypes.

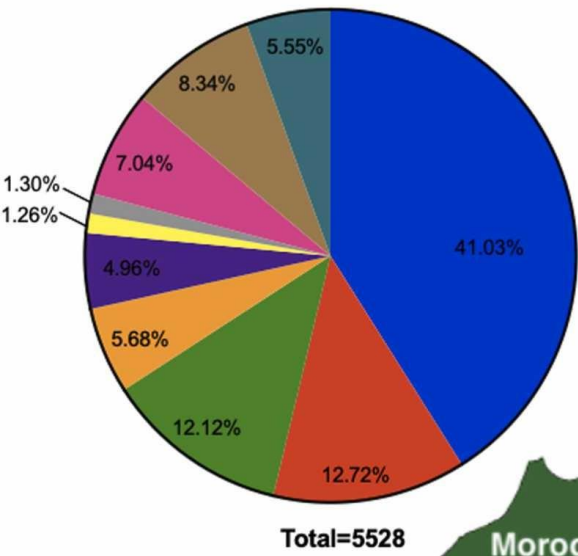
middle East and North Africa (MENA) region

[Journal of Infection and Public Health](#)

[Volume 15, Issue 11](#), November 2022, Pages 1193-1211



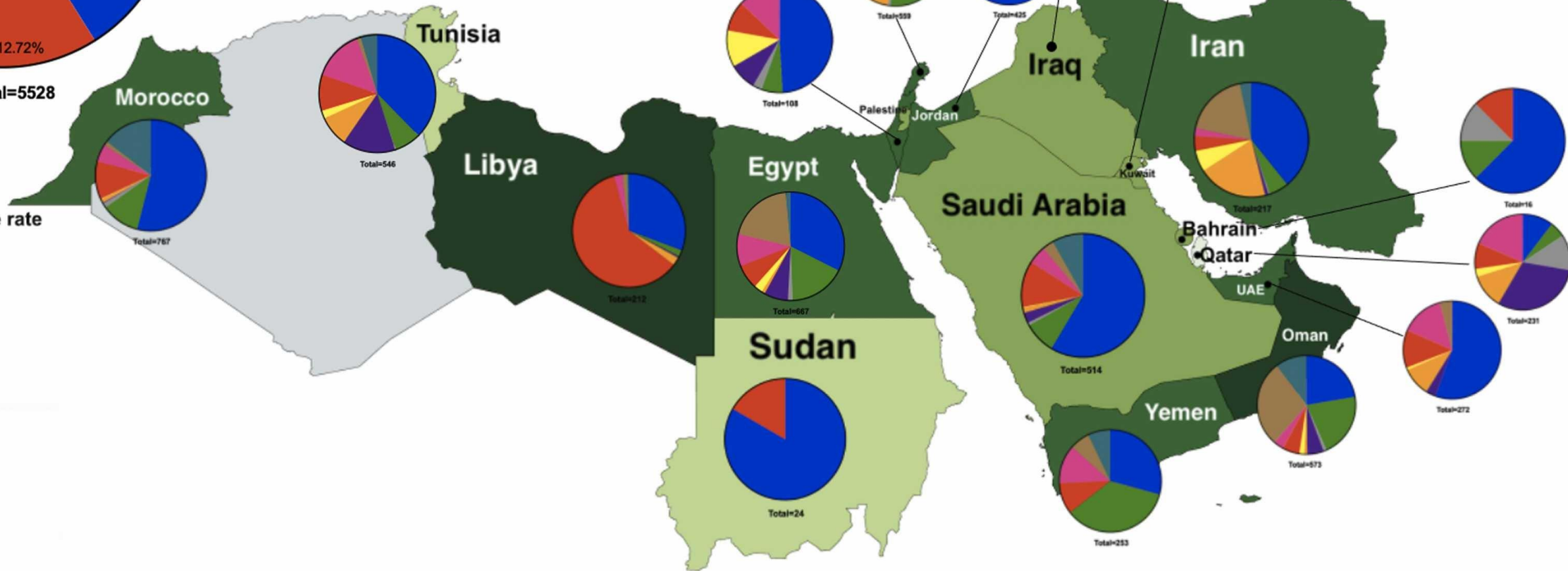
Overall MENA region

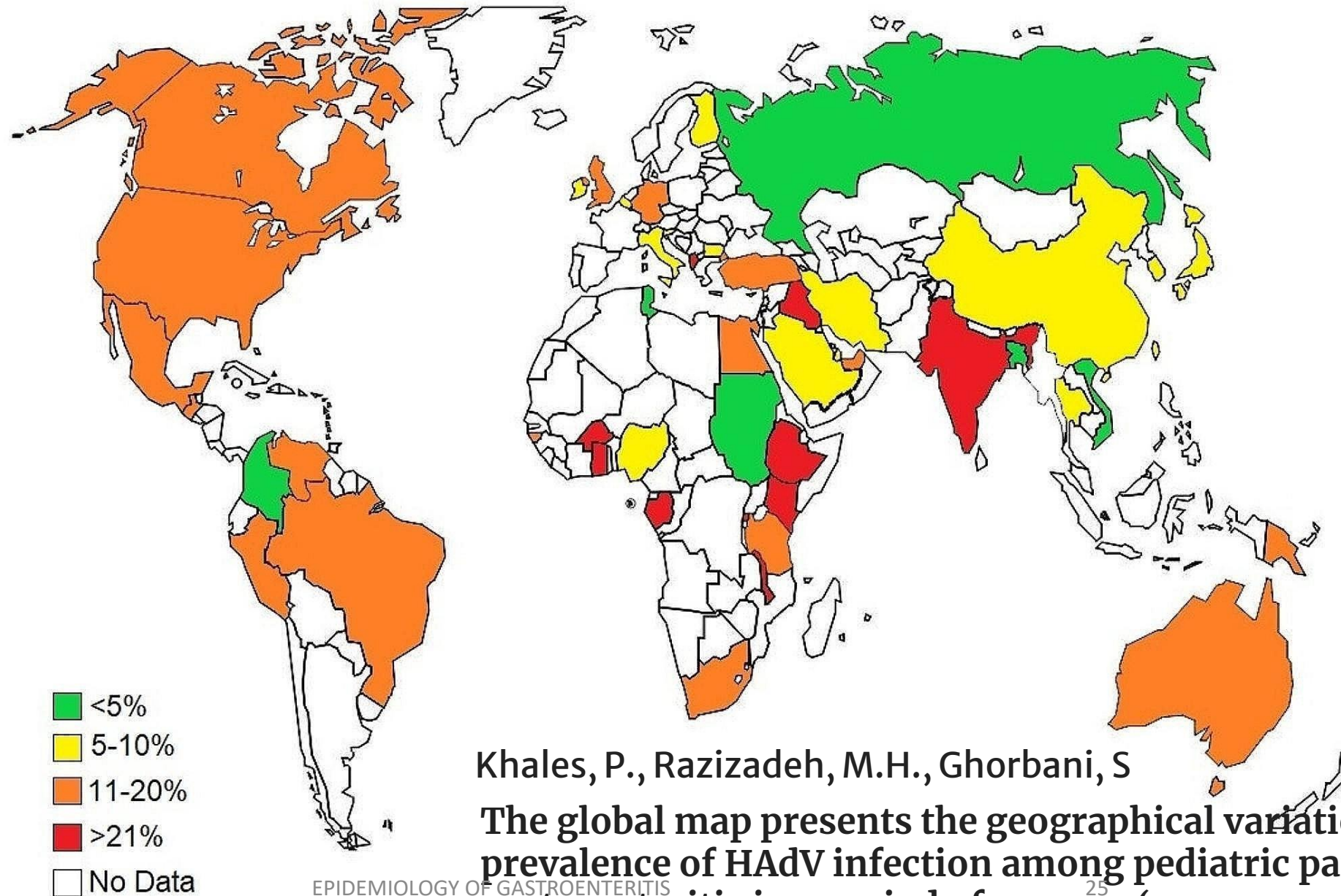


RV average prevalence rate



RV genotypes





Khales, P., Razizadeh, M.H., Ghorbani, S

The global map presents the geographical variations in the prevalence of HAdV infection among pediatric patients with gastroenteritis in a period of 11 years (2003–2023)

In Iran, the national rotavirus vaccination program started on 13 Azar 1403, which corresponds to 3 December 2024.

The schedule is oral vaccination at 2, 4, and 6 months of age.

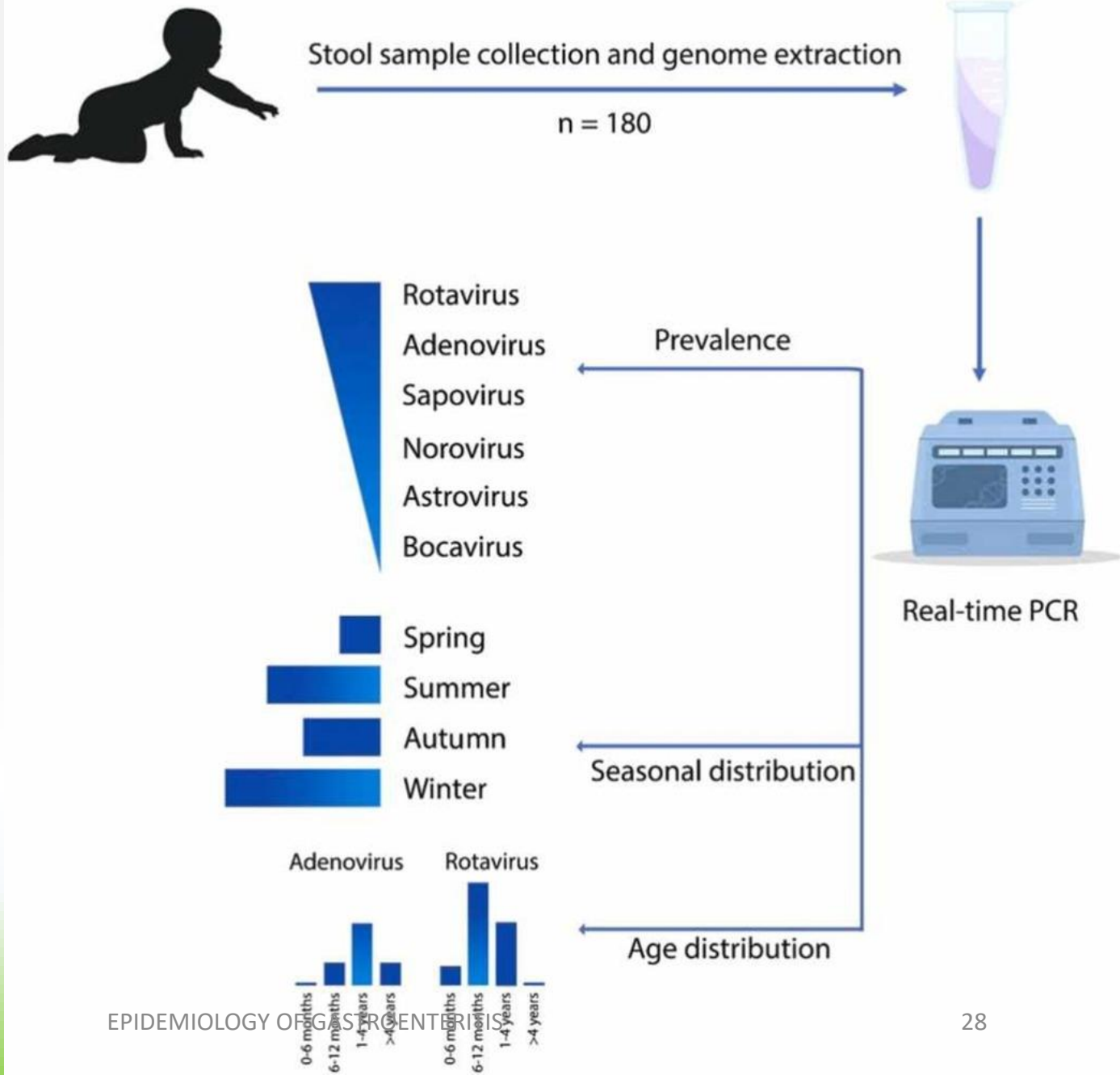
Route: oral

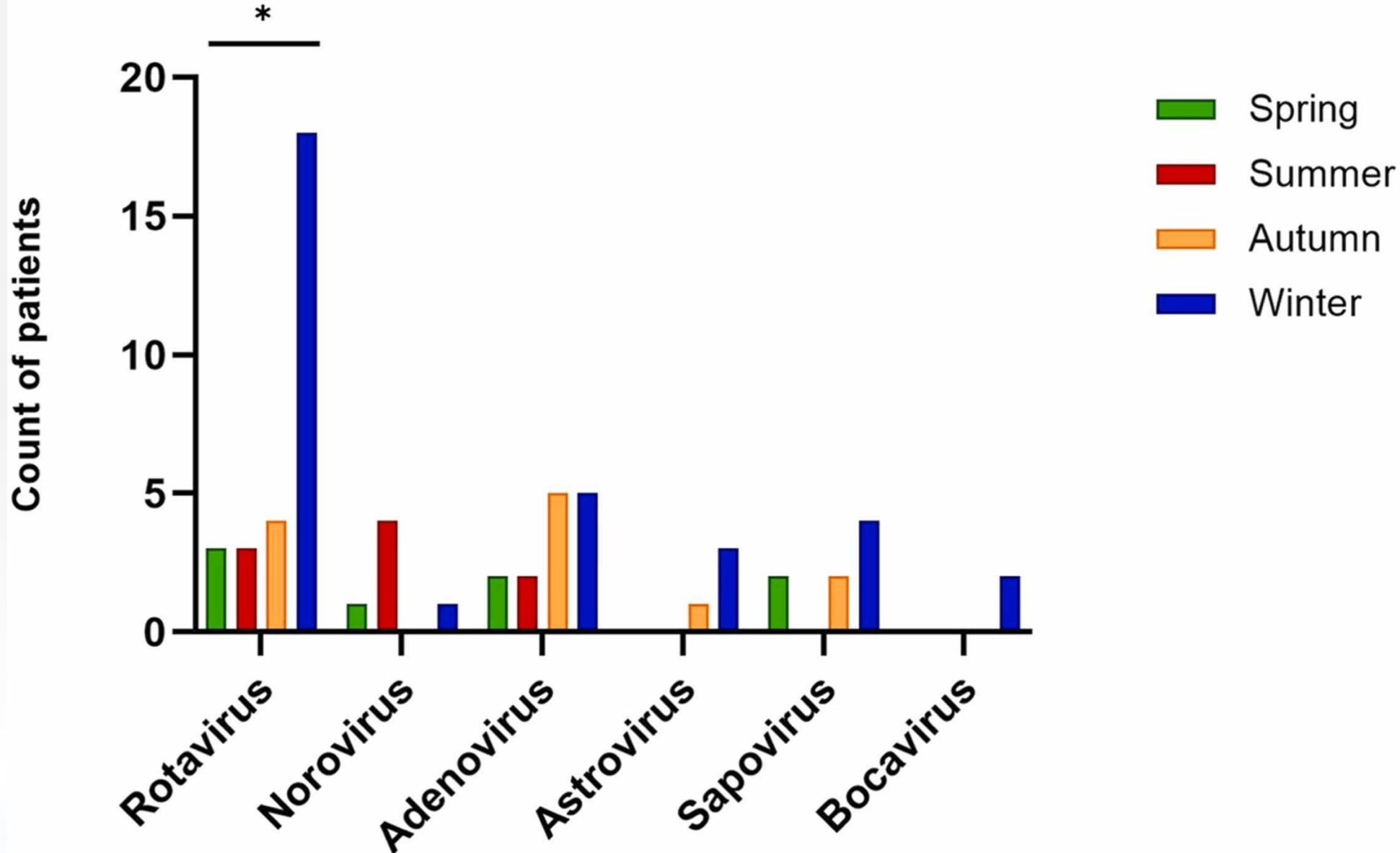


Prevalence of gastrointestinal viral infections in pediatrics with gastroenteritis referred to hospital in northwest Iran 2025

<https://doi.org/10.1016/j.microb.2025.100296>







Seasonal distribution of different viruses. Statistical analysis revealed that the prevalence of rotavirus is significantly higher in winter (* $p < 0.05$), while no significant differences were seen in the seasonal distribution of other viruses. Data are presented as counts.



Iranian hospital data identify a substantial viral signal, but national inference remains limited

What one Tehran study can—and cannot—tell us

28.8%



Rotavirus positivity

49 of 170 children under 5 with acute gastroenteritis in a 2013–2014 Tehran study

Mousavi Nasab et al., Iranian Biomedical Journal (2016-11) — <https://ibj.pasteur.ac.ir/article-1-1697-en.pdf>

01

Norovirus

8.8% positive; 86.6% of positives were genogroup GII

02

Co-infection

3.5% had both rotavirus and norovirus detected

03

Caveat

Single-city, hospital-referred sample; not a national prevalence estimate

04

Policy signal

Iran needs broader, standardized, seasonally resolved surveillance



Syndromic definitions determine urgency before the pathogen is known

— A practical epidemiologic and bedside vocabulary

Acute gastroenteritis

- Acute diarrhoea, often with vomiting, nausea, abdominal pain or fever.
- Usually infectious, but clinical diagnosis does not identify the organism.
- First decide severity and hydration status, not a broad test panel.

Diarrhoea phenotypes

- Acute watery: hours to days; cholera is included.
- Acute bloody: dysentery; concern for invasive disease.
- Persistent: 14 days or longer; greater complexity.



Severity and host context determine escalation beyond stool pattern

A practical five-axis bedside framework

5 axes



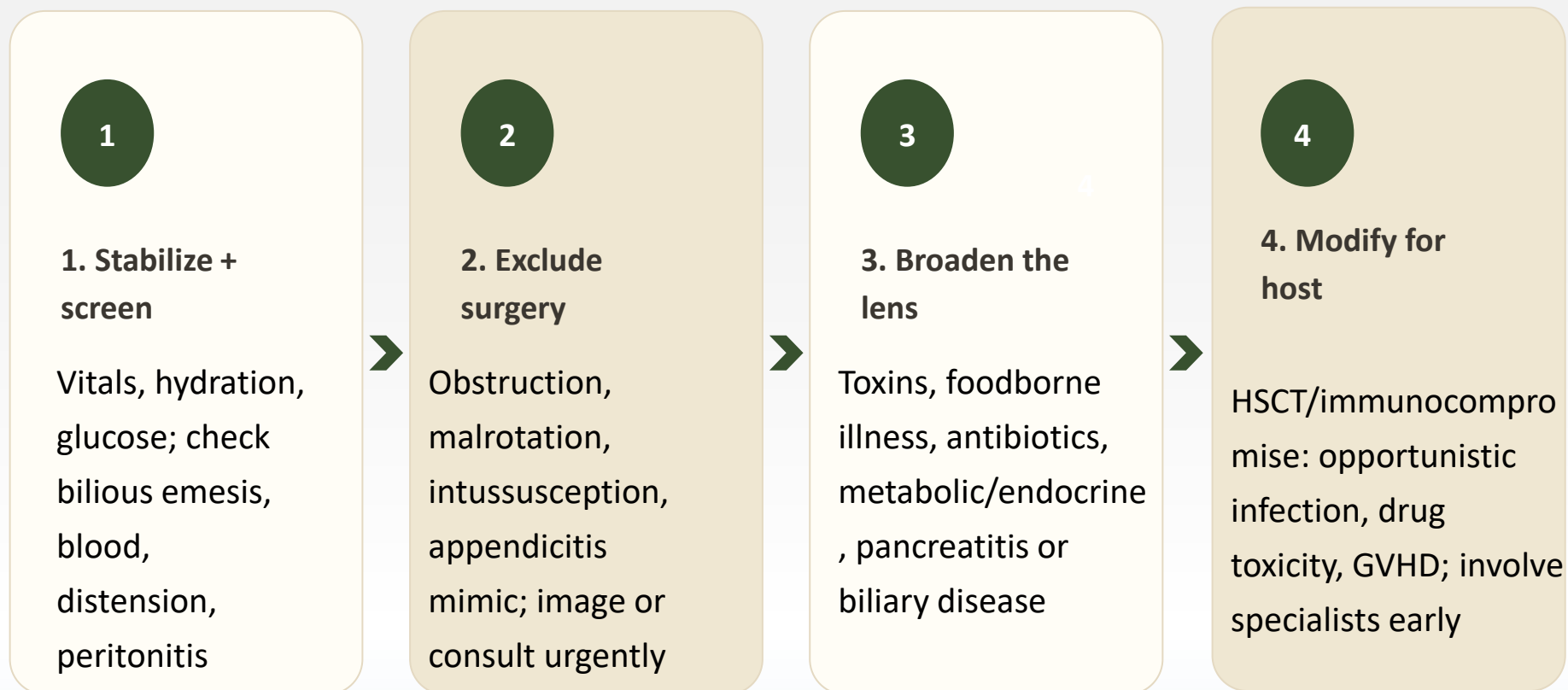
Classify before you label

Stool pattern · duration · dehydration ·
extraintestinal · host risk

- 01 Severe/systemic clues**
Sepsis, toxic appearance, severe dehydration, distension, neurologic features
- 02 Host modifiers**
Severe malnutrition, immunocompromise, very young age, comorbidity
- 03 Take-home**
Pattern identifies the syndrome; severity and host context determine the next action.



Exclude dangerous mimics, then broaden for special hosts



Take-home: pattern first, danger second, prevalence third, and host context throughout.



Iran's prevention context is a layered system, not a single pathogen problem

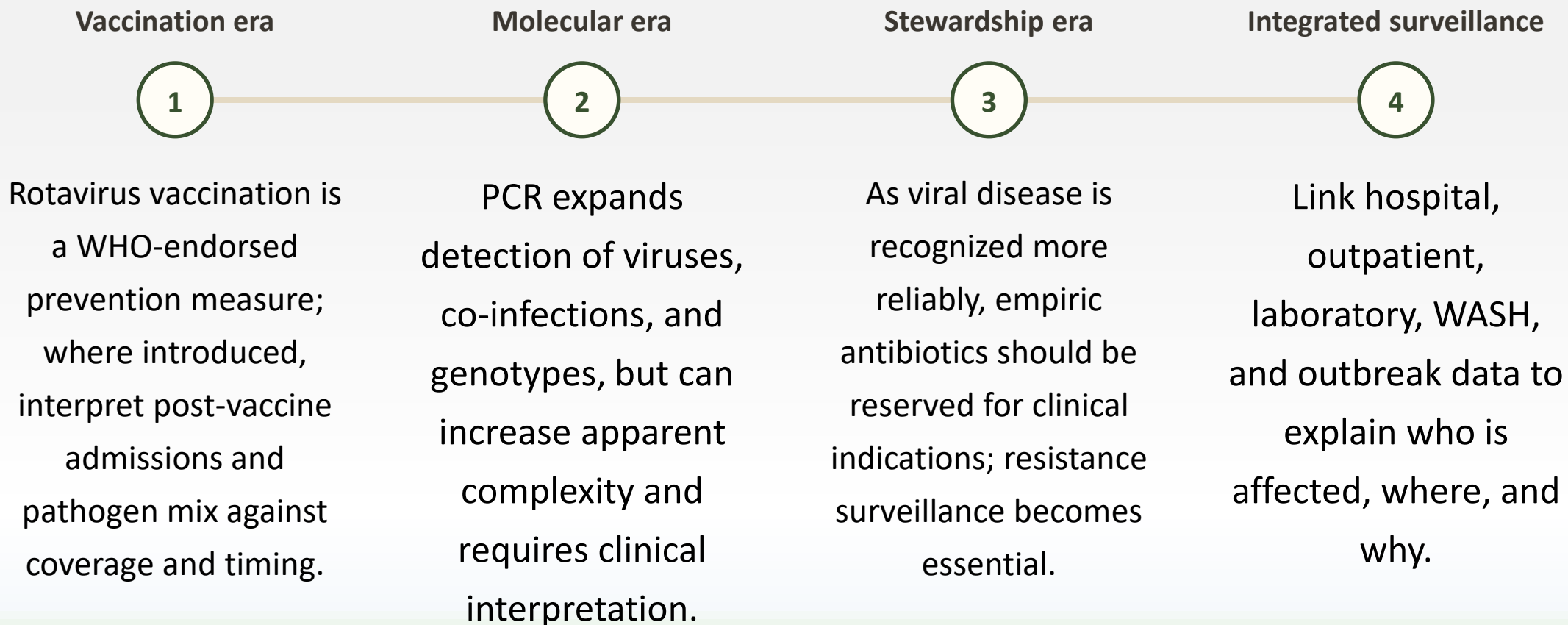
From household protection to health-system resilience

- **Household**
Breastfeeding, safe water storage, food hygiene, handwashing
- **Community**
Sanitation, daycare infection control, outbreak communication
- **Clinical**
Hydration assessment, ORS, zinc where appropriate, selective testing
- **Policy and surveillance**
Standardized pathogen monitoring, vaccine policy review, access and antimicrobial stewardship



The field is moving from broad mortality reduction toward targeted surveillance and stewardship

Three shifts shaping the next decade



Prevention works best when population measures sit above reliable bedside care

A prioritized action stack

1. Prevent exposure

Safe water, sanitation, handwashing, food safety, and infection control

2. Protect the host

Exclusive breastfeeding for 6 months, continued feeding, nutrition support, vaccination

3. Treat early

ORS for dehydration prevention and treatment; zinc where recommended; IV fluids for severe dehydration or shock

4. Use antimicrobials selectively

Target invasive or otherwise indicated disease; avoid routine antibiotics for uncomplicated watery diarrhoea

5. Learn from every episode

Track severity, season, setting, pathogen, resistance, and missed prevention opportunities



**Infectious Gastroenteritis is linked to
Epidemiological issues and is strongly related
to Prevention and Health Facilities**

THANK YOU

