



# TRAVELLER'S DIARRHEA



**Made Agus Hendrayana**



## Program Contents

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English and Spanish  
(800) CDC-INFO  
(800) 232-4636  
TTY: (888) 232-6348  
FAX: (770) 488-4760

## International Travel

Phone: 1-887-394-8747  
email: [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov)

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## Travelers' Diarrhea

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### Frequently Asked Questions

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# International travel and health



World Health  
Organization

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## 3.4 Foodborne and waterborne health risks

Many important infectious diseases (such as campylobacteriosis, cholera, cryptosporidiosis, cyclosporiasis, giardiasis, hepatitis A and E, listeriosis, salmonellosis, shigellosis and typhoid fever) are transmitted by contaminated food and water. Information on these and other specific infectious diseases of interest for travellers is provided in [Chapters 5](#) and [6](#).

## 3.5 Travellers' diarrhoea

Travellers' diarrhoea is a clinical syndrome associated with contaminated food or water that occurs during or shortly after travel. It is the most common health problem encountered by travellers and, depending on length of stay, may affect up to 80% of travellers to high-risk destinations. Travellers' diarrhoea most commonly affects individuals travelling from an area of more highly developed standards of hygiene and sanitation to a less developed one. Diarrhoea may be accompanied by nausea, vomiting, abdominal cramps and fever. Various bacteria, viruses and parasites are the known causes of travellers' diarrhoea, but bacteria are responsible for the majority of cases.

The safety of food, drink and drinking-water depends mainly on the standards of hygiene applied locally in their growing, preparation and handling. In countries or areas with low standards of hygiene and sanitation and poor infrastructure for controlling the safety of food, drink and drinking-water, there is a high risk of contracting travellers' diarrhoea. To minimize any risk of contracting foodborne or waterborne infections in such countries, travellers should take precautions with all food and drink, even that served in good quality hotels and restaurants. While the risks are greater in poor countries, locations with poor hygiene may be present in any country. Another potential source of waterborne infection is contaminated recreational water (see [next section](#)).

It is particularly important that people in more vulnerable groups, i.e. infants and children, the elderly, pregnant women and people with impaired immune systems, take stringent precautions to avoid contaminated food and drink and unsafe recreational waters.

### Treatment of diarrhoea

Most diarrhoeal episodes are self-limiting, with recovery in a few days.

It is important, especially for children, to avoid becoming dehydrated. When diarrhoea starts, fluid intake should be maintained with safe liquids (e.g. bottled,

# Travelling must be :

- Fun
- Pleasant
- Unforgettable



# don't get like this



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## CDC to investigate latest 'sick ship' incident

### Probe of Disney vessel to begin Saturday

Friday, November 22, 2002 Posted: 3:26 PM EST (2026 GMT)

PORT CANAVERAL, Florida (CNN) -- An investigation is being launched into what caused about 100 people aboard a Disney cruise ship to become ill with stomach symptoms associated with the Norwalk virus, a spokeswoman for the Centers for Disease Control and Prevention told CNN on Friday.

A "baseline determination" will be made



Disney's Magic is the second cruise liner to experience a viral outbreak recently.

AP PHOTO/FILE

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## Hawaii cruise cut short after 300 become ill

Wednesday, February 5, 2003 Posted: 2:28 AM EST (0728 GMT)

HONOLULU, Hawaii (AP) -- An outbreak of viral infections similar to those that hit cruise ships in the Caribbean and Alaska cut short a Hawaiian cruise Tuesday after nearly 300 passengers and crew members became sick.

Ten days into the 15-day voyage from Los Angeles to four Hawaiian islands, Princess Cruises diverted the Sun Princess to Honolulu so nearly 2,000 passengers could take flights home



The cruise liner Sun Princess is shown in Honolulu on Tuesday.

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# BALI ?



# Bali Belly



# Balinese food





# Definition :

Three or more in frequency of unformed stools/day, Occurring 4 days to 2 weeks after arrival



# The common symptoms of travelers' diarrhea :

- Increased frequency, volume and altered stool consistency
- Other commonly associated symptoms are : nausea, vomiting, diarrhea, abdominal cramping, bloating, fever, urgency, and malaise



# Travelers' Diarrhea

- The **most common illness** affecting travelers
- Each year between **20%-50%** of international travelers, an estimated **10 million persons**
- Usually occurs within the **first week** of travel
- May occur at **any time** while traveling
- **About four days** without treatment
- Even **after returning** home

# Low-moderate risk destinations area

## Low risk (< 10 percent) :

Northern Europe, Australia and New Zealand,  
United States, Canada, Singapore

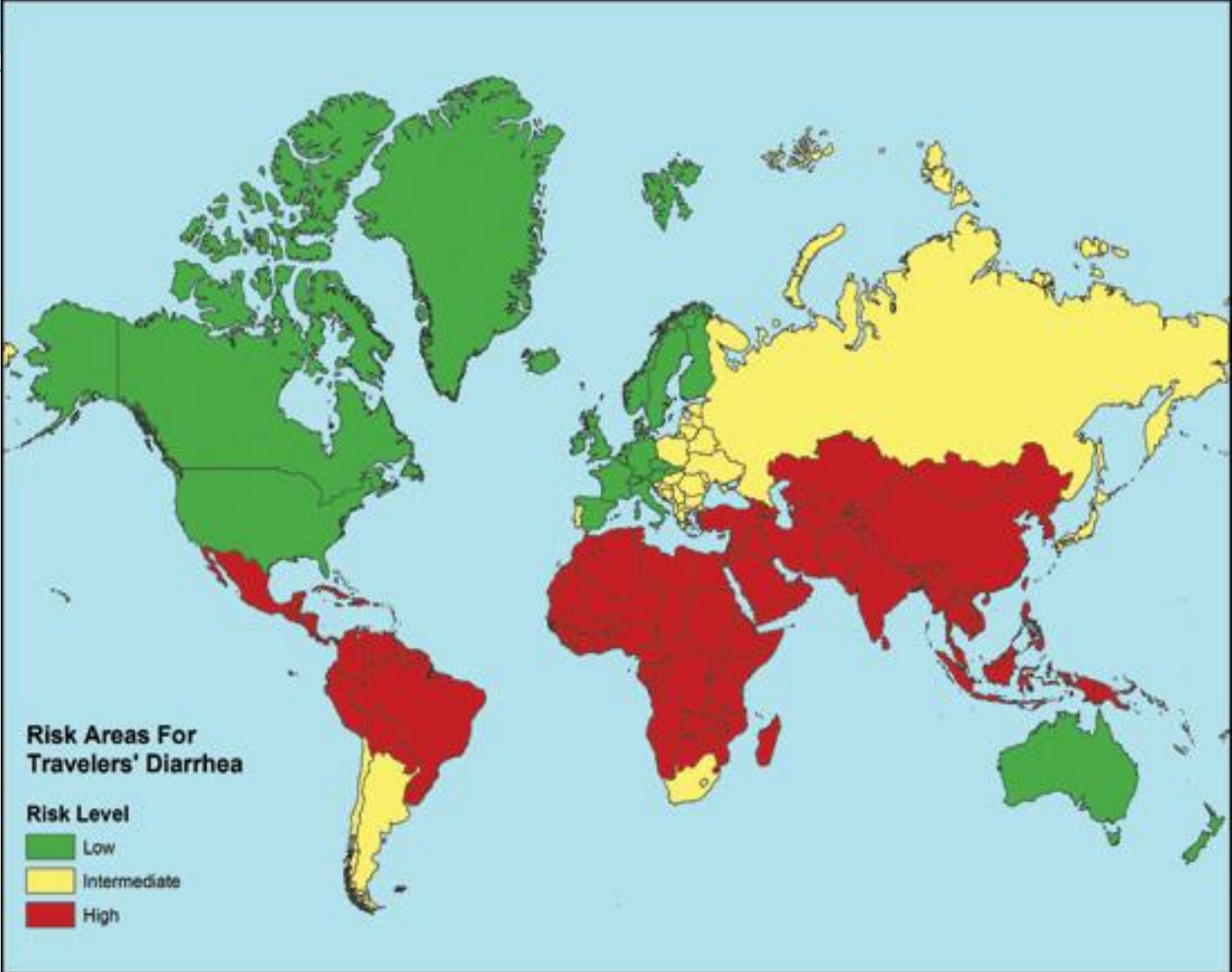
## Moderate risk (10 to 20 percent) :

Caribbean Islands, South Africa,  
and countries bordering the  
Mediterranean Ocean including Israel

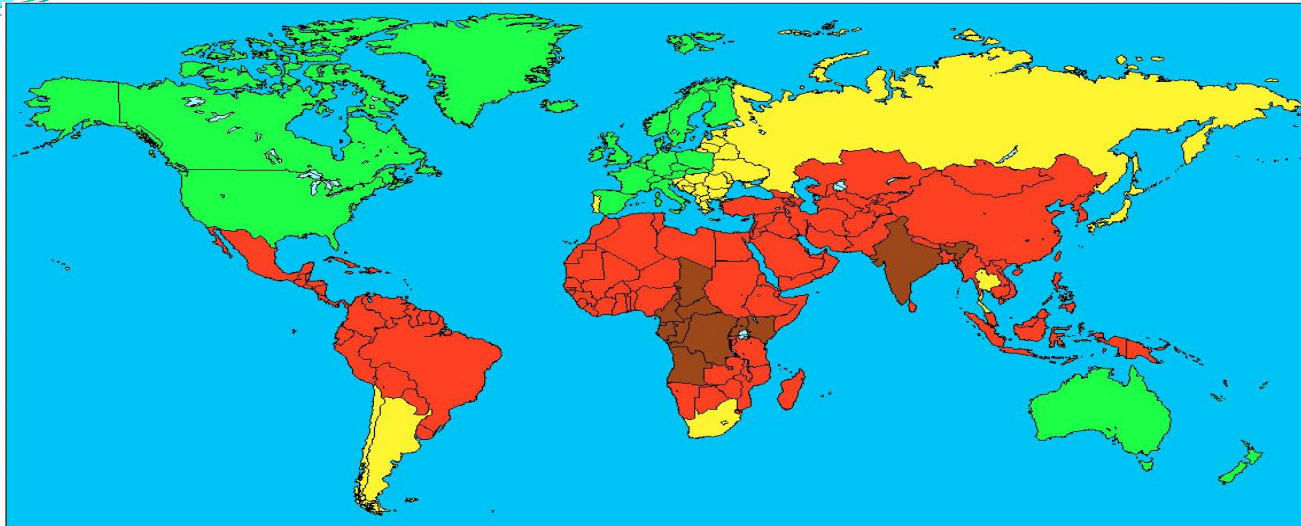


# High-risk destinations are :

- Developing countries of Latin America
- Africa
- Middle east



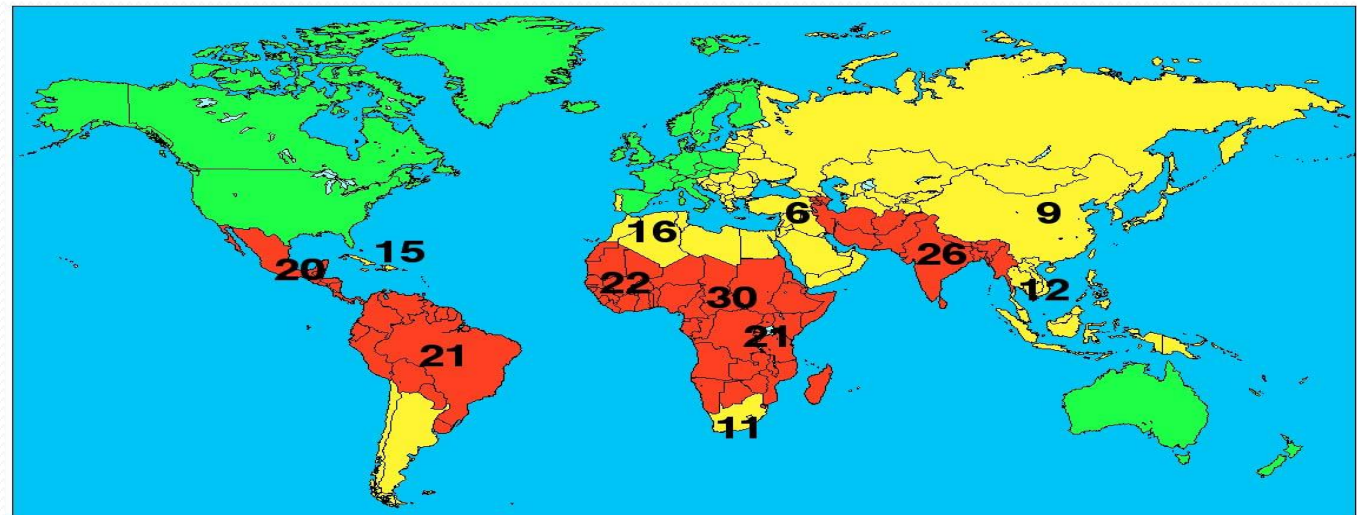
# Decreased risk of travelers' diarrhea



1990's

Risk: ■ Low <8% ■ Intermediate 8-20% ■ High 20-50% ■ Very high >50%

2006 - 2008



Risk: ■ Low <8% ■ Intermediate 8-20% ■ High 20-50% ■ Very high: none!

Steffen R et al. Clin Infect Dis 2005; 41 Suppl 8:S536-40.

Pitzurra R et al. BMC Infect Dis 2010; 10:231.

# ● Asia



# Persons at particular high-risk include :

- Young person,
- Immunosuppressed persons,
- Persons with inflammatory-bowel disease,
- Diabetes,
- Persons taking medicine routinely
- Lowered gastric acidity
- Hypomotility
- **Bad habit**

# The primary source of infection :

- Ingestion of fecally contaminated food or water.



# The causes of travelers' diarrhea

- **Infectious agents** are the primary cause
- **Bacterial enteropathogens** cause approximately 80% of TD cases
- The most common causative agent : **enterotoxigenic *Escherichia coli* (ETEC)**.
- Other pathogens :
  - a variety of **viral**
  - **parasitic** enteric pathogens

**TABLE 1 -- CAUSES OF TRAVELER'S DIARRHEA**

<b>Cause</b>	<b>Percent Isolation</b>
<b>Bacteria</b>	<b>50-75</b>
<i>Escherichia coli</i>	5-70
Enterotoxigenic	5-70
Enteroadhesive	?
Enteroinvasive	?
Enterohemorrhagic	?
<i>Campylobacter</i>	0-30
<i>Salmonella</i>	0-15
<i>Shigella</i>	0-15
<i>Aeromonas</i>	0-10
<i>Plesiomonas</i>	0-5
Others	0-5
<b>Protozoa</b>	<b>0-5</b>
<i>Giardia lamblia</i>	0-5
<i>Entamoeba histolytica</i>	0-5
<i>Cryptosporidium</i>	?
<i>Cyclospora cayetanensis</i>	?
<i>Microsporida</i>	?
<i>Isospora belli</i>	?
Others	?
<b>Viruses</b>	<b>0-20</b>
Rotavirus	0-20
No pathogen isolated	10-40



# Causative Agents for Travellers Diarrhoea

Etiologic agent	Estimated importance in Latin America (%)	Estimated importance in Africa (%)	Estimated importance in South Asia (Indian subcontinent; %)
ETEC	34	31	31
EAEC	24	2	16
<i>Shigella</i>	7	9	8
<i>Salmonella</i>	4	6	7
<i>Campylobacter</i>	3	5	8
<i>Aeromonas</i>	1	3	3
<i>Plesiomonas</i>	1	3	5
Noroviruses	17	13	Unknown
Protozoa*	3	3	9
No pathogen	49	45	39

47%

8%

Shah N et al. Am J Trop Med Hyg. 2009;80:609-614

## ETIOLOGY OF DIARRHEA IN TRAVELERS BY REGION

Organism	Nepal (%)	South East Asia (%)	India (%)	Latin America (%)	Africa (%)
Enterotoxigenic <i>E. coli</i>	20–28	6–30	24	26–72	25–75
Enteroadherent <i>E. coli</i>	13–18	3–8	19	15	–
Enteroinvasive <i>E. coli</i>	0–3	0–3	–	2	0
<i>Shigella</i>	10–23	2–7	10	0–22	0–15
<i>Campylobacter</i>	4–28	15–58	3	2–15	1–5
<i>Salmonella</i>	3–4	3–17	10	0–16	0–5
<i>Yersinia</i>	0–2	1–3	–	–	0
<i>Vibrio</i> spp.	0–1	5–13	5	–	3
<i>Plesiomonas</i>	4	2–13	7	–	2–7
<i>Aeromonas</i>			3	–	2
Rotavirus	3–11	8	5	0–24	0–6
<i>Giardia</i>	9–16	0–2	2	0–36	0
<i>Entamoeba histolytica</i>	3	–	5	–	0
<i>Cryptosporidium</i>	4–5	1–2	2	–	0–2
<i>Cyclospora</i>	11	–	–	–	–
No pathogen	40–53	25–42	45	22–50	29–64

## CAUSES OF PERSISTENT DIARRHEA IN TRAVELERS AND EXPATRIATES

### Infectious

#### Persistent bacterial infection

*Salmonella* spp.  
*Campylobacter* spp.  
*Yersinia* spp.  
 Enteroadherent *E. coli* (3 subgroups)  
*Clostridium difficile*  
*Aeromonas* spp.  
*Plesiomonas* spp.

#### Persistent protozoal infection

*Giardia lamblia*  
*Cryptosporidium parvum*  
*Cyclospora cayetanensis*  
*Entamoeba histolytica*  
*Isoospora belli*  
*Dientamoeba fragilis*  
*Balantidium coli*

#### Helminth infections

*Strongyloides stercoralis*  
*Schistosoma* spp.  
*Capillaria philippinensis*

### Noninfectious

#### Dietary

Lactose intolerance  
 Osmotic diarrhea

#### Gastrointestinal pathology

'Postdysenteric irritable bowel syndrome'  
 Crohn's disease  
 Ulcerative colitis  
 Bacterial overgrowth  
 Celiac disease  
 Collagenous colitis

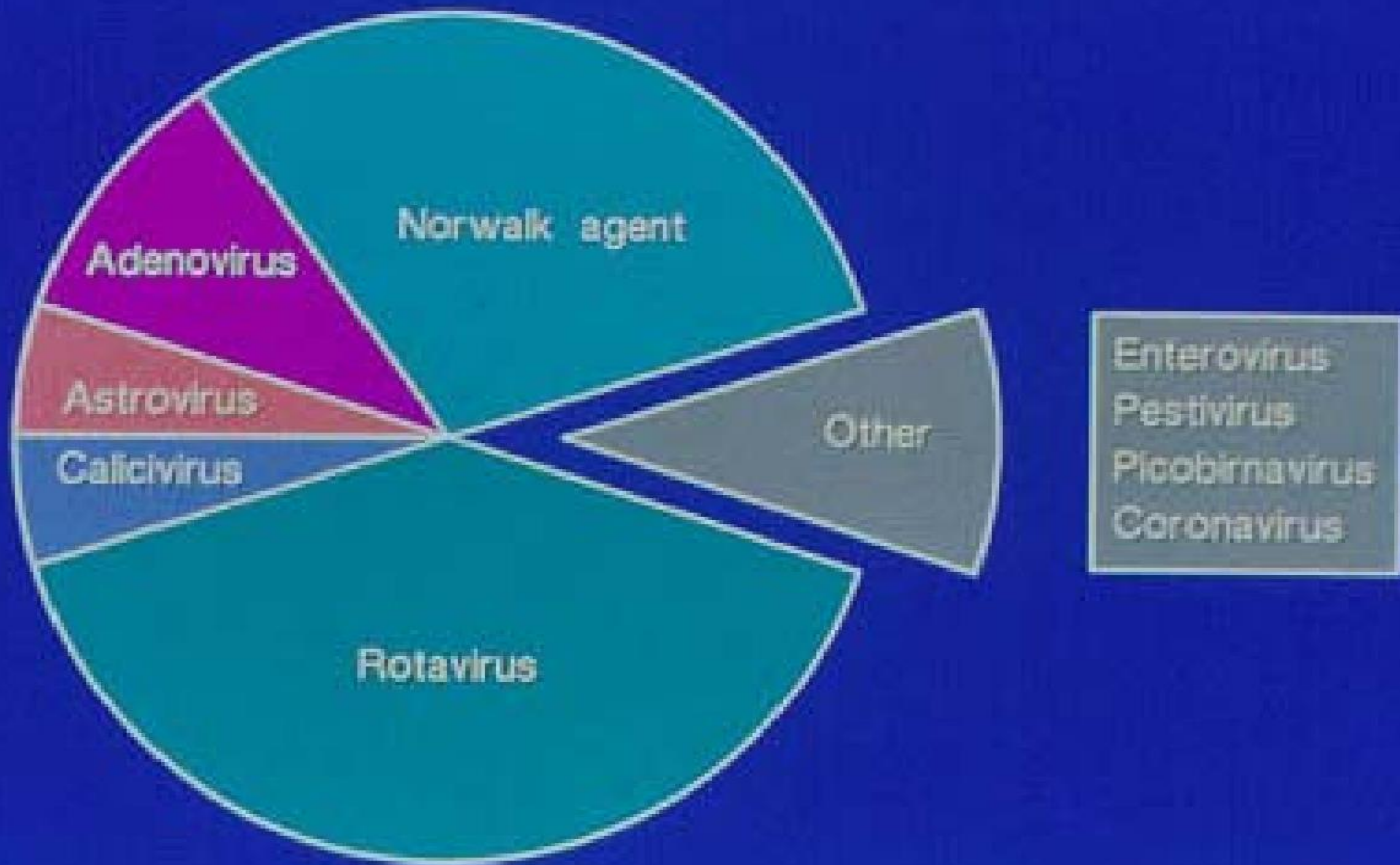
### Unclassified (likely infectious)

Tropical sprue  
 Chronic idiopathic ('Brainerd') diarrhea

**Table 7–5. Bacterial Diseases Transmitted by Foods.**

<b>Bacterium</b>	<b>Typical Food</b>	<b>Main Reservoir</b>	<b>Disease</b>
<b>I. Diarrheal diseases</b>			
<b>Gram-positive cocci</b>			
<i>Staphylococcus aureus</i>	Custard-filled pastries; potato, egg, or tuna fish salad	Humans	Food poisoning, especially vomiting
<b>Gram-positive rods</b>			
<i>Bacillus cereus</i>	Reheated rice	Soil	Diarrhea
<i>Clostridium perfringens</i>	Cooked meat, stew, and gravy	Soil, animals, or humans	Diarrhea
<i>Listeria monocytogenes</i>	Unpasteurized milk products	Soil, animals, or plants	Diarrhea
<b>Gram-negative rods</b>			
<i>Escherichia coli</i>	Various foods and water	Humans	Diarrhea
<i>E. coli</i> O157:H7 strain	Undercooked meat	Cattle	Hemorrhagic colitis
<i>Salmonella enteritidis</i>	Poultry, meats, and eggs	Domestic animals, especially poultry	Diarrhea
<i>Salmonella typhi</i>	Various foods	Humans	Typhoid fever
<i>Shigella</i> species	Various foods and water	Humans	Diarrhea (dysentery)
<i>Vibrio cholerae</i>	Various foods, e.g., seafood, and water	Humans	Diarrhea
<i>Vibrio parahaemolyticus</i>	Seafood	Warm salt water	Diarrhea
<i>Campylobacter jejuni</i>	Various foods	Domestic animals	Diarrhea

# Viral Infectious agents



**Table 7–4. Transmission of Important Waterborne Diseases.**

Portal of Entry	Pathogen	Type of Organism <sup>1</sup>	Disease
Gastrointestinal tract			
1. Ingestion of drinking water	<i>Salmonella species</i>	B	Diarrhea
	<i>Shigella species</i>	B	Diarrhea
	<i>Campylobacter jejuni</i>	B	Diarrhea
	Norovirus <sup>2</sup>	V	Diarrhea
	<i>Giardia lamblia</i>	P	Diarrhea
	<i>Cryptosporidium parvum</i>	P	Diarrhea
2. Ingestion of water while swimming <sup>3</sup>	<i>Leptospira interrogans</i>	B	Leptospirosis
Respiratory tract			
Inhalation of water aerosol	<i>Legionella pneumophila</i>	B	Pneumonia (Legionnaire's disease)
Skin			
Penetration through skin	<i>Pseudomonas aeruginosa</i>	B	Hot-tub folliculitis
	<i>Schistosoma mansoni</i>	H	Schistosomiasis
Nose			
Penetration through cribriform plate into meninges and brain	<i>Naegleria fowleri</i>	P	Meningoencephalitis

# Diagnostic Approach in Destinations

Often based on clinical grounds

Assessing severity is the key issue

- Diagnostic studies often unavailable
- Symptoms could resolve
- Require prompt treatment
- Clinical features that may be helpful
  - Risk factors
  - Stool numbers or volume
  - Presence of blood
  - Associated symptoms

# To obtain high detection rate in TD stool samples

- Collect stool directly from patient
- Within 8 (max 12) hours transfer to
  - 4 cryovials → temp  $-80^{\circ}\text{C}$  for E. coli analysis
  - 2 transport media, temp  $2-8^{\circ}\text{C}$ , analysis in  $\leq 14\text{d}$ 
    - Enteric plus
    - 10% formalin



# Management

- **Rehydration**
- Causal treatment
- Symptomatic treatment
- Complication


# Treatment

## **Aims – Provide Reassurances**

- Treat or prevent dehydration
- Reduce symptoms / duration of diarrhoea

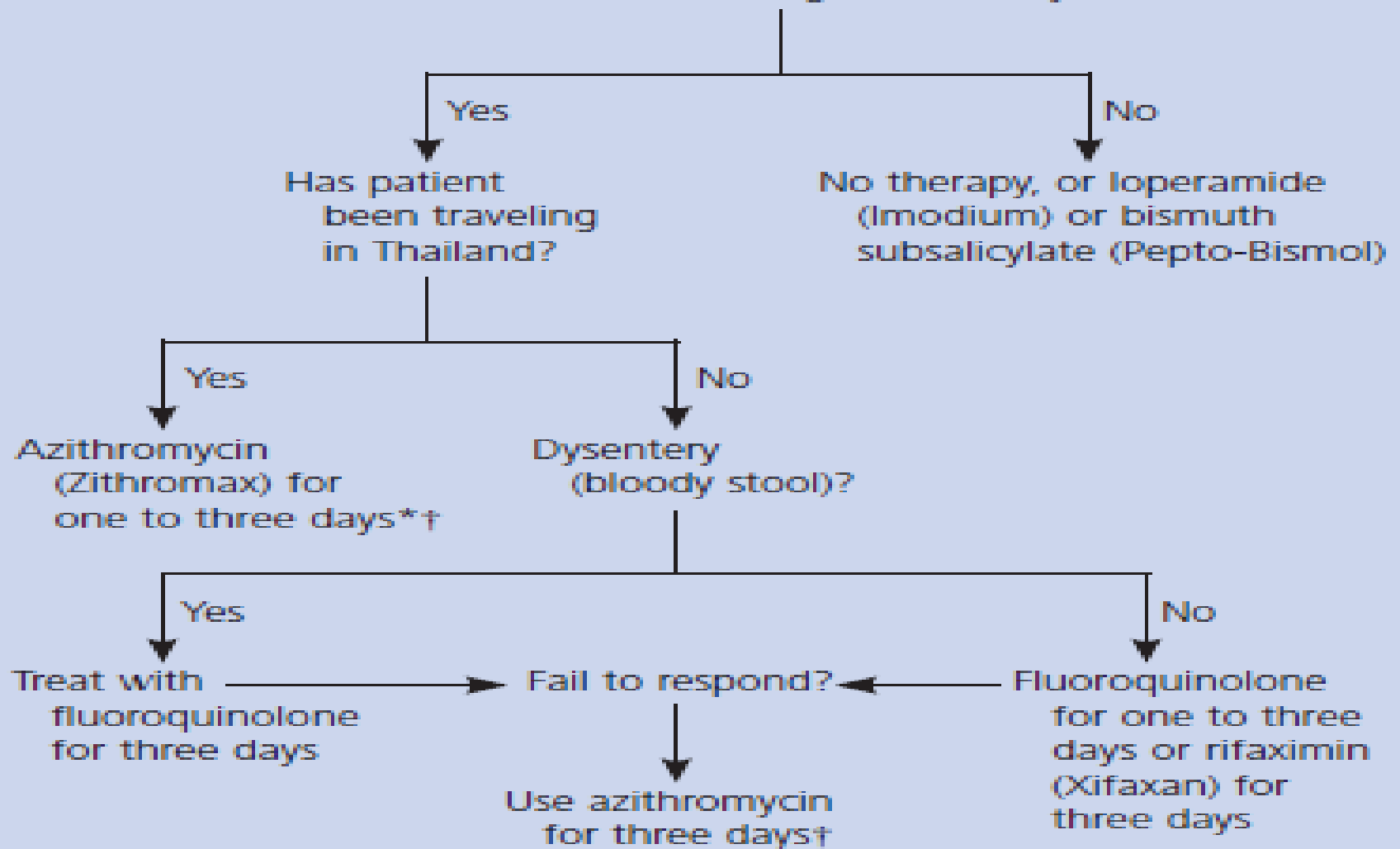
## **Options – Balance risk with intervention**

- Oral rehydration options
- Anti-motility drugs
- Antimicrobial agents
- Consider admission
  - severe abdominal pain
  - persistent vomiting
  - gross dehydration

- 
- Usually self limiting
  - The caution approach is to focus on fluid replacement and maintaining hydration as the cornerstone of therapy
  - Symptomatic treatment (anti motility therapy)
  - Specific anti microbial therapy

# Approach to the Treatment of Traveler's Diarrhea

Acute diarrhea in a traveler is moderate to severe or "distressing" (i.e., forces a change in itinerary)?



**Table 6. Recommended agents for traveler's diarrhea.**

Use, agent	Dosage	References
<b>Prophylaxis<sup>a</sup></b>		
Bismuth subsalicylate (Pepto Bismol)	Two tablets chewed 4 times per day	[168–170]
Norfloxacin <sup>b</sup>	400 mg po daily	[171–173]
Ciprofloxacin <sup>b</sup>	500 mg po daily	[174, 175]
Rifaximin	200 mg qd or bid	[176]
<b>Symptomatic treatment<sup>c</sup></b>		
Bismuth subsalicylate (Pepto Bismol)	1 oz po every 30 min for 8 doses	[177]
Loperamide	4 mg po then 2 mg after each loose stool not to exceed 16 mg daily	[15, 178–180]
<b>Antibiotic treatment<sup>d</sup></b>		
<b>Fluoroquinolones</b>		
Norfloxacin	400 mg po bid	[181–183]
Ciprofloxacin	500 mg po bid	[184–190]
Ofloxacin	200 mg po bid	[191–193]
Levofloxacin	500 mg po qd	[16]
Azithromycin	1000 mg po once	[16, 194]
Rifaximin <sup>e</sup>	200 mg po tid	[17, 184, 195]

<sup>a</sup> There is currently no antibiotic with demonstrated efficacy in prophylaxis against *Campylobacter* species. *Campylobacter* species is more frequent as an etiology of traveler's diarrhea in South and Southeast Asia. No antibiotic has US Food and Drug Administration approval for use in prophylaxis for traveler's diarrhea.

<sup>b</sup> Other fluoroquinolones are likely to be effective but have not been studied in prophylaxis.

<sup>c</sup> See Treatment for other agents that either have limiting adverse effects, are not very efficacious, or have not been studied in traveler's diarrhea.

<sup>d</sup> See Duration of Therapy and Combination Therapy for discussion of duration of therapy and adjunctive therapy with loperamide.

<sup>e</sup> Although the US Food and Drug Administration–approved dose is 200 mg po tid, 1 study demonstrated efficacy with 400 mg po bid. Rifaximin is approved by the US Food and Drug Administration for the treatment of traveler's diarrhea caused by noninvasive strains of *Escherichia coli* in persons  $\geq 12$  years old.

# Complication

- Hypovolumic shock
- Metabolic acidosis
- Acute kidney injury
- Electrolyte imbalance
  - Hypopotassemia
- Over hydration

# Travelers can minimize their risk by :

- Following good personal hygiene practices
- Always wash your hands with soap



# Being careful about what you eat and drink

- Avoid eating foods or drinking beverages purchased from street vendors or other establishments where unhygienic conditions are present





- Drink bottled water, bottled drinks, or beverages made with boiled water. Always avoid ice and tap water
- Avoid eating raw or undercooked meat and seafood



- Avoid eating raw fruits and vegetables unless the traveler peels them. Discard if the skin is broken or bruised.
- Make sure dairy products such as milk, cheese, or yogurt are pasteurized and properly refrigerated



# Is prophylaxis of travelers' diarrhea recommended?

- CDC does **not recommend** antimicrobial drugs to prevent TD
- increases the traveler's risk for **adverse reactions** and for infections **with resistant organisms**.
- Because antimicrobials can increase a traveler 's susceptibility to resistant bacterial pathogens

# What we can do to prevent travelers' diarrhea?

- improve food and water safety around the world
- investigate risk factors associated with acquisition of TD
- in identifying more effective preventive measures
- monitor antimicrobial resistance
- improve sanitary conditions in foreign accommodations (e.g., tourist resorts)

# How to investigate an outbreak ?

## Steps of an outbreak investigation

---

1. Prepare for field work
  2. Establish the existence of an outbreak
  3. Verify the diagnosis
  4. Define and identify cases
    - a. establish a case definition
    - b. identify and count cases
  5. Perform descriptive epidemiology
  6. Develop hypotheses
  7. Evaluate hypotheses
  8. As necessary, reconsider/refine hypotheses and execute additional studies
    - a. additional epidemiologic studies
    - b. other types of studies – laboratory, environmental
  9. Implement control and prevention measures
  10. Communicate findings
-

# Surveillance among food handler



# Vaccine ?

- a vaccine to help protect you against traveller's diarrhea.
- Dukoral™ is the only vaccine currently available in Canada to help prevent traveller's diarrhea caused by enterotoxigenic E. Coli (ETEC)
- Salmonella Vaccine
- Cholera Vaccine

# 'Boil it, Cook it, Peel it or Forget it': Does this Rule Prevent Travellers' Diarrhoea?

MARKUS KOZICKI, ROBERT STEFFEN AND MEINRAD SCHÄR

Kozicki M (Institute of Social and Preventive Medicine of the University, Gloriastrasse 30, CH-8006 Zurich, Switzerland), Steffen R and Schär M. 'Boil it, cook it, peel it or forget it: Does this rule prevent travellers' diarrhoea? *International Journal of Epidemiology* 1985, 14: 169-172.

A total of 688 out of 2240 air charter passengers in flight to Kenya, West Africa or Sri Lanka/Maldives volunteered to participate in a follow-up study investigating the influence of various food and beverage items on the incidence of travellers' diarrhoea. Within the first three days of their stay abroad, 98% accepted food or beverages whose avoidance is traditionally recommended. The incidence of diarrhoea, which was 19.5%, was proportionate to the number of dietary mistakes committed. The most dangerous items were those whose avoidance was traditionally recommended.



# When should adults with diarrhea see a health care provider?

- signs of dehydration
- diarrhea for more than 2 days
- severe pain in the abdomen or rectum
- a fever of 102 degrees or higher
- stools containing blood or pus
- stools that are black and tarry

Thank you!  
Jim

