

STATE-OF-THE-ART CLINICAL ARTICLE

Infectious Diseases on Cruise Ships

Arézou Minooee and Leland S. Rickman

From the Department of Biology and the Epidemiology Unit, Division of Infectious Diseases, University of California, San Diego, San Diego, California

*They set up the mast again and spread on it the white sails,
and the wind blew into the middle of the sail, and at the cutwater
a blue wave rose and sang strongly as the ship went onward.
She ran swiftly cutting across the swell her pathway.*

—Homer (*Iliad* I:480–483)

Travel by sea is one of the earliest forms of transportation. From ancient times to the present, people have traveled by ship for purposes of food obtainment, trade of goods, conquest, employment, and leisure. Before ships were built large enough to take long ocean voyages, the most relevant medical problems included drownings, injuries, and attacks by alligators, sharks, whales, or other sea creatures. It was only after ships sailed for more than a day or two that questions of food and water supply, sanitation, ventilation, care of the sick and injured on board, spread of plagues, and transmission of infectious diseases began to arise. An estimated 4.5 million passengers travel on cruises in North America annually [1].

Traveler's Health

"Emporiatrics" is the modern term coined to describe the science and health of travelers. The word actually comes from the Greek *emporos*, meaning "one who goes on shipboard as a passenger," and *iatrike*, meaning "medicine" [2]. Infectious diseases unique to persons who cruise are rare. We review those illnesses that have been most thoroughly described in association with recreational cruises. Relevant articles in the medical literature tend to focus on outbreaks of gastrointestinal and respiratory illnesses [3–8]. Although not published in the medical literature, outbreaks of cyclosporiasis and varicella have also occurred on cruise liners (Kim D, Centers for Disease Control and Prevention, March 1999, personal communication).

Passengers need to be educated regarding the potential for

the acquisition of infectious diseases, including potential zoonotic illnesses, while on shore and for specific activities offshore. Seal finger (cellulitis of the hand), for example, may be seen during Antarctic cruises (figure 1). There are, by necessity, limitations to the medical facility, design, space, equipment, and supplies on cruise vessels [9]. Special consideration should be made for elderly passengers [10] as well as immunocompromised passengers (e.g., HIV-infected persons) [11] who may present medical problems that require modification of differential diagnosis and treatment regimens from those applicable for other patients.

Clusters of infections on commercial cruise ships demonstrate that passengers and crew members, who may come from a variety of countries and might not have been vaccinated, are potential groups of susceptible persons at risk for disease. Although one may be predisposed to various diseases on board ships, infections transmitted during offshore or pre-cruise activities may also become clinically evident during a cruise. Exclusively ship-related infectious diseases, therefore, probably represent only the "tip of the iceberg" in terms of infectious diseases (figure 2).

Shipboard Medicine in History

In response to outbreaks of plague following the arrival of ships from the east during the Middle Ages, Venice and Rhodes introduced the first regulations in 1377 [12]. Ships that were examined and found to be carrying infected passengers or crew were not permitted entry on land. Regulations typically required such ships to remain in detention and isolation for a period of 40 days. The word "quarantine" was thus derived from the Italian word *quaranta*, meaning "forty" [13].

On 16 July 1798, President John Adams signed an Act for the Relief of Sick and Disabled Seamen that represented the first federal health entitlement program in the United States [14]. The Marine Hospital Service (the forerunner to the Public Health Service) was established by the federal government to provide medical care to the sick and disabled American merchant seamen. Every American flag vessel of >150 tons with a crew of ≥ 10 was required to carry a medicine chest [15]. The Marine Hospital Service issued a medical guide in 1881 entitled "Handbook for the Ship's Medicine Chest," which discussed malarial fevers, dysentery, yellow fever, cholera, syphilis, and smallpox [15]. The treatment of yellow fever, as

Publication of this State-of-the-Art clinical article has been made possible by an educational grant from Roche Laboratories.

Received 14 June 1999; revised 22 June 1999.

Reprints or correspondence: Dr. Leland S. Rickman, Epidemiology Unit, University of California, San Diego, Medical Center-8951, 200 West Arbor Drive, San Diego, California 92103 (lrickman@ucsd.edu).

Clinical Infectious Diseases 1999;29:737–44

© 1999 by the Infectious Diseases Society of America. All rights reserved.
1058–4838/99/2904–0001\$03.00



Figure 1. Hazardous wildlife in South Georgia (a southern fur seal).

described in the handbook, is indicative of the nature of medical practices in the late 1800s. For example, treatment began with senna tea as a laxative; rubbing of the legs with mustard water if the skin was very dry; and the administration of a nitre mixture (consisting of saltpeter, water, and an alcoholic solution of ethyl nitrite) if the patient was vomiting and, if the fever was not high, quinine.

The contributions of smallpox, scurvy, and rodent-associated illnesses to shipboard medicine are of historical interest. Before the description of vaccination by Jenner in 1798, smallpox was one of the most serious diseases, frequently appearing in epidemic form and causing numerous deaths. The spread of smallpox shaped the course of history, as it ensured the success of many conquerors of nonimmune native populations. For example, on sailing to the New World, Columbus introduced smallpox to the native population, which caused the death of millions of American Indians by 1530 [16]. Smallpox probably played a role in crippling naval forces and nullifying important military campaigns as well. In 1779, for example, England was saved from French invasion by an epidemic of smallpox that occurred among the French fleet under the command of Count D'Orvilliers, causing thousands of men to become ill [13].

Until 1747, when James Lind proved the value of lemon juice in the prevention and treatment of scurvy, a vast number of seafarers suffered and ultimately died because for months they sailed in vessels with poor supplies of food sources of essential nutrients. One historical account of such calamity may be attributed to Anson's celebrated voyages around the world, in which two-thirds of the crews of his squadron died from complications of scurvy [13].

Vitamin C deficiency (scurvy) may predispose one to gingivitis, a secondary bacterial infection of the gingiva. Recent clinical trials of vitamin C for the prevention of the common cold have, in general, revealed equivocal results [17]. In 1894, a British expedition spent three winters in Franz-Joseph Land,

remaining healthy on a diet that included fresh meat but very little lime juice. Although Lind's results had indicated that scurvy was a disease due to a deficiency of diet, in the late 19th century the etiology of scurvy was studied in light of Pasteur's germ theory and, as one naval surgeon suggested, the benefit obtained from lime juice was thought to have been that of an antibacterial mouthwash [18]. The relationship of fevers to scurvy was first noted by Lind, when he states in the postscript of "A Treatise on the Scurvy" [19]: "If it be asked, whether an infectious fever be rendered more violent and dangerous, by its attack on a person of a scorbutic habit of body?" With the discovery of its cause and prevention, scurvy is no longer a threat to those who travel by ship but may be evident among malnourished populations.

Transmission of typhus fever, caused by *Rickettsia prowazekii*, on board ships was commonly associated with crowding conditions, filth, and the lack of personal hygiene. The significance of this disease was for centuries disguised by the losses from scurvy, yellow fever, and malaria. Typhus fever was one of the diseases responsible for the high death rate among the crowded prison ships in New York harbor during the American Revolution [13]. Preventive measures, such as quarantine, delousing, and maintaining personal cleanliness by the use of soap, were gradually adopted, and the incidence of typhus fever decreased.

Plague, caused by *Yersinia pestis*, is usually transmitted by the bite of a flea living on rats. Although plague is not described in contemporary literature on shipboard illnesses, the role of traveling ships is quite prominent in the transmission and spread of plague. The Black Death, for example, which spread along the established trading routes of the Mongol empire, began around 1320, wiping out at least one-third of the populations surrounding the Mediterranean and adjacent lands [20].



Figure 2. Expedition vessel M/S Explorer and icebergs in Antarctica.

Food- and Waterborne Infections

Outbreaks aboard cruise ships are of public health importance, given that ships are closed or semiclosed settings in which infection may easily be spread and may be difficult to control. Despite the substantial progress in knowledge of the etiology and management of infectious diseases, there are many reported cases of travel-related illnesses, specifically ship-related, most of which are due to inadequate food handling and water sanitation. Table 1 lists some of the reported outbreaks of gastrointestinal disorders, their causal agents, and possible mechanisms of transmission on cruise ships. Although many infectious diseases may become evident while on a cruise, only reported cases of infections acquired on cruise ships will be discussed below. In the evaluation of the ill cruise passenger or crew, pre-cruise and off-ship activities also need to be considered.

The most common illness acquired by passengers or crew members on board ships is travelers' diarrhea. The risk of infection is strongly associated with dietary indiscretions and sanitary conditions. It is usually defined as the passage of three or more stools per 24-hour period in association with vomiting, nausea, fever, abdominal cramps, or tenesmus [46]. Guidelines and recommendations regarding food and water acquisition for the traveler have been described [47].

Ship-associated enteric pathogens causing disease are reported in two reviews of foodborne illnesses [48, 49]. The introduction of novel molecular methods to detect and differentiate Norwalk-like viruses, for example, has provided a valuable complement to standard microbiological tests and epidemiological studies. Methods of identification include the examination of stool specimens for viral particles by electron microscopy, the amplification of viral RNA by reverse transcriptase-PCR, and further characterization by nucleotide sequencing [50]. Of note, agents described as causing gastrointestinal illnesses may not always be readily identified. Pathogen(s) causing outbreaks of Brainerd's diarrhea on cruise ships, for instance, have not been identified [21]. Practical recommendations for the prevention of gastrointestinal infections in general, as well as on cruise ships, have also been reviewed [51, 52].

Respiratory Infections

Ships provide an isolated environment that may increase the passenger's risk of infection if exposed to respiratory viruses. High attack rates of influenza, for example, are typically seen in closed settings such as cruises, military vessels, aircraft, and institutions. The contemporary epidemiology of injuries and illnesses among passengers on four recreational cruise vessels originating in the United States in 1991 revealed that the most common diagnosis for passengers and crew seeking care in the ship's infirmary was respiratory tract infection [53]. This diagnosis constituted 29.1% of all visits. Antibiotics also made

up 7 of the top 15 oral prescriptions dispensed. Respiratory illnesses, such as diphtheria, legionnaire's disease, rubella, and influenza, that have been reported on cruise ships are described in table 2.

Transmission of tuberculosis is airborne, most often by coughing or sneezing. Frequent overcrowding in a confined environment such as on a cruise or during air travel may increase the risk for infection. There are no published reports of the transmission of tuberculosis on board cruise ships. Outbreaks involving crew members and passengers of commercial aircraft present conditions similar to those of cruises and have been documented [65, 66].

Miscellaneous Infections

The practitioner on board should be aware of other infectious diseases, such as infectious mononucleosis, poliomyelitis, sexually transmitted diseases, and zoonoses, that may become evident on board a cruise ship [67]. In addition, envenomations are also a frequent issue confronting infectious disease practitioners [68, 69]. Table 3 summarizes several potential infections that may pose a threat to all travelers. Medical resources for the primary care provider at sea have been published [70–78].

Serological markers for antibodies to hepatitis A and B viruses have been shown among shipboard military personnel in association with Caribbean deployment (hepatitis A) and deployment in the South Pacific and India area [79]. It is recommended that all travelers practice preventive measures and seek vaccinations before departing to foreign lands.

Although transmission of malaria on board ships is apparently uncommon, clinicians need to be aware that the clinical manifestation of malaria may become evident during a cruise. Historically, the principal persons to contract malaria were the watering parties sent ashore to fill the casks with fresh water [13]. All travelers visiting high-risk environments may help prevent infection by wearing long-sleeved shirts and trousers to avoid exposing their arms and legs. In addition, the proper use of insect repellent and chemoprophylaxis is recommended.

Although gastrointestinal and respiratory illnesses were the most common infections implicated in a review article of medical logs from two passenger cruise ships with 7- to 10-day cruises in the Caribbean, one case of bacterial meningitis was also mentioned [80].

Yellow fever is an often fatal viral disease transmitted by the bite of an infective female *Aedes aegypti* mosquito. Several other species of mosquitoes are able to transmit yellow fever in tropical forests as well. Although the clinical manifestation may become apparent during a cruise because of the short incubation period of 3–7 days, transmission of yellow fever on board contemporary cruise ships is uncommon. Historically, the disease spread from an original site of endemicity on the west coast of Africa to the New World via the old slave trading

Table 1. Several gastrointestinal illnesses reported on cruise liners.

Reference	Causal agent	Year	Comments
[21]	Unknown (Brainerd's diarrhea)	1992	Outbreak of chronic diarrhea among 58 passengers on a cruise ship visiting the Galapagos Islands, Ecuador; water handling and chlorination were deficient on board; therefore, consuming the ship's unbottled water or ice or eating fruits and vegetables washed with the ship's water may have been the vehicles of transmission; on examination, no etiologic agent was revealed
[22]	<i>Campylobacter jejuni</i>	1984	Case report of a 42-year-old man who developed febrile gastroenteritis following a Caribbean cruise
[23]	<i>Cyclospora</i>	1997	220 cases of cyclosporiasis reported among persons on a cruise that departed from Florida; eating food items such as raspberries from Guatemala was significantly associated with risk for illness
[24]	<i>Escherichia coli</i>	1975	Onset of diarrheal illness while on board among one-third of the passengers on two successive roundtrip cruises carrying 900 passengers and 386 crew members from Miami to Nassau in the Bahamas; mode of transmission is unidentified
[25]	<i>E. coli</i>	1981	Diarrhea among 7 of 10 passengers during a 5-day ocean cruise from Miami; eating potato salad or eating at cold buffets on ship were associated with illness
[26]	<i>E. coli</i>	1984	Outbreak affecting 251 passengers and 51 crew members on board a cruise in the United Kingdom; contamination of inadequately chlorinated water was the probable vehicle of transmission
[27]	Norwalk virus	1977	Explosive outbreaks of gastrointestinal illness reported on five consecutive cruises; common-source exposure, such as eating béarnaise sauce or tartar sauce on one cruise and probable person-to-person transmission on the other four, were the suggested modes of transmission
[28]	Norwalk virus	1986	Three outbreaks occurring on two Caribbean cruise ships, one of which appeared to be associated with the Norwalk virus; deficiencies relating to water chlorination record-keeping, food preparation or handling, and potential contamination of food were the possible modes of transmission
[29]	Norwalk virus	1990	Outbreak affecting 217 of 527 passengers on a cruise ship in Hawaii, possibly due to the consumption of fresh-cut fruit and stuffed eggs served at two buffets on board; sanitation violations, such as wiping shoes with a cloth that was washed in a sink and later used for preparing food as well as hitting spoons against the upper rim of a garbage can to remove melon seeds, were examples of possible modes of transmission
[30]	Norwalk virus	1992	104 cases of acute gastroenteritis reported on a cruise ship touring the Hawaiian islands; mode of transmission was associated with the amount of ice consumed
[31]	<i>Salmonella infantis</i>	1973	Gastrointestinal illness among five persons (possibly due to the deplorable food handling practices described by passengers)
[32]	<i>Salmonella typhi</i>	1970	Epidemic of typhoid on a British ship affecting 83 crewmen and passengers; one passenger, a 63-year-old man, died of complications; the water supply was fecally polluted and might have been the vehicle of spread
[33]	<i>Shigella dysenteriae</i>	1996	330 passengers affected aboard an Italian cruise ship in the eastern Mediterranean, with the probable transmission vectors being smoked swordfish with salted cod
[34]	<i>Shigella flexneri</i> 4a	1989	Outbreak aboard a cruise ship in the Caribbean, with 72 passengers and 12 crew members affected; a case-control study suggested German potato salad served on board as the probable vehicle of transmission
[35]	<i>S. flexneri</i> 6	1973	Gastrointestinal illness among 90% of 650 passengers and 35% of 299 crew members on a 7-day Caribbean cruise liner; the ship's water and ice were suggested as the probable vehicles of transmission
[36]	<i>S. flexneri</i> 2a	1994	Gastrointestinal illness among 586 passengers and 24 crew members on a Caribbean cruise ship, with one death occurring (a 78-year-old man with diarrhea); mode of transmission remains unknown
[37]	SRSV (possibly related to the Snow Mountain agent)	1988	Diarrhea reported by 70 passengers during a transatlantic journey from Great Britain to Miami; a similar outbreak occurred on a previous cruise despite thorough inspection and cleaning of the ship; vehicle of transmission was suggested to be contaminated bathrooms where person-to-person spread of the agent may have taken place
[38]	SRSV	1995	378 reported cases during four cruises in the western Mediterranean; person-to-person transmission was suggested
[39]	SRSV	1998	Explosive diarrhea and vomiting of sudden onset among 347 passengers and 28 crew members on board a cruise liner from the Dominican Republic; passengers of two previous cruises on board the same ship complained of similar symptoms (mode of transmission is being investigated)
[40, 41]	<i>Staphylococcus aureus</i>	1983	Food poisoning on a Caribbean cruise ship associated with eating cream-filled pastries at two separate meals
[42, 43]	<i>Vibrio cholerae</i> O139	1992	Illness affecting cruise ship passengers in Southeast Asia; illness was associated with eating yellow rice at a buffet restaurant in Bangkok
[44]	<i>Vibrio parahaemolyticus</i>	1974–1975	Gastrointestinal illness on two Caribbean cruise ships affecting 697 passengers and 27 crew members; evidence showed that seafoods served on the ships were the possible vehicles of transmission
[45]	<i>Vibrio</i> , <i>Salmonella</i> , <i>E. coli</i> , and <i>Shigella</i>	1976 and 1981	Two outbreaks among passengers after onshore visits to buffets where seafood or seafood salad was consumed

NOTE. SRSV = small, round structured virus.

Table 2. Several respiratory illnesses reported on cruise liners.

Reference	Causal agent	Year	Comments
[54]	<i>Corynebacterium diphtheria</i> variety <i>gravis</i>	1997	A case of diphtheria confirmed in an unimmunized 72-year-old woman who developed a sore throat during a cruise around the Baltic Sea
[55]	Influenza A (H3N2)	1987	Among cruise ship passengers traveling from Asia, 104 passengers interviewed reported having developed acute respiratory illnesses
[56, 57]	Influenza A (H3N2)	1997	Outbreaks of respiratory illness on two cruise ships: one from New York City to Montreal affecting 39 of 1,445 passengers and 3 of 631 crew; and the second from Tahiti to Hawaii affecting 48 of 1,443 passengers and 16 of 639 crew
[58]	<i>Legionella</i> -like organism	1984	Illness among 52 passengers on a cruise from Gothenburg to Bordeaux, Lisbon, Cadiz, Casablanca, Lanzarote, Madeira, Cherbourg, London, and back to Gothenburg; although <i>Legionella</i> was not confirmed, water systems on board might have been reservoirs for <i>Legionella pneumophila</i>
[59–61]	<i>L. pneumophila</i>	1994	Outbreak affecting 50 cruise ship passengers (16 confirmed, 34 probable) identified from nine cruises; exposure to whirlpool spas was strongly associated with disease
[62]	<i>L. pneumophila</i>	1994	A case of legionnaires' disease associated with each of two consecutive Mediterranean cruises on the same ship; on investigation, problems with the air handling units were revealed
[63]	<i>L. pneumophila</i>	1998	Two cases of legionnaires' disease reported among two passengers on separate cruises to the southern Mediterranean (a 77-year-old woman and a 71-year-old man); the ship's water supply and plumbing system were improved thereafter
[64]	Rubella	1997	Two clusters of rubella reported on commercial cruise ships from Florida to the Bahamas

routes. Of all the diseases that decimated the crews of the old ships, yellow fever was considered the most terrifying [13]. The disease is still endemic in Africa from coast to coast between the south of the Sahara and Zimbabwe and in parts of Central and South America. Those traveling to high-risk areas should seek vaccination.

Vessel Sanitation

Following shipboard outbreaks of typhoid fever [32] and shigellosis [35], the U.S. Centers for Disease Control (CDC) established the Vessel Sanitation Program, also known as "VSP," in 1975 in cooperation with the cruise ship industry to minimize the potential for disease outbreaks and to ensure a healthful environment for passengers and crew. Every American ship with a foreign itinerary carrying ≥ 13 passengers as well as all international cruise ships arriving at U.S. ports are subject to unannounced inspections and, when necessary, reinspection by the CDC [81]. After inspection, all ships receive a score that is published biweekly in the Summary of Sanitation Inspections of International Cruise Ships, commonly referred to as the Green Sheet, which may be found at the following web site: www.cdc.gov/nceh/programs/sanit/vsp/vsp.htm. Ships are rated on items such as water sanitation, food preparation and handling, potential contamination of food, general cleanliness, storage, and repair. A score of $\geq 86\%$ is considered acceptable by the CDC. It must be noted that no international maritime regulation requires that there be medical personnel aboard cruise ships

[80], although Norway, Britain, and Italy have regulations in this area [82]. Health care guidelines for cruise ship medical facilities [83–85] as well as safety guidelines for the polar tourist [86], for example, have been published.

Table 3. Diseases potentially acquired by travelers.

Cholera
Cyclosporiasis
Diphtheria
Gastrointestinal illnesses (travelers' diarrhea)
Infectious mononucleosis
Influenza
Legionnaires' disease
Malaria
Meningitis
Plague (or other zoonoses)
Poliomyelitis
Rubella
Sexually transmitted diseases
Tuberculosis
Typhoid fever
Varicella
Viral hepatitis
Yellow fever
Zoonoses

Conclusion

Travel by sea has been an integral part of our history. Today, cruise ships epitomize the enjoyable aspects of travel. They represent a heterogeneous group of sailing vessels, from small adventurer ships to large, several-thousand-passenger luxury cruise liners. The level of sophistication of the medical facilities may also range from barely adequate to well-equipped with intensive care unit capabilities. There is potential risk for infection when traveling by any means of transportation. Special consideration should, therefore, be given to the prevention of disease by maintaining sanitary conditions on board, providing maritime medical care for passengers and crew members when necessary, and utilizing preventive measures (i.e., vaccinations). In the evaluation of ill cruise ship passengers and crew, the type of cruise, cruise itinerary, passenger itinerary, and offshore activities need to be considered. When traveling abroad, the enjoyment of any trip ultimately depends on the ease and comfort of conveyance.

Acknowledgment

The authors thank Susan G. Kanfer for editorial and photographic assistance.

References

- Meeting reviews strategies for preventing rubella, influenza A outbreaks on cruise ships. *Focus* **1999**;8:7.
- Shultz MG. Emporiatrics—travelers' health. *Br Med J* **1982**;285:582–3.
- Addiss D, Yashuk J, Clapp D, Blake P. Outbreaks of diarrhoeal illness on passenger cruise ships, 1975–85. *Epidemiol Infect* **1989**;103:63–72.
- Christenson B, Lidin-Janson G, Kallings I. Outbreak of respiratory illness on board a ship cruising to ports in southern Europe and northern Africa. *J Infect* **1987**;14:247–54.
- Dannenberg AL, Yashuk JC, Feldman RA. Gastrointestinal illness on passenger cruise ships, 1975–1978. *Am J Public Health* **1982**;72:484–8.
- Koo D, Maloney K, Tauxe R. Epidemiology of diarrheal disease outbreaks on cruise ships, 1986 through 1993. *JAMA* **1996**;275:545–7.
- Merson MH, Hughes JM, Lawrence DN, Wells JG, D'Agnese JJ, Yashuk JC. Food and waterborne disease outbreaks on passenger cruise vessels and aircraft. *Journal of Milk and Food Technology* **1976**;39:285–8.
- Merson MH, Hughes JM, Wood BT, Yashuk JC, Wells JG. Gastrointestinal illness on passenger cruise ships. *JAMA* **1975**;231:723–7.
- Wheeler RE. Cruise ship medicine (reply). *Ann Emerg Med* **1995**;26:761–2.
- Crossley KB, Peterson PK. Infections in the elderly. In: Mandell GL, Bennett JE, Dolin R, eds. *Mandell, Douglas and Bennett's principles and practice of infectious diseases*. 4th ed. New York: Churchill Livingstone, **1995**:2737–42.
- Wilson M, Von Reyn C, Fineberg H. Infections in HIV-infected travelers: risks and prevention. *Ann Intern Med* **1991**;114:582–92.
- Cossar JH. Health hazards of international travel. *World Health Stat Q* **1989**;42:61–9.
- Roddis LH. Disease and disaster in the old sailing ships. In: *A short history of nautical medicine*. New York: Paul B Hoeber, **1941**:18–68.
- Hinman EJ. The United States public health service and merchant seamen. *N Y State J Med* **1992**;92:331–2.
- Parascandola J. The first edition of 'The ship's medicine chest' (1881). *Public Health Rep* **1995**;110:504–5.
- Desowitz, RS. Who gave Pinta to the Santa Maria? Torrid diseases in a temperate world. 1st ed. New York: WW Norton, **1997**.
- Chalmers T. Effects of ascorbic acid on the common cold: an evaluation of the evidence. *Am J Med* **1975**;58:532–6.
- French RK. Scurvy. In: Kiple KF, ed. *The Cambridge world history of human disease*. New York: Cambridge University Press, **1993**:1000–5.
- Lind J. Postscript (section II). In: *A treatise on the scurvy*. New York: Leslie B. Adams, Jr., **1980**:507.
- Cossar JH. Influence of travel and disease: an historical perspective. *Journal of Travel Medicine* **1994**;1:36–9.
- Mintz ED, Weber JT, Guris D, et al. An outbreak of Brainerd diarrhea among travelers to the Galapagos Islands. *J Infect Dis* **1998**;177:1041–5.
- Hoffman T. Febrile gastroenteritis after a Caribbean cruise. *Hosp Pract (Off Ed)* **1984**;19:111–2.
- Centers for Disease Control and Prevention. Update: outbreaks of cyclosporiasis—United States and Canada, 1997. *MMWR Morb Mortal Wkly Rep* **1997**;46:521–3.
- Lumish RM, Ryder RW, Anderson DC, Wells JG, Puhr ND. Heat-labile enterotoxigenic *Escherichia coli*-induced diarrhea aboard a Miami-based cruise ship. *Am J Epidemiol* **1980**;111:432–6.
- Snyder JD, Wells JG, Yashuk J, Puhr N, Blake PA. Outbreak of invasive *Escherichia coli* gastroenteritis on a cruise ship. *Am J Trop Med Hyg* **1984**;33:281–4.
- O'Mahony M, Noah ND, Evans B, Harper D. An outbreak of gastroenteritis on a passenger cruise ship. *J Hyg (Lond)* **1986**;97:229–36.
- Gunn RA, Terranova WA, Greenberg HB, et al. Norwalk virus gastroenteritis aboard a cruise ship: an outbreak on five consecutive cruises. *Am J Epidemiol* **1980**;112:820–7.
- Centers for Disease Control. Gastroenteritis outbreaks on two Caribbean cruise ships. *MMWR Morb Mortal Wkly Rep* **1986**;35:383–4.
- Herwaldt BL, Lew JF, Moe CL, et al. Characterization of a variant strain of Norwalk virus from a food-borne outbreak of gastroenteritis on a cruise ship in Hawaii. *J Clin Microbiol* **1994**;32:861–6.
- Khan AS, Moe CL, Glass RI, et al. Norwalk virus-associated gastroenteritis traced to ice consumption aboard a cruise ship in Hawaii: comparison and application of molecular method-based assays. *J Clin Microbiol* **1994**;32:318–22.
- Werner SB, Hudgins MP, Morrison FR, Chin J. Gastroenteritis on a cruise ship—a recurring problem. *Public Health Rep* **1976**;91:433–6.
- Davies JW, Simon WR, Cox KG, Bowmer EJ, Mallory A. Typhoid at sea: epidemic aboard an ocean liner. *Can Med Assoc J* **1972**;106:877–83.
- Gikas A, Padiaditis J, Giti Z, Papadakis J, Tselentis Y. Shigellosis on an Italian cruise ship [letter]. *Lancet* **1996**;348:1593–4.
- Lew JF, Swerdlow DL, Dance ME, et al. An outbreak of shigellosis aboard a cruise ship caused by a multiple-antibiotic-resistant strain of *Shigella flexneri*. *Am J Epidemiol* **1991**;134:413–20.
- Merson MH, Tenney JH, Meyers JD, et al. Shigellosis at sea: an outbreak aboard a passenger cruise ship. *Am J Epidemiol* **1975**;101:165–75.
- From the Centers for Disease Control and Prevention. Outbreak of *Shigella flexneri* 2a infections on a cruise ship. *JAMA* **1994**;272:1404.
- Ho MS, Glass RI, Monroe SS, et al. Viral gastroenteritis aboard a cruise ship. *Lancet* **1989**;2:961–5.
- McEvoy M, Blake W, Brown D, Green J, Cartwright R. An outbreak of viral gastroenteritis on a cruise ship. *Commun Dis Rep CDR Rev* **1996**;6:R188–96.
- An outbreak of viral gastroenteritis on board a cruise liner. *Commun Dis Rep CDR Wkly* **1998**;8:1.
- Centers for Disease Control. Staphylococcal food poisoning on a cruise ship. *MMWR Morb Mortal Wkly Rep* **1983**;32:294–5.
- Waterman SH, Demarcus TA, Wells JG, Blake PA. Staphylococcal food poisoning on a cruise ship. *Epidemiol Infect* **1987**;99:349–53.

42. Boyce TG, Mintz ED, Greene KD, et al. *Vibrio cholerae* O139 Bengal infections among tourists to Southeast Asia: an intercontinental food-borne outbreak. *J Infect Dis* **1995**;172:1401–4.
43. Mahon BE, Mintz ED, Greene KD, Wells JG, Tauxe RV. Reported cholera in the United States, 1992–1994: a reflection of global changes in cholera epidemiology. *JAMA* **1996**;276:307–12.
44. Lawrence DN, Blake PA, Yashuk JC, Wells JG, Creech WB, Hughes JH. *Vibrio parahaemolyticus* gastroenteritis outbreaks aboard two cruise ships. *Am J Epidemiol* **1979**;109:71–80.
45. Berkelman RL, Cohen ML, Yashuk J, Barrett T, Wells JG, Blake PA. Traveler's diarrhea at sea: two multi-pathogen outbreaks caused by food eaten on shore visits. *Am J Public Health* **1983**;73:770–2.
46. Tornieporth NG, Johnson WD Jr. Infections associated with international travel: recent developments and global trends. *Adv Intern Med* **1996**;41:119–64.
47. Lange RW, Kreider SD. Food and water acquisition abroad: guidelines for finding safe sustenance. *Travel Medicine* **1983**;73:325–32.
48. Lew JF, LeBaron CW, Glass RI, et al. Recommendations for collection of laboratory specimens associated with outbreaks of gastroenteritis. *MMWR Morb Mortal Wkly Rep* **1990**;39:1–13.
49. LeBaron CW, Furutan NP, Lew JF, et al. Viral agents of gastroenteritis. Public health importance and outbreak management. *MMWR Morb Mortal Wkly Rep* **1990**;39(RR-5):1–24.
50. Ando T, Jin Q, Gentsch JR, et al. Epidemiologic applications of novel molecular methods to detect and differentiate small round structured viruses (Norwalk-like viruses). *J Med Virol* **1995**;47:145–52.
51. Thacker SB, Hughes JM. Advisory letter on preventing foodborne disease outbreaks on cruise ships: CDC Vessel Sanitation Program, 1994. Atlanta: Centers for Disease Control and Prevention, 1994.
52. The prevention of human transmission of gastrointestinal infections, infestations, and bacterial infestations. *Commun Dis Rep CDR Rev* **1995**;5:R157–72.
53. Peake DE, Gray CL, Ludwig MR, Hill CD. Descriptive epidemiology of injury and illness among cruise ship passengers. *Ann Emerg Med* **1999**;33:67–72.
54. Diphtheria acquired during a cruise in the Baltic Sea. *Commun Dis Rep CDR Wkly* **1997**;7:1.
55. Centers for Disease Control. Acute respiratory illness among cruise-ship passengers—Asia. *MMWR Morb Mortal Wkly Rep* **1988**;37:63–6.
56. Centers for Disease Control and Prevention. Update: influenza activity—United States, 1997–98 season. *MMWR Morb Mortal Wkly Rep* **1997**;46:1094–8.
57. Miller J, Tam T, Afif C, et al. Influenza A outbreak on a cruise ship. *Commun Dis Rep* **1998**;24:9–11.
58. Berntsson E, Hogevis H, Lidin-Janson G, Jeansson S, Kallings I. Infections among cruise passengers (a *Legionella*-like organism?) [letter]. *Infection* **1986**;14:93.
59. From the Centers for Disease Control and Prevention. Update: outbreak of Legionnaires' disease associated with a cruise ship, 1994. *JAMA* **1994**;272:915.
60. Centers for Disease Control and Prevention. Outbreak of pneumonia associated with a cruise ship, 1994. *MMWR Morb Mortal Wkly Rep* **1994**;43:521.
61. Jernigan DB, Hofmann J, Cetron MS, et al. Outbreak of Legionnaires' disease among cruise ship passengers exposed to a contaminated whirlpool spa. *Lancet* **1996**;347:494–9.
62. Joseph C, Hutchinson E, Dedman D, Birtles R, Watson J, Bartlett C. Legionnaire's disease surveillance: England and Wales 1994. *Commun Dis Rep CDR Rev* **1995**;5:R180–3.
63. *Legionella* on board a cruise ship. *Commun Dis Rep CDR Wkly* **1998**;8:237.
64. Centers for Disease Control and Prevention. Rubella among crew members of commercial cruise ships—Florida, 1997. *MMWR Morb Mortal Wkly Rep* **1998**;46:1247–50.
65. Driver CR, Valway SE, Morgan WM, Onorato IM, Castro KG. Transmission of *Mycobacterium tuberculosis* associated with air travel. *JAMA* **1994**;272:1031–5.
66. Kenyon TA, Valway SE, Ihle WW, Onorato IM, Castro KG. Transmission of multidrug-resistant *Mycobacterium tuberculosis* during a long airplane flight. *N Engl J Med* **1996**;334:933–8.
67. Spees DN. Health risks of foreign travel: preparing adults for jaunts abroad. *Postgrad Med* **1991**;89:147–50, 153, 156.
68. Fenner PJ. Dangers in the ocean: the traveler and marine envenomation. I. Jellyfish. *Journal of Travel Medicine* **1998**;5:135–41.
69. Fenner PJ. Dangers in the ocean: the traveler and marine envenomation. II. Marine vertebrates. *Journal of Travel Medicine* **1998**;5:213–16.
70. DuPont HL, Steffen R. *Textbook of travel medicine and health*. Malden, MA: BC Decker, **1997**.
71. Schlossberg D. *Infections of leisure*. 2nd ed. Philadelphia: ASM Press, **1999**.
72. Goethe W, Watson E, Jones D, eds. *Handbook of nautical medicine*. New York: Springer-Verlag, **1984**.
73. *International medical guide for ships*. 2nd ed. Geneva: World Health Organization, **1988**.
74. Duffy JC, ed. *The ship's medicine chest and medical aid at sea*. Washington: United States Government Printing Office, **1984**.
75. Dick L. Travel medicine: helping patients prepare for trips abroad. *Am Fam Physician* **1998**;58:383–98, 401–2.
76. D'Alessandro DM, D'Alessandro MP, Hendrix MJ, Bakalar RS. Information needs of naval primary care providers and patients at sea. *Mil Med* **1999**;164:127–31.
77. Fitzgerald RH. Medical facilities and needs aboard a cruise ship: points to ponder before an ocean cruise. *South Med J* **1986**;79:1413–4.
78. Lange RW, Kreider SD. The little black bag: medical travel kits for patients and physician. *Travel Medicine* **1983**;73:259–332.
79. Hawkins RE, Malone JD, Cloninger LA, et al. Risk of viral hepatitis among military personnel assigned to US Navy ships. *J Infect Dis* **1992**;165:716–9.
80. DiGiovanna T, Rosen T, Forsett R, Sivertson K, Kelen GD. Shipboard medicine: a new niche for emergency medicine. *Ann Emerg Med* **1992**;21:1476–9.
81. Centers for Disease Control. Vessel sanitation scores. *MMWR Morb Mortal Wkly Rep* **1988**;37:114–7.
82. Wade B. Assessing ships' medical care. *New York Times*, **1996**.
83. American College of Emergency Physicians. Guidelines of care for cruise ship medical facilities. *Ann Emerg Med* **1996**;27:846.
84. American College of Emergency Physicians. Health care guidelines for cruise ship medical facilities. *Ann Emerg Med* **1998**;31:535.
85. Health care guidelines for cruise ship medical facilities: policy resource and education paper. Dallas, TX: American College of Emergency Physicians, **1998**.
86. Levinson JM, Ger E. Safe passage questioned: medical care and safety for the polar tourist. Centreville, MD: Cornell Maritime Press, **1998**.

The "Conflict-of-Interest Policy" of the Office of Continuing Medical Education, UCLA School of Medicine, requires that faculty participating in a CME activity disclose to the audience any relationship with a pharmaceutical or equipment company which might pose a potential, apparent, or real conflict of interest with regard to their contribution to the program. The authors report no conflicts of interest.