Gastroenteritis on a Cruise Ship —A Recurring Problem—

S. BENSON WERNER, MD, MPH, MICHAEL P. HUDGINS, MD, MPH, FLORENCE R. MORRISON, MA, and JAMES CHIN, MD, MPH

AN OUTBREAK OF GASTROENTERITIS occurred on a luxury cruise ship in August 1973. The passengers returned to California after 1 week on the Mediterranean, which included a brief stop in Naples at the height of its cholera epidemic (*1*). Because gastrointestinal illness among the passengers was reported, a detailed investigation was conducted to rule out the possible importation of cholera to the United States. Rectal swabs were collected from all 253 passengers, but *Vibrio cholerae* was not isolated from any of the swabs. However, many improper food handling practices were noted. The outbreak was similar to others that had occurred aboard international cruise ships (*2–6*), and investigations of those outbreaks also disclosed poor sanitary practices.

Although the Quarantine Division of the Center for Disease Control has a regular inspection program for all cruise ships that use U.S. ports, no routine uniform inspection has been required for liners plying international waters. Such inspections should be required, and a system should be devised to monitor compliance with existing sanitary guidelines proposed by the World Health Organization.

☐ *Dr. Werner is medical epidemiologist, Ms. Morrison is chief of the statistical unit, and Dr. Chin is chief of the Infectious Disease Section of the California State Department of Health. At the time of this investigation, Dr. Hudgins was a public health resident at the health department; he is now an officer of the Epidemic Intelligence Service of the Center for Disease Control, assigned to the Rhode Island Department of Health as acting State epidemiologist.*

Tearsheet requests to S. Benson Werner, MD, California State Department of Health, 2151 Berkeley Way, Berkeley, Calif. 94704.

Background

The Infectious Disease Section of the California State Department of Health was requested by the Center for Disease Control to assist the Center's Quarantine Division in an investigation of an outbreak of diarrhea among passengers on a flight scheduled to arrive at the Oakland International Airport. The call came at 1:30 am on September 4, 1973; the plane was due 5½ hours later. The passengers had flown to Palma de Mallorca from California on August 19, and the

next day they started their 7-day cruise of the Mediterranean, which included brief stops at several ports. Cholera was epidemic in Naples when the tour group docked on August 22. The ship returned to Palma de Mallorca on August 27, and the passengers remained there until their departure for the United States on September 3.

On the return flight to California, the aircraft commander—as required by regulation—radioed the Quarantine Division to report that gastroenteritis was prevalent among the passengers.

The Investigation

A questionnaire was rapidly designed to obtain demographic, clinical, and epidemiologic information, and a team of four physicians and a nurse was dispatched from the State health department to meet the passengers at the airport. No one was critically ill. The passengers were requested to complete the questionnaire and to have a rectal swab taken before proceeding through customs; all complied. The investigation at the airport proceeded smoothly, and all 253 passengers were processed in 2½ hours.

The swabs were placed in freshly prepared 1 percent peptone broth and transported to the Microbial Diseases Laboratory of the California State Department of Health. The swabs were then used to inoculate thiosulfate-citrate-bile-sucrose (TCBS) agar for isolation of *V. cholerae,* xylose lysine deoxycholate (XLD) for isolation of shigellae, and selenite F enrichment broth. Cultures of the broth were inoculated into bismuth sulfite agar for the isolation of salmonellae. Studies for enteropathogenic *Escherichia coli* were not done.

Results

Questionnaire. The questionnaire responses were coded, key punched, tabulated, and analyzed. A passenger was considered to have been ill if he or she had experienced diarrhea or vomiting at any time while on the tour, from August 19 through September 4. Of the 253 passengers, 183 or 72 percent had been ill. The attack rates did not differ by age or sex. Symptoms were unremarkable, except that fever was reported by only 10 percent of those who had been ill (see table). The disease was primarily lower gastrointestinal (all of the affected persons experienced diarrhea) rather than upper gastrointestinal (28 percent experienced vomiting) and generally mild; only one person was hospitalized.

An analysis of the efficacy of cholera vaccine indicated that the vaccine conferred no protection against gastrointestinal illness even when administered within 6 months of departure from the United States. The rate of gastrointestinal illness among the passengers who had been vaccinated was similar to that of those who had not been vaccinated.

The epidemic curve (see chart) shows a relatively abrupt onset on August 21—1 day after the cruise began. The peak date for onsets was August 22, but the cruise ship did not arrive at the Port of Naples until 9:30 pm that day. The only prior stop was Palermo, Italy, where the ship docked for 5 hours earlier in the day. All meals were available aboard ship, even when it was in port. However, a statistical analysis showed that eating off ship in Naples was unrelated to the risk of gastrointestinal disease, despite the cholera epidemic and the possibility of concomitant foodborne and waterborne transmission of other enteric diseases.

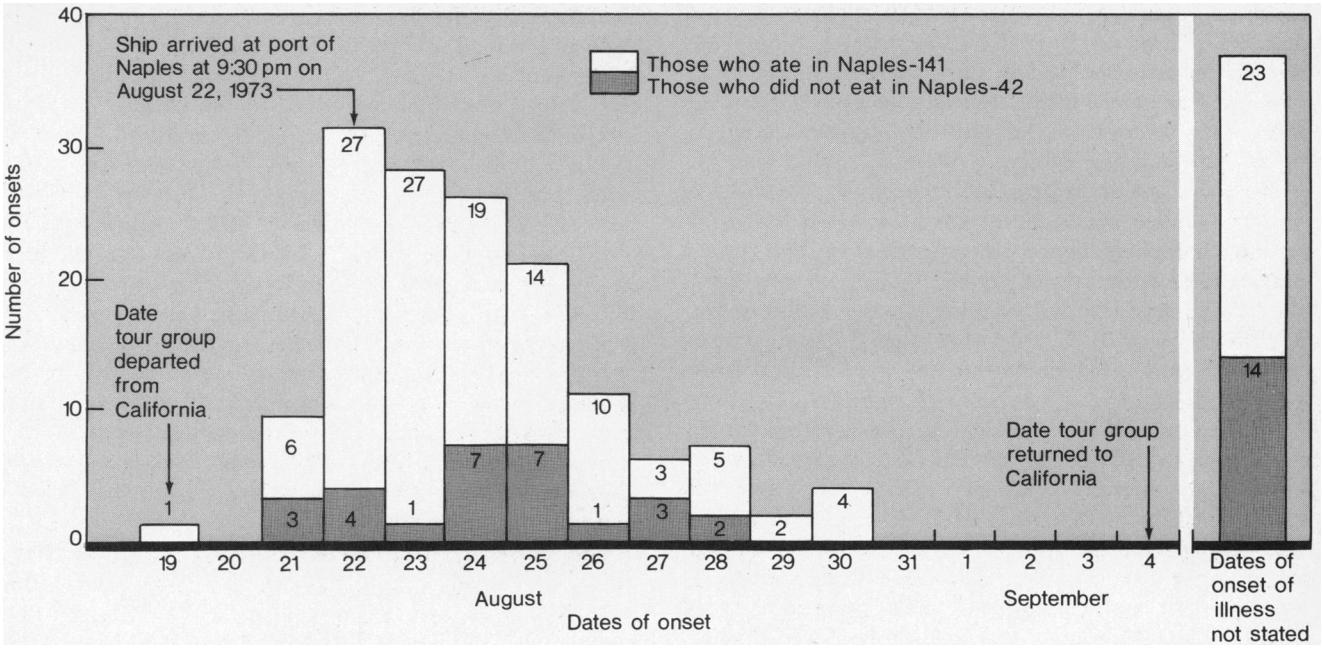
Laboratory studies. None of the 253 rectal swabs grew *V. cholerae.* Other bacterial pathogens were sought, but only one, *Salmonella infantis,* was isolated; this was cultured from five persons. No shigellae were isolated.

Symptoms among 183 cruise ship passengers who reported illness,[1] by number who ate in Naples or aboard ship while in Naples

Symptom	Ate in Naples (N=141)		Ate aboard ship (N=42)		Total	
	Number	Percent	Number	Percent	Number	Percent
Diarrhea	141	100	42	100	183	100
Abdominal cramps	71	50	17	40	88	48
Nausea	47	33	12	29	59	32
Vomiting	36	26	15	36	51	28
Headache	33	23	5	12	38	21
Fever	16	11	2	5	18	10
Chills	14	10	1	2	15	8
Bloody diarrhea	5	4	1	2	6	3
Other	13	9	6	14	19	10

[1] Persons were classified as "ill" if they reported vomiting or diarrhea at any time between Aug. 19 and Sept. 4, 1973.

Gastrointestinal illness by date of onset, August 19-September 4, 1973



Comments by Passengers

Many passengers reported deplorable sanitary practices aboard the cruise ship. Waiters used restrooms on the ship without subsequent hand washing. Kitchenware was seen at times to be merely dipped in dirty water, wiped with a dirty bath towel, and then immediately used for serving other persons. Foul odors like that of "sewage" emanated from the kitchen. Foods were served buffet style at poolside without refrigeration, and left exposed to the sun for up to 4 hours. The same leftover foods reportedly were served several times. Hot foods were not kept hot, nor were cold foods kept cold. Also, there was no "cough guard" at the buffet line.

The passengers also indicated that members of the ship's crew told them that illness had occurred on previous tours and that it was "normal for at least half the passengers to develop diarrhea." Another remark, attributed to the ship's nurse, was that the ". . . last eight shiploads also had gastrointestinal illness" with attack rates of approximately "80 percent."

Although the comments were anecdotal and were not verified, the complaints were so common and offered without solicitation that some credence must be given to them.

Discussion

The etiologic agent responsible for the outbreak of gastroenteritis was not determined. It was not *V. cholerae* or one of the common bacterial pathogens such as shigellae or salmonellae. Five swabs were positive for *S. infantis;* we consider this an excessive recovery rate for just 1 of the 1,500 known *Salmonella* serotypes. The organism probably was acquired on the tour; it may have caused illness in some of the five persons with positive swabs, or it was ingested as a co-contaminant with the "real" pathogen in the vehicle or vehicles that caused the illness. It is unlikely that the outbreak was due to salmonellosis because fever was infrequent, illnesses were generally mild, and many more convalescent carriers would have been detected if salmonellae had been primarily responsible for the illnesses.

Alternative possibilities include: (*a*) "turista" that may result from newly acquired flora such as foreign enteropathogenic *E. coli* (*7*); (*b*) nonbacterial, or viral, gastroenteritis such as that caused by the "Norwalk agent" (*8*) present in fecal contamination of food or water supplies; or (*c*) food poisoning, especially from *Clostridium perfringens* or *Staphylococcus aureus,* because fever was so rare. The deplorable food handling practices described by the passengers make food poisoning highly probable.

The reports of deplorable sanitary conditions on board ship merited investigation, whether or not these conditions caused the outbreak. If only half of the statements made by passengers were accurate, enough violations of sanitary practices occurred to prompt officials of the Center for Disease Control to send a letter to officials of the shipping line. Their reply, however, was terse and indignant; and they accurately pointed out that the U.S. Government had no jurisdiction over their operations. The cruise ship is owned by a Greek firm with head offices in London.

The unsanitary conditions reported are not unique. Improper practices have been identified in many other shipborne outbreaks (*3–6*). Reports of salmonellosis (from *Salmonella bareilly* and *Salmonella senftenberg*) among passengers of a Caribbean cruise ship in 1973 led to an epidemiologic investigation of five consecutive

Caribbean cruises of that vessel between December 29, 1973, and February 18, 1974 (*4*). Of 3,228 passengers contacted, 244 or 8 percent experienced diarrheal illness; the attack rates for the 5 cruises ranged from 6 to 10 percent. Salmonellae were recovered from 20 percent of 199 persons who submitted enteric specimens —the predominant serotypes were *S. bareilly* or *S. senftenberg,* or both, from all 5 cruises. The illness was not related to consumption of food or water at any port. Environmental investigation of the ship's galley revealed contact of cooked foods with raw ones, inadequate refrigeration of food at the buffet table, and the recovery of *S. senftenberg* and *S. bareilly* from uncooked food, cooked food, galley utensils, and from food handlers (*4*).

The Center for Disease Control also investigated 38 cooperating ships among the 98 that departed from U.S. ports between January 1972 and October 1973 (*3*). The medical logs of 2,445 cruises (an estimated 55 percent of the voyages made) were reviewed to ascertain the incidence of gastrointestinal illness. Eight percent of the cruises had an incidence of gastrointestinal illness greater than 1 percent and, for 2 percent of the cruises, the incidence of such illness was greater than 5 percent. The disease occurred in direct proportion to the duration of the cruise, and the incidence was highest for world and Mexican tours. However, a questionnaire survey revealed that the actual incidence of gastrointestinal illness on nine selected cruises was at least four times as high as that recorded in the medical logs, because many ill persons did not visit the ship's physician.

There was evidence that at least some of the illness was shipborne. Environmental surveys revealed poor sanitary conditions on some ships, particularly in the galleys (*3*). In fact, even the best of 12 cruise ships studied by the Center's sanitarians had a grade of 16 deficiencies representing hazards to health; the maximum possible deficiency grade was 90.

As a result of the preceding findings, a meeting was held at the Center for Disease Control with representatives of the passenger cruise industry early in 1974. At that time, the representatives were asked to maintain better surveillance of gastrointestinal disease among passengers and to have ship masters report all cases of such illness to U.S. quarantine stations. Finally, the following recommendations were proposed for improving sanitary practices: (*a*) improve availability and use of hand-washing facilities by food-service personnel, (*b*) improve refrigeration facilities and practices, (*c*) store all perishable cold food at 45°F (7°C) at all times, (*d*) upgrade facilities and practices for washing and sanitizing dishes, glasses, and utensils, and (*e*) institute continuous chlorination or other acceptable water treatment methods or routine coliform testing of all potable water, or both (*3*). The World Health Organization guidelines for proper food and water sanitation aboard vessels were stressed (*9*).

Conclusions

We do not wish to indict all cruise ships; many are well maintained. However, we do believe that routine inspections are in order. At present, no regular, uniform inspections are made of sanitary conditions aboard international passenger ships. The Quarantine Division of CDC does board and inspect foreign ships at U.S. ports, but inspection of international carriers has not been a routine practice of many other nations.

If a laissez-faire attitude by many nations persists concerning sanitary conditions—including water sanitation and food handling—aboard cruise ships bearing flags of other countries as well as their own, the risk to human health and well-being will continue. Stringent inspections should become a routine and frequent practice by nations whose cruise ships sail between international ports. If, for various reasons, such inspections are not possible by those nations, we suggest that international regulatory agencies be established—for example, by the World Health Organization—to safeguard the health of international travelers. Undoubtedly, it will be difficult to establish official regulatory agencies, but it could possibly be accomplished if consumer protection groups, travel agencies, and other organizations were to rally behind this effort.

If sanitary standards were established, a grading system could be used. In many communities throughout the United States, restaurants are rated A, B, or C by official health agencies. These ratings are indicative of restaurant kitchens' sanitation and facilities, which diners are not privileged to examine. Travelers on international cruise ships are entitled to no less.

References

1. Center for Disease Control: Cholera—Italy. Morbidity and Mortality Weekly Report 22: 300, Sept. 1, 1973.
2. Center for Disease Control: Shigellosis on a Caribbean cruise ship. Morbidity and Mortality Weekly Report 22: 217–218, June 30, 1973.
3. Center for Disease Control: Survey of the incidence of gastrointestinal illness in cruise ship passengers. Morbidity and Mortality Weekly Report 23: 65–66, Feb. 16, 1974.
4. Center for Disease Control: Salmonellosis on a Caribbean passenger cruise ship. Morbidity and Mortality Weekly Report 23: 70–75, Feb. 23, 1974.
5. Center for Disease Control: Salmonellosis on a Caribbean cruise ship. Morbidity and Mortality Weekly Report 23: 333–339, Sept. 28, 1974.
6. Center for Disease Control: *Vibrio parahaemolyticus* gastroenteritis on cruise ships. Morbidity and Mortality Weekly Report 24: 109–115, Mar. 22, 1975.
7. Rowe, B., Taylor, J., and Bettelheim, K.A.: An investigation of travellers' diarrhea. Lancet 1: 1–5, Jan. 3, 1970.
8. Kapikian, A. Z., et al.: Visualization by immune electron microscopy of a 27 nm particle associated with acute infectious nonbacterial gastroenteritis. J Virol 10: 1075–1081, November 1972.
9. Lamoureux, V. B.: Guide to ship sanitation. World Health Organization, Geneva, 1967.