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I. SUMMARY

In 1977 there were 436 outbreaks of foodborne disease involving 9,896 cases reported to the CDC Foodborne Disease Surveillance Activity. Etiology was confirmed in 36% (157) of the outbreaks; the majority (101) were caused by bacterial agents.

II. INTRODUCTION

The reporting of foodborne and waterborne diseases in the United States began about 50 years ago when state and territorial health officers, concerned about the high morbidity and mortality caused by typhoid fever and infantile diarrhea, recommended that cases of enteric fever be investigated and reported. The purpose was to obtain information about the role of food, milk, and water in outbreaks of intestinal illness as the basis for sound public health action. Beginning in 1923, the United States Public Health Service published summaries of outbreaks of gastrointestinal illness attributed to milk. In 1938 it added summaries of outbreaks caused by all foods. These early surveillance efforts led to the enactment of important public health measures which had a profound influence in decreasing the incidence of enteric diseases, particularly those transmitted by milk and water.

From 1951 through 1960 the National Office of Vital Statistics reviewed reports of outbreaks of foodborne illness and published summaries of them annually in Public Health Reports. In 1961 the Center for Disease Control (CDC), then the Communicable Disease Center, assumed responsibility for publishing reports on foodborne illness. For the period 1961-66 CDC discontinued publication of annual reviews, but reported pertinent statistics and detailed individual investigations in the Morbidity and Mortality Weekly Report (MMWR).

In 1966 the present system of surveillance of foodborne and waterborne diseases began with the incorporation of all reports of enteric disease outbreaks attributed to microbial or chemical contamination of food or water into an annual summary. Since 1966 the quality of investigative reports has improved primarily as a result of more active participation by state and federal agencies in the investigation of foodborne and waterborne outbreaks. Included in this report are data from foodborne and waterborne disease outbreaks reported to CDC in 1977.

Foodborne and waterborne disease surveillance has traditionally served 3 objectives:

1. Disease Control: Early identification and removal of contaminated products from the commercial market, correction of faulty food preparation practices in food service establishments and in the home, and identification and appropriate treatment of human carriers of foodborne pathogens are the fundamental control measures that result from surveillance of foodborne disease. Identification of contaminated water sources and adequate purification of water from these sources are the primary control measures in the surveillance of waterborne disease outbreaks. Rapid reporting and thorough investigation of outbreaks are important for prevention of subsequent outbreaks.

2. Knowledge of Disease Causation: The responsible pathogen has not been identified in 30% to 60% of foodborne disease outbreaks reported to CDC in each of the last 5 years. In many of these outbreaks pathogens known to cause foodborne illness may not have been identified because of late or incomplete laboratory investigation. In others the responsible pathogen may have escaped detection even when a thorough laboratory investigation was carried out because the pathogen is not yet known to be a cause of foodborne disease or because it cannot yet be identified by available laboratory techniques. These pathogens might be identified, and suitable measures to control diseases caused by them might be instituted as a result of thorough clinical, epidemiologic, and laboratory investigations. Pathogens suspected of being, but not yet determined to be, etiologic agents in foodborne disease include Group D Streptococcus, Campylobacter, Citrobacter, Enterobacter, Klebsiella, Pseudomonas, and the presumably viral agents of acute infectious non-bacterial gastroenteritis (e.g., rotavirus, parvovirus-like agents). Other pathogens

such as Escherichia coli, Bacillus cereus, Yersinia enterocolitica, and Vibrio parahaemolyticus are known causes of foodborne illness, but the extent and importance of their roles have not as yet been determined. The etiologic agent(s) responsible for the majority of waterborne outbreaks also awaits identification. In waterborne disease, as in foodborne disease, the roles of a variety of viral and bacterial agents remain to be clarified.

3. Administrative Guidance: The collection of data from outbreak investigations permits assessment of trends in etiologic agents and food vehicles and focuses on common errors in food and water handling. By compiling the data in an annual summary, it is hoped that local and state health departments and others involved in the implementation of food and water protection programs will be kept informed of the factors involved in food- and waterborne disease outbreaks. Comprehensive surveillance should result in a clearer appreciation of priorities in food and water protection, institution of better training programs, and more rational utilization of available resources.

III. FOODBORNE DISEASE OUTBREAKS

A. Definition of Outbreak

For the purpose of this report a foodborne disease outbreak is defined as an incident in which 1) 2 or more persons experience a similar illness, usually gastrointestinal, after ingestion of a common food, and 2) epidemiologic analysis implicates the food as the source of the illness. There are a few exceptions; 1 case of botulism or chemical poisoning constitutes an outbreak.

In this report outbreaks have been divided into 2 categories:

1. Laboratory confirmed--Outbreaks in which laboratory evidence of a specific etiologic agent is obtained and specified criteria are met (see Section G).
2. Undetermined etiology--Outbreaks in which epidemiologic evidence implicates a food source, but adequate laboratory confirmation is not obtained. These outbreaks are subdivided into 4 subgroups by incubation period of the illness--less than 1 hour (probable chemical), 1 to 7 hours (probable Staphylococcus), 8 to 14 hours (probable Clostridium perfringens), and greater than 14 hours (other infectious agents).

B. Source of Data

The general public and local, state and federal agencies which have responsibility for public health and food protection participate in foodborne disease surveillance. Consumers, physicians, hospital personnel, and persons involved with food service or processing report complaints of illness to health departments or regulatory agencies. Local health department personnel (epidemiologists, sanitarians, public health nurses, etc.) carry out most epidemiologic investigations of these reports and make their findings available to state health departments. State agencies concerned with food safety frequently participate in the initial investigation of the outbreak and offer laboratory support. Occasionally, on special request, CDC participates in an investigation, particularly if the outbreak is large or involves products that move in interstate commerce. State or other officials eventually summarize the findings of the investigation on the standard CDC reporting form (see Section E).

The 2 federal regulatory agencies which have major responsibilities for food protection, the Food and Drug Administration (FDA) and Department of Agriculture (USDA), report episodes of foodborne illness to CDC and to state and local health authorities, which in turn, report to FDA or USDA any foodborne disease outbreaks that might involve commercial products. The U.S. Armed Forces also report outbreaks directly to CDC.

By special arrangement pharmaceutical companies immediately report all requests for botulinum antitoxin to CDC. This is sometimes the first communication of a botulism outbreak to public health authorities, although physicians are urged to promptly report all suspect botulism cases. In botulism outbreaks CDC works closely with physicians, state and local health authorities, and FDA or USDA representatives to provide diagnostic and therapeutic consultation and to rapidly identify the respon-

IV. WATERBORNE DISEASE OUTBREAKS, 1977

In 1977, 34 waterborne disease outbreaks were reported to the Center for Disease Control for the United States, a decrease of 3% from 1976.

A. Definition of Terms

In this report a waterborne disease outbreak is defined as an incident in which 1) 2 or more persons experience similar illness after consumption of water, and 2) epidemiologic evidence implicates the water as the source of illness.

There is 1 exception; 1 case of chemical poisoning constitutes an outbreak if the water is demonstrated to be contaminated by the chemical. In most of the reported outbreaks, the implicated water source was demonstrated to be contaminated; only outbreaks associated with water intended or used for drinking are included.

In this report, municipal systems are defined as public or investor-owned water supplies that serve large or small communities, subdivisions and trailer parks of at least 15 service connections or 25 year-round residents. Semipublic water systems are those in institutions, industries, camps, parks, hotels, service stations, etc., which have their own water system available for use by the general public. Individual water systems, generally wells and springs, are those used by single or several residences or by persons traveling outside populated areas (e.g., backpackers). These definitions correspond closely to those used in the safe drinking water act (PL93-523).

B. Sources of Data

Waterborne disease outbreaks are reported to CDC by state health departments. In addition, the Health Effects Research Laboratory, Environmental Protection Agency (EPA), contacts all state water supply agencies to obtain information about waterborne disease outbreaks, and these data are included in this report. Personnel from CDC and EPA work together in the investigation and evaluation of waterborne disease outbreaks. When requested by a state health department, CDC and EPA offer epidemiologic assistance, provide expertise in the engineering and environmental aspects of water purification, and as indicated, provide large volume water sampling for isolation of viruses, parasites (*Giardia*), and specific bacterial pathogens. A standard reporting form that was pretested in 8 states is now being used (see Section E). Data obtained on outbreaks are reviewed and summarized by representatives from CDC and EPA. A line listing of reported waterborne disease outbreaks in 1977 is included (see Section F).

C. Interpretation of Data

Data included in this summary of waterborne disease outbreaks have limitations similar to those outlined in the foodborne disease summary and must be interpreted with caution since they represent only a small part of a larger public health problem. These data are helpful in revealing the various etiologies of waterborne diseases, the seasonal occurrence of outbreaks, and the deficiencies in water systems that most frequently result in outbreaks. As in the past, the pathogen(s) responsible for many outbreaks in 1977 remains unknown. It is hoped that advances in laboratory techniques and standardization of reporting of waterborne disease outbreaks will augment our knowledge of waterborne pathogens and the factors responsible for waterborne disease outbreaks.

D. Analysis of Data

In 1977, 34 waterborne disease outbreaks, a decrease of 3% from 1976 (35 outbreaks), and 3,860 cases, a decrease of 24% from 1976 (5,068 cases), were reported to CDC (Table 1). However, the number of outbreaks reported in 1976 (35) and 1977 (34) represents a 33% increase over the 4-year average for 1972-75 (26). Increased reporting by certain states probably accounts for the increased number of recorded outbreaks in 1976 and 1977. As in 1976, Pennsylvania accounted for more than one-fourth of all reported outbreaks (10 of 34, 29%).

Figure 1 shows the geographic distributions of outbreaks by states. Nineteen states reported at least 1 outbreak. Figure 2 depicts the trend in reported waterborne disease outbreaks in the period 1938-1977.

Table 2 shows the number of outbreaks and cases by etiology and type of water system. Of 34 outbreaks, 20 (59%) were designated as "acute gastrointestinal illness". This category includes outbreaks characterized by upper and/or lower gastrointestinal symptomatology for which no specific etiologic agent was identified. In previous

years these outbreaks were grouped under the category "sewage poisoning". There were 14 (41%) outbreaks of known etiology: chemical (6), Giardia lamblia (4), Salmonella (2), Shigella (1), and hepatitis A (1). In 3 of the 5 largest outbreaks an etiologic agent was found, Giardia lamblia, in a municipal water system in New Hampshire (750 cases), photographic developer fluid (hydroquinone) aboard a U.S. Navy vessel in California (531 cases), and Salmonella typhimurium in a municipal water system in Iowa (206 cases). There were 3 outbreaks caused by contaminated ice and 1 outbreak in which contaminated water was used to make whipped cream, the vehicle of infection.

The 6 chemical outbreaks were due to toxic amounts of copper (3) (4.0, 12.5, and 38.5 mg/liter), fluoride (24 mg/liter), photographic developer, and gasoline (10 mgm/liter of leaded gasoline). The 3 outbreaks attributed to copper represent problems associated with the leeching of copper from plumbing. In 1 outbreak, naturally corrosive water with a low pH in contact with copper plumbing caused high levels of copper to be dissolved into the drinking water; in another, pH adjustment of naturally corrosive water was interrupted allowing copper to be leached from plumbing; and in another, a defective check valve allowed carbon dioxide from a drinking dispensing machine to flow into the drinking water system lowering the pH and making the water corrosive to copper plumbing.

In the 28 non-chemical outbreaks results of microbiologic tests of water samples were reported in 21; evidence of contamination (presence of coliforms or pathogens) was found in 86% (18/21). In the 4 outbreaks of giardiasis, Giardia cysts were identified in the water supply in the New Hampshire outbreak and were not identified or results were unknown in the remaining 3 (Montana (2), Utah). Results of microbiologic examination were known in 3 of the Giardia outbreaks and only 1 (Utah) were coliforms (80 MPN/100 ml) identified. It is important that an attempt be made to isolate pathogens from the water supply during an outbreak to help establish the etiology, but it is equally important to also document the presence of coliforms and document their relative importance as indicator organisms for use in routine surveillance of water supplies.

Most outbreaks involved semipublic (56%) and municipal (35%) water systems, and fewer involved individual (9%) systems (Table 3). This distribution is similar to that seen in 1976. Outbreaks attributed to water from municipal systems affected an average of 191 persons compared with 81 persons in outbreaks involving semipublic systems and 11 persons in outbreaks associated with individual water systems. Deficiencies in treatment (inadequately or untreated water) accounted for 26 (76%) of the outbreaks. Untreated water (surface or ground) accounted for 14 of these 26 outbreaks.

Of the 19 outbreaks associated with semipublic water supply systems, 15 (79%) involved visitors to areas used mostly for recreational purposes. Of these 15, 13 occurred in the summer months May through September (Table 4).

E. Comments

The 33% increase in the number of outbreaks reported in 1976 and 1977 is probably due to more complete reporting. Diligent investigation, such as was done in outbreaks reported from Pennsylvania and California, can uncover relatively small waterborne outbreaks that often originate from semipublic water systems. It is hoped that similar investigation and reporting will be done by other states so that major deficiencies commonly affecting semipublic water systems, especially in recreational areas, can be better understood and ultimately corrected.

As in recent years outbreaks originating from semipublic water systems in recreational areas contributed significantly to the total number of waterborne outbreaks reported in 1977; more than half occurred in camping areas. Water systems used on a seasonal basis or those that do not usually have an overwhelming demand placed upon them by large numbers of visitors are now showing the strains of such pressure. Water supply systems in such areas, especially national, state, and local parks, must be routinely reappraised and monitored and corrections made to insure safe water under increased demands. The large outbreaks that occurred in 1975 in Crater Lake National Park (more than 1,000 cases) and in 1977 in Yellowstone National Park (more than 400 cases) underscores the actual and potential problems that can occur in recreational areas.

Coliform organism identification is used as an indication of fecal contamination of water supplies and is widely employed in routine surveillance programs. Negative results have usually been interpreted as providing assurance that the water is free of enteric pathogens. This interpretation must be re-evaluated in light of data available from waterborne outbreaks of giardiasis.

In 1977, as in 1976, outbreaks of giardiasis (4) continued to occur. In 3 of the outbreaks in which coliform counts were reported, only 1 (Utah) showed evidence of water contamination. In the New Hampshire outbreak and 1 of the Montana outbreaks (200 cases) the water came from a surface supply and was chlorinated but received no pretreatment (coagulation/flocculation, settling and filtration - Montana), or received inadequate or defective pretreatment (New Hampshire - 2 water supply plants involved). Although adequate disinfection data are not currently available, it is felt that Giardia cysts are as resistant to chlorination as cysts of Entamoeba histolytica, and therefore, high concentrations of chlorine and long contact times would be required for cyst inactivation. Almost all of the outbreaks of giardiasis documented in the United States since 1965 have occurred as a result of drinking untreated surface water or surface water in which the only treatment was disinfection. Disinfection practices normally employed in these systems would not provide for high concentrations of chlorine or long contact times, and it's likely that Giardia cysts could survive, whereas coliforms would not. The coliform test in these situations would not provide assurance that an outbreak of giardiasis would be prevented.

To limit the possibility of Giardia contamination of a surface water supply, the watershed should be protected from human and if possible from wildlife contact. Since this is not practical in most instances, water treatment in addition to disinfection is needed to remove such cysts. Water filtration theories indicate that organisms the size of Giardia cysts should be removed by conventional sand filters; however, effective pretreatment of the water prior to filtration must be accomplished. Conventional treatment of surface water generally includes coagulation/flocculation and settling prior to filtration or if the settling process is not used, the addition of appropriate chemicals for conditioning of the filter media. Pressure filters are generally utilized for iron and manganese removal and for a number of reasons are generally not considered effective for microbiologic treatment. In Giardia outbreaks that have occurred in filtered supplies, treatment and operational deficiencies have been identified. Available data would indicate that well-operated conventional treatment plants employing coagulation/flocculation, settling, and filtration are successful in preventing outbreaks of giardiasis.

The outbreak of hepatitis A occurred after an unknown cross connecting pipe was accidentally broken during the repair of a septic tank inflow line. Sewage discharging from the septic tank line entered the broken piping that connected directly to a nearby (50 yards) unchlorinated ground water well which had previously provided safe drinking water. This outbreak illustrates the hazards of contaminating an established safe source during nearby repair work involving pipes and sewerage lines. During such repairs, unchlorinated drinking supplies should be temporarily chlorinated and such water should be closely monitored bacteriologically during and for some time after the repair work is completed to insure their potability.

Fig. 1 WATERBORNE DISEASE OUTBREAKS, 1977

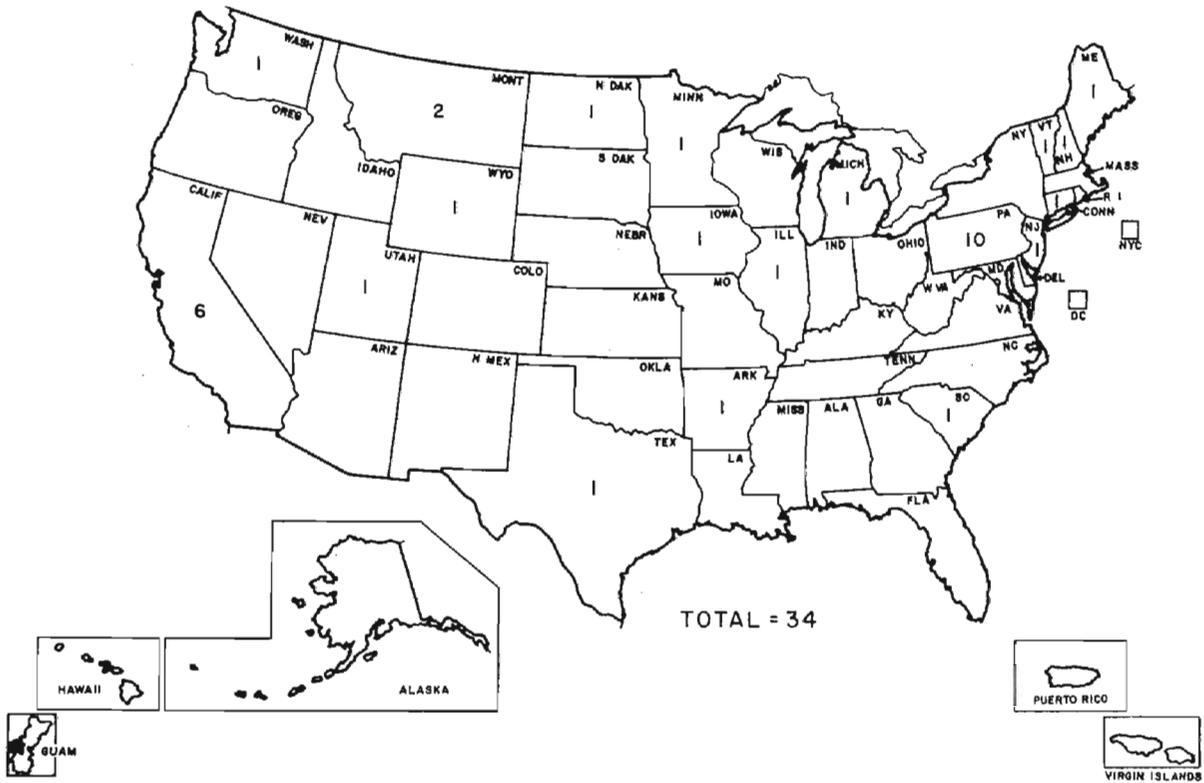
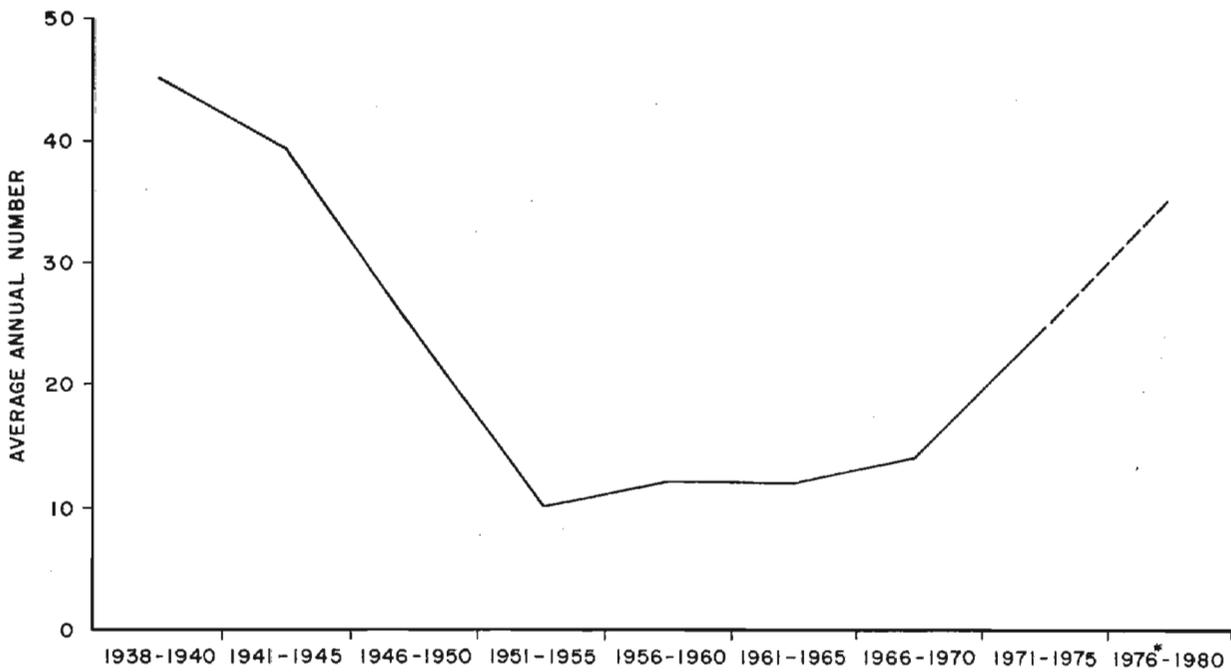


Fig. 2 AVERAGE ANNUAL NUMBER WATERBORNE DISEASE OUTBREAKS, 1938-1977



*NUMBER OUTBREAKS 1976-1977

Table 1

Waterborne Disease Outbreaks,
1972-1977

	<u>1972</u>	<u>1973*</u>	<u>1974*</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>Total</u>
Outbreaks	29	26	25	24	35	34	173
Cases	1,638	1,774	8,356	10,879	5,068	3,860	31,575

*Revised totals

Table 2

Waterborne Disease Outbreaks, by Etiology and
Type of Water System, 1977

	<u>MUNICIPAL</u>		<u>SEMIPUBLIC</u>		<u>INDIVIDUAL</u>		<u>TOTAL</u>	
	<u>Outbreaks</u>	<u>Cases</u>	<u>Outbreaks</u>	<u>Cases</u>	<u>Outbreaks</u>	<u>Cases</u>	<u>Outbreaks</u>	<u>Cases</u>
Acute gastro-intestinal illness	5	518	13	1,396	2	24	20	1,938
Chemical poisoning	4	612	1	11	1	10	6	633
Giardiasis	2	950	2	62	0	0	4	1,012
Salmonellosis	1	206	1	7	0	0	2	213
Hepatitis	0	0	1	47	0	0	1	47
Shigellosis	0	0	1	17	0	0	1	17
TOTAL	12	2,286	19	1,540	3	34	34	3,860

Table 3

Waterborne Disease Outbreaks, by Type of System, and Cause
of System Deficiency, 1977

	<u>MUNICIPAL</u>		<u>SEMIPUBLIC</u>		<u>INDIVIDUAL</u>		<u>TOTAL</u>	
	<u>Outbreaks</u>	<u>Cases</u>	<u>Outbreaks</u>	<u>Cases</u>	<u>Outbreaks</u>	<u>Cases</u>	<u>Outbreaks</u>	<u>Cases</u>
Untreated surface water	1	200	1	55	1	12	3	267
Untreated ground water	0	0	9	547	2	22	11	569
Treatment deficiencies	4	1,362	8	891	0	0	12	2,253
Deficiencies in distribution system	6	718	1	47	0	0	7	765
Miscellaneous	1	6	0	0	0	0	1	6
TOTAL	12	2,286	19	1,540	3	34	34	3,860

Table 4

Waterborne Disease Outbreaks Involving Semipublic Water Supplies,
by Month, and Population Affected, 1977

<u>Month</u>	<u>Number of Outbreaks</u>	<u>Usual Population*</u>	<u>Visitors**</u>
January	1	1	-
February	-	-	-
March	-	-	-
April	1	-	1
May	3	-	3
June	2	-	2
July	8	2	6
August	2	-	2
September	-	-	-
October	1	-	1
November	1	1	-
December	-	-	-
TOTAL	<u>19</u>	<u>4</u>	<u>15</u>

*Outbreaks affecting individuals using the water supply
on regular basis

**Outbreaks affecting individuals not using the water
supply on a regular basis

Table 5

Waterborne Disease Outbreaks, by Month of Occurrence, 1977

<u>Month</u>	<u>Number of Outbreaks</u>	<u>Month</u>	<u>Number of Outbreaks</u>
January	3	July	13
February	0	August	3
March	1	September	1
April	2	October	2
May	4	November	2
June	2	December	1

TOTAL 34

F. INVESTIGATION OF A WATERBORNE OUTBREAK

1. Where did the outbreak occur? _____ (1-2) City or Town _____ County _____

2. Date of outbreak: (Date of onset of 1st case) _____ (3-8)

3. Indicate actual (a) or estimated (e) numbers:
Persons exposed _____ (9-11)
Persons ill _____ (12-14)
Hospitalized _____ (15-16)
Fatal cases _____ (17)

4. History of exposed persons:
No. histories obtained _____ (18-20)
No. persons with symptoms _____ (21-23)
Nausea _____ (24-26) Diarrhea _____ (33-35)
Vomiting _____ (27-29) Fever _____ (36-38)
Cramps _____ (30-32)
Other, specify (39) _____

5. Incubation period (hours):
Shortest _____ (40-42) Longest _____ (43-45)
Median _____ (46-48)

6. Duration of illness (hours):
Shortest _____ (49-51) Longest _____ (52-54)
Median _____ (55-57)

7. Epidemiologic data (e.g., attack rates [number ill/number exposed] for persons who did or did not eat or drink specific food items or water, attack rates by quantity of water consumed, anecdotal information) * (58)

ITEMS SERVED	NUMBER OF PERSONS WHO ATE OR DRANK SPECIFIED FOOD OR WATER				NUMBER WHO DID NOT EAT OR DRINK SPECIFIED FOOD OR WATER			
	ILL	NOT ILL	TOTAL	PERCENT ILL	ILL	NOT ILL	TOTAL	PERCENT ILL

8. Vehicle responsible (item incriminated by epidemiologic evidence): (59-60) _____

9. Water supply characteristics

(A) Type of water supply** (61)

- Municipal or community supply (Name _____)
- Individual household supply
- Semi-public water supply
 - Institution, school, church
 - Camp, recreational area
 - Other, _____
- Bottled water

(B) Water source (check all applicable):

- Well
- Spring
- Lake, pond
- River, stream

(C) Treatment provided (circle treatment of each source checked in B):

- | | | | | |
|---|---|---|---|---|
| a | b | c | d | a. no treatment |
| a | b | c | d | b. disinfection only |
| a | b | c | d | c. purification plant - coagulation, settling, filtration, disinfection (circle those applicable) |
| a | b | c | d | d. other _____ |

10. Point where contamination occurred: (66)

- Raw water source
- Treatment plant
- Distribution system

*See CDC 4.245 Investigation of a Foodborne Outbreak, Item 7.

**Municipal or community water supplies are public or investor owned utilities. Individual water supplies are wells or springs used by single residences. Semipublic water systems are individual-type water supplies serving a group of residences or locations where the general public is likely to have access to drinking water. These locations include schools, camps, parks, resorts, hotels, industries, institutions, subdivisions, trailer parks, etc., that do not obtain water from a municipal water system but have developed and maintain their own water supply.

11. Water specimens examined: (67)

(Specify by "X" whether water examined was original (drunk at time of outbreak) or check-up (collected before or after outbreak occurred))

ITEM	ORIGINAL	CHECK UP	DATE	FINDINGS		BACTERIOLOGIC TECHNIQUE (e.g., fermentation tube, membrane filter)
				Quantitative	Qualitative	
Examples: Tap water	X		6/12/74	10 fecal coliforms per 100 ml.		
Raw water		X	6/2/74	23 total coliforms per 100 ml.		

12. Treatment records: (Indicate method used to determine chlorine residual):

Example: Chlorine residual - One sample from treatment plant effluent on 6/11/74 - trace of free chlorine

Three samples from distribution system on 6/12/74 - no residual found

13. Specimens from patients examined (stool, vomitus, etc.) (68)

SPECIMEN	NO. PERSONS	FINDINGS
Example: Stool	11	8 <i>Salmonella typhi</i> 3 negative

14. Unusual occurrence of events:

Example: Repair of water main 8/11/74; pit contaminated with sewage, no main disinfection. Turbid water reported by consumers 8/12/74.

15. Factors contributing to outbreak (check all applicable):

- | | | |
|--|---|--|
| <input type="checkbox"/> Overflow of sewage | <input type="checkbox"/> Interruption of disinfection | <input type="checkbox"/> Improper construction, location of well/spring |
| <input type="checkbox"/> Seepage of sewage | <input type="checkbox"/> Inadequate disinfection | <input type="checkbox"/> Use of water not intended for drinking |
| <input type="checkbox"/> Flooding, heavy rains | <input type="checkbox"/> Deficiencies in other treatment processes | <input type="checkbox"/> Contamination of storage facility |
| <input type="checkbox"/> Use of untreated water | <input type="checkbox"/> Cross-connection | <input type="checkbox"/> Contamination through creviced limestone or fissured rock |
| <input type="checkbox"/> Use of supplementary source | <input type="checkbox"/> Back-siphonage | <input type="checkbox"/> Other (specify) _____ |
| <input type="checkbox"/> Water inadequately treated | <input type="checkbox"/> Contamination of mains during construction or repair | |

16. Etiology: (69-70)

Pathogen _____	Suspected 1	(71)
Chemical _____	Confirmed 2 (Circle one)	
Other _____	Unknown 3	

17. Remarks: Briefly describe aspects of the investigation not covered above, such as unusual age or sex distribution; unusual circumstances leading to contamination of water; epidemic curve; control measures implemented; etc. (Attach additional page if necessary)

Name of reporting agency: (72)

Investigating Official:

Date of investigation:

Note: Epidemic and Laboratory assistance for the investigation of a waterborne outbreak is available upon request by the State Health Department to the Center for Disease Control, Atlanta, Georgia 30333.

To improve national surveillance, please send a copy of this report to: Center for Disease Control
Attn: Enteric Diseases Branch, Bacterial Diseases Division
Bureau of Epidemiology
Atlanta, Georgia 30333

Submitted copies should include as much information as possible, but the completion of every item is not required.

G. Line Listing of Waterborne Disease Outbreaks, 1977

State	Month	Disease	Cases	Type of System	Location of Outbreak	System Deficiency*
Arkansas**	July	<u>Salmonella javiana</u>	7	Semipublic	Trailer Camp	3
California	July	Acute gastrointestinal illness	63	Semipublic	Camp	3
California	July	Acute gastrointestinal illness	203	Semipublic	Camp	3
California	July	Developer Fluid	531	Municipal	U.S. Navy ship	4
California	August	Acute gastrointestinal illness	75	Semipublic	Camp	2
California	September	Acute gastrointestinal illness	12	Individual	Camp	2
California	December	Acute gastrointestinal illness	6	Municipal	Restaurant	5 [†]
Connecticut	October	Copper ^{††}	3	Municipal	College	4
Illinois	May	Acute gastrointestinal illness	154	Semipublic	Restaurant	2
Iowa	July	<u>Salmonella typhimurium</u>	206	Municipal	Residence	3
Maine	July	Acute gastrointestinal illness	91	Semipublic	Camp	2
Michigan	November	Fluoride	4	Municipal	Residence	3
Minnesota	June	Acute gastrointestinal illness	13	Semipublic	Resort	2
Montana	July	Giardiasis	55	Semipublic	Hotel	1

Montana	July	Giardiasis	200	Municipal	Residence	1†††
New Hampshire	April	Giardiasis	750	Municipal	Residence	3
New Jersey	April	Acute gastrointestinal illness	10	Semipublic	Camp	2
North Dakota	August	Acute gastrointestinal illness	25	Municipal	Motel	4†
Pennsylvania	January	Gasoline	10	Individual	Residence	2
Pennsylvania	January	<u>Shigella sonnei</u>	17	Semipublic	Apartment	2
Pennsylvania	January	Acute gastrointestinal illness	73	Municipal	Restaurant	4†
Pennsylvania	May	Acute gastrointestinal illness	500	Semipublic	Restaurant	3
Pennsylvania	May	Acute gastrointestinal illness	30	Semipublic	Restaurant	2
Pennsylvania	July	Acute gastrointestinal illness	47	Semipublic	Camp	3
Pennsylvania	July	Acute gastrointestinal illness	15	Semipublic	Camp	3
Pennsylvania	August	Acute gastrointestinal illness	150	Semipublic	Camp	2
Pennsylvania	October	Acute gastrointestinal illness	45	Semipublic	Camp	3
Pennsylvania	November	Copper	11	Semipublic	School	3
South Carolina	July	Hepatitis A	47	Semipublic	Factory	4
Texas	May	Acute gastrointestinal illness	12	Municipal	Residence	4

<u>State</u>	<u>Month</u>	<u>Disease</u>	<u>Cases</u>	<u>Type of System</u>	<u>Location of Outbreak</u>	<u>System Deficiency*</u>
Utah	June	Giardiasis	7	Semipublic	Camp	2
Vermont	March	Copper	74	Municipal	Restaurant	4
Washington	July	Acute gastrointestinal illness	12	Individual	Hikers	1
Wyoming	July	Acute gastrointestinal illness	402	Municipal	Park	3

*(1) Untreated surface water (2) Untreated ground water (3) Treatment deficiencies (4) Distribution system deficiencies (5) Miscellaneous

**Occurred in 1976 but not reported until 1977

+Contaminated ice

++Drinking water used for washing - affected hair color

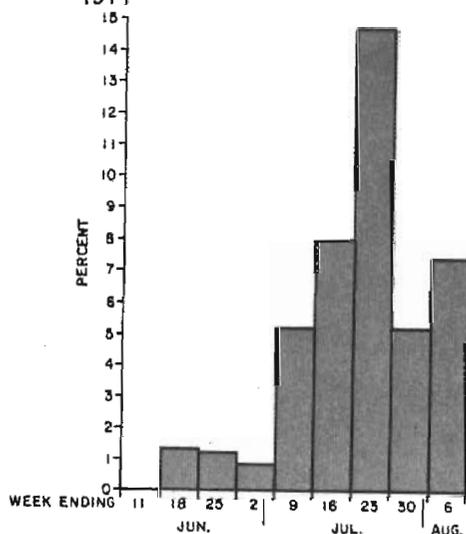
+++Surface water with chlorination only

H. Selected Waterborne Outbreak Articles, 1977, Taken from Morbidity and Mortality Weekly Report

Gastroenteritis -- Yellowstone National Park, Wyoming
(MMWR 26(34):283, 1977)

An outbreak of mild gastroenteritis presumed to be viral in etiology began early in July in Yellowstone National Park. The center of the outbreak was Canyon Village, a small, centrally located town in the park which provides lodging accommodations, campsites, and eating facilities for tourists. A survey by CDC on August 6 of Canyon Village employees revealed an attack rate of 32% since June 1, with a peak attack rate of nearly 15% for the week ending July 23 (Figure 3). The disease was characterized by the acute onset of vomiting or diarrhea, which lasted approximately 24 hours.

Fig. 3 ATTACK RATE OF GASTROENTERITIS IN CANYON VILLAGE EMPLOYEES, BY WEEK, JUNE--AUGUST, 1977



In Lake Village, 17 miles south of Canyon Village, and Old Faithful Village, 42 miles west of Canyon Village, outbreaks also occurred in July; overall attack rates for these 2 villages were approximately 15%. In Lake Village the peak occurred during the week ending July 30, when the attack rate was 3.7%.

Initially, investigation suggested a common-source outbreak temporarily associated with the use of a secondary water source. The primary water source for Canyon Village is Soda Creek, a small

mountain stream. When it is not sufficient, Cascade Creek, an unprotected surface water source which originates at Cascade Lake and runs approximately 4 miles to a small reservoir, is used as an auxiliary water source. Because of inadequate rain this summer, Cascade Creek has been used intermittently every day since June 29, except for 2 days - July 24-25 - when there was adequate rainfall. These 2 days occurred in the week ending July 30, which had a decrease in the attack rate for Canyon Village (Figure 1).

Among employees in Canyon Village, those who drank an average of more than 5 glasses of water per day were at a significantly higher risk of contracting gastroenteritis than those who drank 2 glasses or less ($p < 0.05$). Furthermore, employees who boiled their water were at significantly less risk of having gastroenteritis than those who drank water without boiling it ($p < 0.05$). Among visitors to Yellowstone Park surveyed on August 8, those who visited Canyon Village and drank more than 2 glasses of water per day while in the park were at significantly higher risk of having gastroenteritis than those who did not drink this much water or visit Canyon Village ($p < 0.001$).

Fluorescent dye studies to determine if there are any cross-connections between the sewage and water supplies are underway.

Although water was the probable source of some cases, other factors suggested person-to-person transmission for many cases in the 3 villages. Social intermingling among employees in these villages is commonplace, and surveys in Canyon Village documented that roommates of persons ill with gastroenteritis were at a significantly higher risk of becoming ill than roommates of well persons ($p < 0.001$). Among Park Service personnel, individuals residing in dormitories were at a significantly higher risk than those residing in trailers or apartments ($p < 0.01$), suggesting that person-to-person spread was occurring, particularly in areas of community living.

On August 12, the Canyon Village water supply was chlorinated to a free chlorine residual of 1 ppm. A memorandum

was issued to all park employees advising them of the problem and urging them, if ill with vomiting, diarrhea, or nausea, to report such illness to the Yellowstone Medical Service. Ongoing surveillance was also established with a questionnaire for each person identified by the clinic as having compatible symptoms. On August 18 cases were still occurring, and the Park Service was advised by CDC to avoid using Cascade Creek water for human consumption. On August 20 a temporary water system utilizing the Yellowstone River was established to be used by Canyon Village for the rest of this season. It was also recommended that a meeting be held later this summer to develop plans to correct deficiencies in the Canyon Village water supply before the opening of the park next spring.

Reported by M Smith, MD, Yellowstone Medical Service; MD Skinner, MD, State Epidemiologist, Montana State Dept of Health and Environmental Sciences; and Enteric and Neurotropic Diseases Br, Viral Diseases Div, CDC.

Hydroquinone Poisoning Aboard a Navy Ship
(MMWR 27(28):237-238,243, 1978)

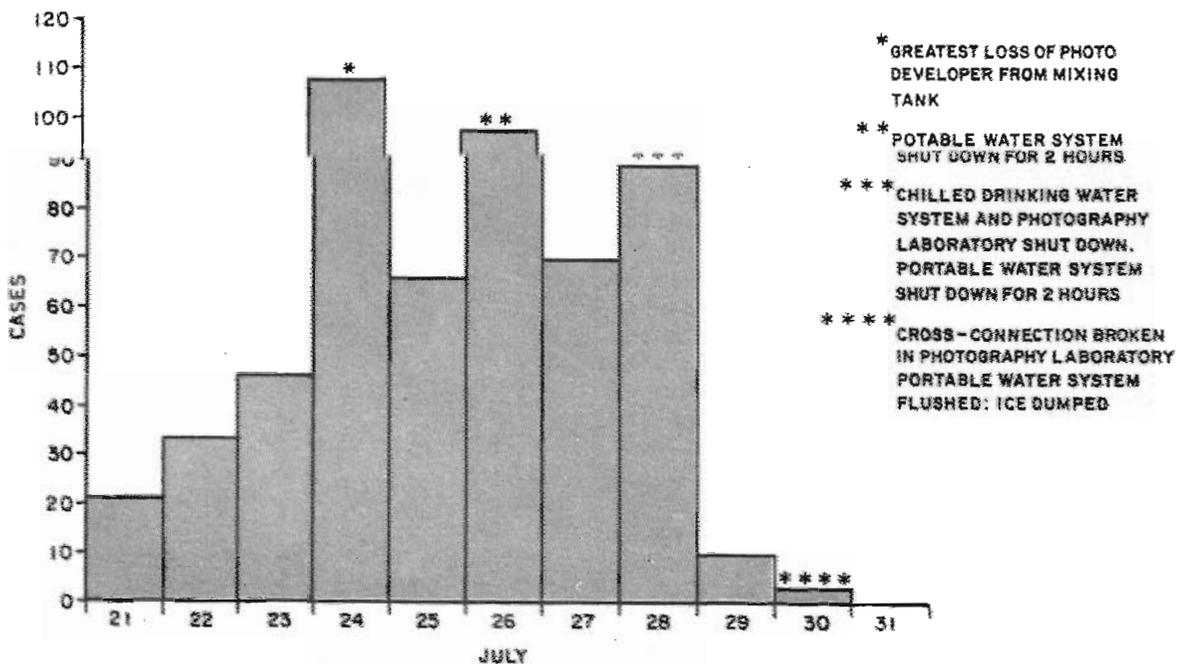
Between July 21-31, 1977, 544 crewmen aboard a large U.S. Navy vessel developed gastrointestinal disease (Figure 4). The illness was characterized by the acute onset of nausea, vomiting, abdominal cramps, and diarrhea generally resolving within 12-36 hours. Patients were usually afebrile but had elevated white blood cell counts. Stool and vomitus cultures from patients as well as cultures of water and various foods failed to yield any bacterial pathogens.

On the morning of July 28, when reporting for their required morning roll call, 301 men from 4 units with high attack rates were interviewed. Fifty-five of these individuals met the definition of a case (vomiting during the last 7 days), leaving 246 controls. Interview responses indicated that cases were significantly more likely to have drunk water while the ship was at sea ($p < .001$), implicating the ship's water system.

On July 19, 2 days prior to the onset of the outbreak, a chilled drinking water system to the forward part of the ship was used for the first time in 1½ years. Because the time relationship implicated this system, it was shut down July 28. Within the next 24 hours, there was a reduction in the number of cases (Figure 1).

Subsequently, it was learned that the chilled water system supplied water to automatic photo-developing machines on the ship. A makeshift cross-connection (a rubber hose) was detected leading from a 40-gallon tank used to mix photographic developer to the ship's potable water system, which supplied water throughout the ship. When the chilled water system was shut down on July 28, the mixing of photographic developer in the tank ceased. Only 13 more cases were detected after that time.

Fig. 4 GASTROENTERITIS ON A LARGE NAVAL VESSEL, JULY 21-31, 1977



Chemical analysis of water specimens taken shortly after the connecting hose had been removed showed non-toxic levels of lead, nickel, and dissolved solids; the pH was in an acceptable range. No hydroquinone, a chemical used in photographic developing, was found in the water samples. However, subsequent liquid chromato-

graphic analysis of serum specimens of 6 ill patients found it to be present in 3 specimens ($>.1\mu\text{g/ml}$); no hydroquinone was found in specimens from 6 non-ill controls.

Editorial Note: Hydroquinone, 1, 4 dihydroxybenzene, is used extensively as a photographic developer and in the manufacture of certain dyes. The most common toxic exposures are from aerosolized materials (fumes) affecting the eyes and skin; this can lead to depigmentation and corneal lesions. Ingestion of this compound results in gastrointestinal symptoms, such as those described in this outbreak. Heavier exposure can cause convulsions, cardiovascular collapse, pulmonary edema, and systemic acidosis. Rarely, hydroquinone has been etiologically implicated in methemoglobinemia and renal and hepatic failure. Therapy is limited to general supportive measures and to oral administration of activated charcoal or vegetable oils to absorb any of the chemical remaining in the gastrointestinal tract (1, 2).

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Outbreak of Acute Gastroenteritis Due to Copper Poisoning -- Vermont
(MMWR 26(27):218,223, 1977)

Three employees at a Vermont hospital became ill with nausea and vomiting on the afternoon of March 28, 1977, within 5 minutes after consuming a carbonated soft drink in the hospital coffee shop. A survey of hospital employees revealed 46 additional individuals who had onset of gastrointestinal symptoms during the afternoon or evening of the same day. Of 231 individuals who ate or drank in the coffee shop, 38 developed illness versus 11 of 461 employees who did not visit the coffee shop ($\chi^2=44.1$ $p<0.01$). Of the 189 employees who drank, with or without ice, water or carbonated beverages made from this water, 36 became ill versus 1 of 39 employees who did not consume one of these beverages ($\chi^2=5.3$ $p<0.02$). (A beverage history was not available on the other ill individual who had visited the coffee shop.) Twenty-one of these 36 ill individuals had onset within 2 hours of being in the coffee shop.

Samples of water and of ice produced in an ice machine on the same water distribution system indicated pH levels below 5.4 (the normal water pH level for this community is 6.8) and the presence of a blue precipitate. After resuspension of the precipitate in the laboratory, the copper levels in the water and ice samples ranged from 7-70 mg/l. (The Environmental Protection Agency recommends that copper in public water supply sources not exceed 1 mg/l[1]). Blood and stool samples for copper were normal in those individuals tested, but samples were collected more than 24 hours after illness ended.

The carbonated beverages were dispersed from a machine that was supplied by carbonated water produced in a system adjacent to the machine. Carbon dioxide gas from pressurized tanks was mixed with water to form the carbonated water used in the soft drink dispenser. A defective check valve had permitted the CO₂ gas and carbonated water to flow back into the copper piping of the hospital water system. Leaching of the copper from the pipes resulted in high levels of copper in the water supplied to the beverage and ice machines and to the tap. Reported by AJ Hamel, Medical Center Hospital of Vermont, Burlington; R Drawbaugh, MS, AM McBean, MD, WN Watson, MD, Acting State Epidemiologist, LE Witherell, PE, MPH, Vermont State Dept of Health; and Environmental Hazards Activity, Chronic Diseases Div, Bur of Epidemiology, CDC.

Editorial Note: Ingestion of beverages containing high concentrations of copper (2), zinc (3), and tin (4) has been associated with acute gastroenteritis within one hour of exposure. No chronic systemic effects have been noted in such acute exposures. Leaching of metals from the lining of storage containers by acidic beverages has been the usual mechanism of beverage contamination. Although these substances may impart an unpleasant taste to the beverage (the taste threshold for copper is 1.0 - 5.0 mg/l) (1), soft drink flavoring may mask the objectionable taste.

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V. ARTICLES ON CRUISE SHIP OUTBREAKS TAKEN FROM MORBIDITY AND MORTALITY
WEEKLY REPORTS

Gastrointestinal Illness Aboard the T.S.S. Fairsea
(MMWR 26(21):176, 1977)

Outbreaks of gastrointestinal illness occurred on 3 consecutive voyages of a cruise ship, the T.S.S. Fairsea. The first cruise (April 23-30) and the second cruise (April 30-May 7) were 7-day round trip cruises from Los Angeles with 1-day visits to 2 ports in Mexico. The third cruise (May 7-21) was a 14-day cruise from Los Angeles to San Juan, Puerto Rico, with visits to 2 ports in Mexico and 4 in the Caribbean.

On the first cruise an outbreak of gastrointestinal illness began late April 24 and peaked on the third day of the cruise before reaching the first Mexican port. A questionnaire survey revealed that 514 passengers (58%) and 22 crew members (5%) were ill. None of these crew members worked in food preparation. The illness was characterized by diarrhea, vomiting, and abdominal cramps with headache reported in approximately half and fever reported in approximately one-quarter of cases. Symptoms lasted 2 days or less in 92% of ill individuals. Illness was not associated with any meal or food item, but risk of illness did increase with increasing consumption of water ($p=.002$). Approximately 200 passengers visited the ship's physicians. Stool specimens were negative for Salmonella, Shigella, Vibrio parahaemolyticus, Bacillus cereus, and Yersinia enterocolitica. One culture grew toxigenic Escherichia coli. Viral studies are pending. A sanitary inspection of the vessel failed to reveal any major deficiency in food or water handling, and the water distribution system had adequate residual chlorine. No coliform bacteria were found in water and ice samples.

On the second cruise, 30 of approximately 900 passengers visited the ship's physicians for a gastrointestinal illness similar to, but milder than, that seen on the first cruise. A telephone survey of 61 randomly selected passengers found that 30 (49%) individuals reported illness. The outbreak peaked on the fifth day of the cruise.

On the ninth day of the third cruise, 20 passengers reported to the ship's physicians for treatment of gastroenteritis, increasing the number seen since the beginning of the voyage to 29. An investigation found that 289 passengers (37%) and 7 crew members (2%) reported a gastrointestinal illness during the first 11 days of the third cruise, with the peak incidence occurring on the ninth day. None of the ill crew members were kitchen workers. The symptoms were similar to and as mild as those reported by passengers on the second cruise, and the duration of illness was usually 1-2 days. An increase in risk of illness was again associated with consumption of increasing amounts of water ($p=.007$). Stool specimens were obtained for bacterial and viral studies. A sanitary inspection again revealed adequate chlorine levels in the water distribution system and no major deficiencies in food handling. No coliform bacteria were isolated from water and ice samples obtained on May 20, when the ship docked in St. Thomas. The environmental investigation revealed that bilge water sometimes covered the suction line from one of the fresh water storage tanks. Water from this storage tank was used twice during the outbreak period of the May 7-21 cruise, but at no time immediately before or during the outbreak periods of the April 23-30 and April 30-May 7 cruises. This defect was corrected before the ship departed on its present cruise.

Editorial Note: The cause and source of these 3 outbreaks remain unknown. CDC is continuing to investigate the ship's water distribution system, to monitor gastrointestinal illness during the current cruise, and to process laboratory specimens. During the third consecutive outbreak of gastrointestinal illness, CDC requested that the cruise line inform all passengers booked for the May 21-June 4 cruise of the situation. The cruise line sent telegrams to travel agents stating the existence of these 3 consecutive, and increasingly mild, outbreaks of gastroenteritis and informing them of the unknown risk of similar illness to future passengers.

Gastroenteritis Caused by Vibrio parahaemolyticus Aboard a Cruise Ship
(MMWR 27(9):65, 1978)

An outbreak of gastrointestinal illness occurred aboard the S/S Statendam, a Caribbean cruise ship of Dutch registry, on its December 2-11 voyage. The outbreak was uncovered on December 8, 1977, when a U.S. Quarantine Officer boarded the ship in St. Thomas, U.S. Virgin Islands, to conduct a follow-up inspection of sanitary deficiencies noted during a previous voyage. A routine review of the physician's log revealed that 29 (4%) of 671 passengers and 7 (2%) of 388 crew members had reported illness between December 3 and 7. However, the ship had not notified health officials of the illness on board, as required by U.S. Quarantine Regulations, before docking in San Juan on December 7 or in St. Thomas the next day. Following these findings, an epidemiologic and environmental investigation was begun on December 8.

Eighty-six (13%) of 660 passengers and 12 (3%) of 376 crew members responding to a questionnaire survey on December 9 reported suffering a gastrointestinal illness (defined as at least 3 or more loose stools per day or vomiting and abdominal cramps). Most passengers and crew members became ill on December 3 and 4, but cases occurred on each day of the cruise including December 8. The duration of illness ranged from 1 to 8 days with a median of 1 day.

Illness was equally distributed among male and female and Dutch and non-Dutch passengers as well as Indonesian and non-Indonesian crew members. It occurred with equal frequency among passengers from each deck and from each sitting in the dining room.

Analysis of food-specific attack rates for items consumed by passengers on the evening of December 2, the first evening of the voyage, showed a significant association between illness and consumption of seafood salad ($p=.02$). There was no association between illness and consumption of water or ice.

Laboratory analyses were performed on rectal swab specimens, food samples, and water samples. Vibrio parahaemolyticus was cultured at CDC from 8 of 10 rectal swabs from ill passengers but from none of 10 rectal swabs from well controls. Seven of the isolates were type 03:K33; 1 was type 05:K negative. All were Kanagawa positive. Samples of the actual seafood salad served on the evening of December 2 were not available for analysis; an attempt to isolate the organism from samples of the pre-cooked seafood used in making the seafood salad was unsuccessful. Water samples obtained while the ship was in St. Thomas showed adequate levels of residual chlorine and were negative for coliform organisms.

An environmental inspection revealed several defects in food handling. Precooked, thawed seafood was stored before it was served in the same refrigerator with uncooked seafood, and leftover prepared foods were saved for use the next day. Other sanitary deficiencies, including the incorrect calibration of the ship's automatic chlorinator, which had been noted and brought to the attention of the ship's captain during a previous voyage, were also identified. Galley personnel denied using salt water from the ship's fire control system in the galley.

Editorial Note: Outbreaks of V. parahaemolyticus gastroenteritis aboard cruise ships, though infrequent, have been reported (1). The common denominator in these previous episodes was the use of salt water from the ship's fire control system in the galley to thaw frozen seafood or to wash fresh seafood. Although galley personnel on the S/S Statendam denied such practices, the other food-handling deficiencies identified could have resulted in cross-contamination of the precooked frozen seafood used in the seafood salad.

According to the Public Health Service laws and regulations, the Master of the S/S Statendam was required to notify the San Juan Quarantine Station of the illness on board before arrival. Had the follow-up inspection not been conducted, this failure to comply could have resulted in the outbreak's going unrecognized. CDC had apprised the cruise ship company of the seriousness of the violation and has informed them that any future breach will result in further action, as provided by law.

Reference

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VI. ARTICLES ON FOODBORNE AND WATERBORNE DISEASE OUTBREAKS, 1977, TAKEN FROM
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