ANNUAL SUMMARY 1981
ISSUED SEPTEMBER 1982

CENTERS FOR DISEASE CONTROL

Water-related Disease Outbreaks

SURVEILLANCE

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES • Public Health Service

Water-related disease outbreaks surveillance

PREFACE

This report summarizes information received from state and local health departments and the Environmental Protection Agency. The information is preliminary and is most useful to those persons in disease control activities. Anyone wishing to quote this report should contact the Water-Related Diseases Activity, Enteric Diseases Branch, for further interpretation.

Contributions to the report are most welcome. Please address them to:

Enteric Diseases Branch
Division of Bacterial Diseases
Center for Infectious Diseases
Centers for Disease Control
Atlanta, Georgia 30333

SUGGESTED CITATION
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Annual Summary 1981, Issued September 1982

WATER-RELATED DISEASES SURVEILLANCE ANNUAL SUMMARY 1981

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ACKNOWLEDGMENTS

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I. INTRODUCTION

Since 1971 the Centers for Disease Control (CDC) has tabulated foodborne and waterborne disease outbreak data separately and reported these data in annual reports. The Water-related Diseases Activity has set the following goals: 1) to determine the frequency of epidemics of water-related diseases in the United States, 2) to characterize the epidemiology of water-related diseases, 3) to disseminate information on prevention and control of water-related diseases to appropriate public health personnel, 4) to train federal, state, and local health department personnel in epidemiologic techniques for the investigation of water-related disease outbreaks, and 5) to collaborate with local, state, other federal and international agencies in initiatives concerning prevention of water-related diseases. Also included in the responsibilities of the Water-related Diseases Activity is the investigation of outbreaks of acute gastrointestinal disease on ocean-going vessels.

II. WATERBORNE DISEASE OUTBREAKS, 1981

In 1981, 17 states reported 32 outbreaks of waterborne disease involving 4,430 cases to the Centers for Disease Control (CDC).

A. Definition of Terms

A waterborne disease outbreak is an incident in which 1) 2 or more persons experienced similar illness after consumption--or use--of water intended for drinking, and 2) epidemiologic evidence implicated the water as the source of illness. In addition, a single case of chemical poisoning constitutes an outbreak if laboratory studies indicated that the water was contaminated by the chemical. Only outbreaks associated with water intended for drinking are included.

Community public water systems (municipal systems) are public or investor-owned water systems that serve large or small communities, subdivisions or trailer parks of at least 15 service connections or 25 year-round residents. Noncommunity public water systems (semi-public water systems) are those in institutions, industries, camps, parks, hotels, or service stations that may be used by the general public. Individual systems (private water systems), generally wells and springs, are those used by single or several residences or by persons traveling outside populated areas. These definitions correspond to those in the Safe Drinking Water Act (PL 93-523) of 1974.

B. Sources of Data

State health departments report waterborne disease outbreaks to CDC on a standard reporting form (Section F). In addition, the Health Effects Research Laboratory of the Environmental Protection Agency (EPA) contacts all state water-supply agencies annually to obtain information about waterborne disease outbreaks; information from both sources is included in this report. Representatives from CDC and EPA review and summarize outbreak data and also work together in the investigation and evaluation of waterborne disease outbreaks. In addition, upon request by state health departments, CDC and EPA offer epidemiologic assistance, provide consultation in the engineering and environmental aspects of water treatment, and, when indicated, collect large volume water samples for identification of viruses, parasites, and bacterial pathogens.

C. Interpretation of Data

The limitations of the data in this report must be appreciated to avoid misinterpretation. The number of waterborne disease outbreaks reported to CDC and EPA clearly represents a fraction of the total number that occur. Since investigations were sometimes incomplete or

conducted long after the outbreak, the waterborne hypothesis could not be proved in all instances; however, it was the most logical explanation in these outbreaks. The likelihood of an outbreak coming to the attention of health authorities varies considerably from 1 locale to another depending largely upon consumer awareness, physician interest, and disease surveillance activities of state and local health and environmental agencies. Large interstate outbreaks and outbreaks of serious illness are more likely to come to the attention of health authorities. The quality of investigation conducted by state or local health departments varies considerably according to the department's interest in waterborne diseases and its budgetary, investigative, and laboratory capabilities. This report should not be the basis for firm conclusions about the true incidence of waterborne disease outbreaks, and it should not be used to draw firm conclusions about the relative incidence of waterborne diseases of various etiologies. The number of reported outbreaks of different etiologies may depend upon the interest of a particular health department or individual. For example, if an epidemiologist or microbiologist becomes interested in Giardia lamblia or Norwalk-like viruses, he is likely to confirm more outbreaks caused by these agents. Furthermore, a few outbreaks involving very large numbers of persons may vastly alter the relative proportion of cases attributed to various etiologic agents.

These data are helpful, however, in revealing the etiologies of reported waterborne disease outbreaks, the seasonality of outbreaks, and the deficiencies in water systems that most frequently result in outbreaks. As in the past, the pathogens responsible for many outbreaks in 1981 were not determined. It is hoped that more complete epidemiologic investigations, 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 1981, 32 waterborne disease outbreaks involving an estimated 4,430 persons were reported to CDC and EPA. This is a decline from 1979 and 1980 (Table 1).

Table 1 Waterborne Disease Outbreaks, by Year and Type of System, United States, 1971-1981

	Community	Noncommunity	Private	TOTAL	TOTAL CASES
1971	5	10	4	19	5182
1972	10	18	2	30	1650
1973	5	16	3	24	1784
1974	11	10	5	26	8363
1975	6	16	2	24	10879
1976	9	23	3	35	5068
1977	12	19	3	34	3860
1978	10	18	4	32	11435
1979	23	14	4	41	9720
1980	23	22	5	50	20008
1981	14	16	2	32	4430
TOTAL (%)	128 (37)	182 (52)	37 (11)	347	82404

Seventeen states reported at least 1 outbreak (Section G). Colorado reported more outbreaks than any other state (9/32 - 28%).

Table 2 shows the number of outbreaks and cases by etiology and type of water system. Of the 32 outbreaks, 14 (44%) were of unknown etiology and were designated as "acute gastrointestinal illness" (AGI). This category includes outbreaks characterized by upper or lower gastrointestinal symptoms for which no etiologic agent was identified. The etiology of the remaining 18 (56%) outbreaks was confirmed: G. lamblia (9), chemical (5), Shigella (1), Campylobacter (1), Vibrio cholerae 01 (1), and rotavirus (1).

Table 2 Waterborne Disease Outbreaks by Etiology and Type of Water System, 1981

	Public Water Systems				Private Water Systems		Total	
	Community		Noncommunity					
	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases
AGI*	2	904	12	989	0	0	14	1893
Giardia	8	265	1	32	0	0	9	297
Chemical	2	93	1	31	2	4	5	128
Shigella	0	0	1	253	0	0	1	253
Campylobacter	1	81	0	0	0	0	1	81
V. cholerae 01	0	0	1	17	0	0	1	17
Rotavirus	1	1761	0	0	0	0	1	1761
Total	14	3104	16	1322	2	4	32	4430

*Acute gastrointestinal illness of unknown etiology

Results of microbiologic tests of water samples were reported in 19 of 27 nonchemical outbreaks; evidence of contamination (presence of coliforms or pathogens) was found in 16 (84%). Water sample filtration for Giardia cysts was performed in 4 of the 9 Giardia outbreaks; cysts were found in all 4.

Most outbreaks involved noncommunity (50%) and community (44%) public water systems. Outbreaks attributed to water from community public water systems affected an average of 222 persons compared with 83 persons in noncommunity public water system outbreaks and 2 persons in outbreaks involving individual water systems (Table 2). Use of untreated or inadequatelv treated water was documented in 24 (75%) of the outbreaks (Table 3). Outbreaks occurred in every month of the year but most frequently in July and August (Table 4).

Table 3 Waterborne Disease Outbreaks, by Type of System and Type of Deficiency, 1981

	Public Water Systems		Private Water Systems	Total
	Community Outbreaks	Noncommunity Outbreaks	Outbreaks	Outbreaks
Untreated surface water	1	3	0	4
Untreated ground water	1	7	1	9
Treatment deficiencies	8	3	0	11
Deficiencies in distribution system	1	1	0	2
Miscellaneous	1	2	0	3
Multiple deficiencies	2	0	1	3
TOTAL	14	16	2	32

Table 4 Waterborne Disease Outbreaks, by Month of Occurrence, United States, 1981

Month	Number of Outbreaks	Month	Number of Outbreaks
January	1	July	4
February	1	August	7
March	2	September	3
April	3	October	2
May	1	November	3
June	3	December	2
		Total:	32

Outbreaks in recreational areas continued to be a problem in 1981, accounting for 38% of all outbreaks. Of the 16 outbreaks associated with noncommunity public water systems, implicated water supplies involved camps and campgrounds (5), restaurants (4), motels (2), a condominium (1), an oil rig (1), a school (1), a park (1), and a lodge (1).

In 11 of the 14 outbreaks of acute gastroenteritis of unknown etiology an incubation period was reported. In all but 2 instances the median incubation period was less than or equal to 48 hours, and the mean was approximately 46 hours.

Two interesting episodes that did not meet the definition of a waterborne outbreak, but may well have been examples of waterborne transmission, occurred in 1981 in the state of Washington. Both were single, unrelated cases of diarrhea in young children from whom Yersinia enterocolitica was isolated. In both cases, Y. enterocolitica of the same biotype was isolated from the child's water supply, but in neither case were other family members ill or infected?

E. Comments

The decrease in the number of outbreaks reported in 1981 may well be due to less complete reporting rather than an actual decrease. The waterborne disease surveillance system is, for the most part, a passive surveillance one. There is evidence to suggest that this report contains only a small and variable fraction of the outbreaks and cases that occur each year in the United States. Supporting this is the fact that 4 states reported a full 59% of all the outbreaks in 1981. Three of these, Colorado, Vermont, and Washington, received federal funds for surveillance in 1981 through contracts with EPA, and the fourth, Pennsylvania, has an extremely well-developed suveillance system. Colorado received these federal funds for surveillance in both 1980 and 1981, and in those years reported an average of 7 outbreaks per year, in contrast with its previous average, reported in 1971-1979, of 1.9 outbreaks per year.

Water systems used on a seasonal basis such as those in camps, parks, and resorts have an abnormal demand placed upon them by large numbers of visitors during specific periods of the year and in some instances cannot meet such demands. For the most part these are noncommunity systems. Such water supply systems, especially those at campgrounds and parks, must be reevaluated and monitored, and corrections made to ensure the continued provision of safe water during periods of increased demand. The large outbreaks that occurred in 1975 in Crater Lake National Park (1) and Yellowstone National Park (2) underscore the problems related to water supplies in recreational areas that can occur.

In 1981, the number of outbreaks related to noncommunity systems only slightly exceeded the number related to community systems. EPA estimates, however, that there are 20 million noncommunity, 180 million community, and 30 million individual water system users in the United States, so that the rate of illness was far greater among noncommunity system users than among community system users. Two pathogens followed recent trends in 1981. Giardia lamblia was the most frequently identified pathogen for the fourth consecutive year. It caused 28% of the outbreaks, the highest percentage since the present surveillance system began in 1971. Campylobacter jejuni, first identified as the cause of a waterborne outbreak in 1978 (3), caused 1 outbreak in 1981. This outbreak occurred after a water main broke and the water presumably became contaminated in a community in Illinois. C. jejuni was isolated from the stools of several ill persons, but water samples were not collected until late in the outbreak, and the only one which grew Campylobacter was taken 6 weeks after the outbreak from a house which had been unoccupied during and after the outbreak. This emphasizes the importance of "stored" water samples, such as ice, or water from fire hydrants or unused spigots, in the late investigation of waterborne outbreaks.

Two pathogens were identified as causes of U.S. waterborne outbreaks in this country for the first time in 1981, and there was 1 notable absence. V. cholerae 01 caused 17 cases of severe diarrhea on an oil rig in Texas. In this outbreak, the index patient probably became ill after consumption of seafood. Sewage which included his stool apparently then contaminated the potable water supply of the rig via a cross-connection. This was the largest cholera outbreak in the United States in the 20th century. Rotavirus caused an outbreak of 1761 cases in a Colorado resort town. For the first time since 1977, there were no outbreaks due to the Norwalk agent reported in 1981. Reagents for diagnosis of this organism are in short supply, and this probably accounted for the lack of reported outbreaks in 1981.

Five chemical outbreaks were recorded in 1981 and were caused by 4 chemicals: lead (2), copper (1), fluoride (1), and nitrate (1). Three of these outbreaks (2 lead, 1 copper) were

very similar in that contamination occurred after excessively corrosive water dissolved metal from pipes. The contamination was eliminated primarily by decreasing the corrosivity of the water, but replacement of the lead-containing pipes was recommended as well.

In addition to 32 outbreaks related to drinking water systems, 3 outbreaks, involving 20 cases, were reported that resulted from contaminated water not meant for drinking (Table 5). Two resulted from drinking untreated surface water. One, caused by Giardia, occurred in a group of hikers in a back-country area. The other, whose etiology was undetermined, occurred in a road work crew who drank untreated water from a creek. Water in natural springs and creeks should be considered nonpotable and should be disinfected before it is consumed.

The third of these outbreaks occurred after workmen in a factory drank from an unmarked spigot used for sampling partially-treated sewage effluent. All who drank the water became ill within 48 hours. They initially had a short diarrheal illness, but no bacterial pathogen could be identified in their stools. Six of 7, however, developed chronic diarrhea, and all 4 whose stools were examined had Giardia. As in the past (4), this probably represented an outbreak caused by multiple pathogens after an episode of "sewage poisoning."

Table 5 Waterborne Disease Outbreaks Not Related to Potable Water Systems, United States, 1981

State	Month	Etiology	Cases	Water Source	Location
Colo	Oct	Giardia	7	Stream	Wilderness
Fla	Oct	AGI, Giardia	7	Sewage	Factory
Penn	July	AGI	6	Creek	Town
		Total	20		

DEPARTMENT OF
HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL
CENTER FOR INFECTIOUS DISEASES
ATLANTA, GEORGIA 30333

F. INVESTIGATION OF A WATERBORNE OUTBREAK

Form Approved
OMB No.0920-0004

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)

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 rate 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 52.13 (Formerly 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.

CDC 52.12 (f. 4.46l)
REV. 7-81

This report is authorized by law (Public Health Service Act, 42 USC 241).
While your response is voluntary, your cooperation is necessary for the understanding and control of the disease.

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 *Salmonella typhi*
		3 negative

14. Unusual occurrence of events:

Example: Repair of water main 6/11/74; pit contaminated with sewage, no main disinfection. Turbid water reported by consumers 6/12/74.

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

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

16. Etiology: (69-70)

Pathogen _____

Chemical _____

Other _____

(71)

Suspected 1

Confirmed . . . . . 2 *(Circle one)*

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. (Attack 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 Centers for Disease Control, Atlanta, Georgia 30333.

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

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

CDC 52.12 (f. 4.461) (BACK)
7-81

G. Line Listing of Waterborne Outbreaks, United States, 1981

State	Month	Etiology*	Cases	Type of System†	Deficiency§	Location of Outbreak	Source
Ariz	June	AGI	326	C	2	subdivision	wells
Calif	April	AGI	61	NC	2	restaurant	spring
Colo	March	Rotavirus	1761	C	3	town	stream
Colo	June	Giardia	8	C	3	town	creek
Colo	July	Giardia	30+	C	3	town	creek
Colo	Aug	Giardia	110	C	3	town	creek
Colo	Aug	AGI	578	C	3	town	creek
Colo	Sept	Giardia	32	NC	3	camp	creek
Colo	Nov	Giardia	38	C	3	ski area	creek
Colo	Dec	Giardia	14	C	3	town	spring
Colo	Dec	Giardia	18	C	3	town	stream
Conn	Aug	AGI	80	NC	2	park	well
Ill	Sept	Campylobacter	81	C	4	subdivisions	well
Iowa	June	AGI	14	NC	5	camp	wells
Kan	Aug	AGI	100	NC	1	restaurant	well
Maine	Oct	Fluoride	31	NC	5	school	well
Md	Aug	AGI	72	NC	2	condominium	well
NY	Aug	AGI	400	NC	2	camp	well
Ore	Feb	AGI	40	NC	3	lodge	spring
Penn	Jan	Lead	3	I	3,4	home	well
Penn	April	AGI	9	NC	2	motel	well
Penn	April	AGI	35	NC	2	motel	well
Penn	May	AGI	51	NC	2	restaurant	well
Penn	July	AGI	97	NC	1	camp	spring
Penn	July	AGI	30	NC	3	restaurant	well
Penn	Nov	Lead	84	C	3,4	town	river
Penn	Nov	Copper	9	C	3,4	school	reservoir
SD	Mar	Nitrate	1	I	2	farm	well
Tex	Aug	V. cholerae 01	17	NC	4	oil rig	bayou
Vt	Oct	Giardia	22	C	1	town	spring
Wash	July	Shigella	253	NC	1	campground	stream
Wisc	Sept	Giardia	25	C	5	motel	well

* (AGI) acute gastrointestinal illness of unknown etiology
† (C) community (municipal); (NC) non-community (semi-public); (I) individual
§(1) untreated surface water (2) untreated ground water (3) treatment deficiencies (4) distribution system deficiencies (5) miscellaneous

H. Guidelines for Confirmation of Waterborne Disease Outbreaks

tiologic Agent	Clinical Syndrome	Epidemiologic Criteria
. Escherichia coli	a) Incubation period 6-36 hours	a) Demonstration of organisms of same serotype in epidemiologically incriminated water and stool of ill persons but not in stools of controls.
		-OR-
	b) Gastrointestinal syndrome: majority of cases with diarrhea	b) Isolation of organisms of the same serotype which have been shown to be enterotoxigenic or invasive by special laboratory techniques from stools of most ill persons.
. Salmonella	a) Incubation period 6-48 hrs	a) Isolation of Salmonella organism from epidemiologically implicated water.
		-OR-
	b) Gastrointestinal syndrome: majority of cases with diarrhea	b) Isolation of Salmonella organism from stools or tissues of ill persons.
. Shigella	a) Incubation period 12-48 hrs	a) Isolation of Shigella organism from epidemiologically implicated water.
		-OR-
	b) Gastrointestinal syndrome: majority of patients diarrhea	b) Isolation of Shigella organism from stools of ill persons.
. Campylobacter jejuni	a) Incubation period usually 2-5 days	a) Isolation of Campylobacter organisms from epidemiologically implicated water.
		-OR-
	b) Gastrointestinal syndrome: majority of patients diarrhea	b) Isolation of Campylobacter organisms from stools of ill persons.
. Yersinia enterocolitica	a) Incubation period 3-7 days	a) Isolation of Yersinia organisms from epidemiologically implicated water.
		-OR-
	b) Gastrointestinal syndrome: majority of patients with diarrhea or cramps	b) Isolation of Yersinia organisms from stools of ill persons.
		-OR-
		c) Significant rise in bacterial agglutinating antibodies in acute and early convalescent sera.
. Others	Clinical and laboratory data appraised in individual circumstances	

Etiologic Agent	Clinical Syndrome	Epidemiologic Criteria
CHEMICAL		
1. Heavy metals Antimony Cadmium Copper Iron Tin Zinc, etc.	a) Incubation period 5 min. to 8 hours (usually <1 hour) b) Clinical syndrome compatible with heavy metal poisoning--usually gastrointestinal syndrome and often metallic taste	Demonstration of high concentration of metallic ion in epidemiologically incriminated water.
2. Fluoride	a) Incubation period usually <1 hr b) Gastrointestinal illness usually nausea, vomiting, and abdominal pain	Demonstration of high concentration of fluoride ion in epidemiologically incriminated water.
3. Other chemicals	Clinical and laboratory data appraised in individual circumstances	
PARASITIC		
1. *Giardia lamblia*	a) Incubation period 1-4 weeks b) Gastrointestinal syndrome: chronic diarrhea, cramps, fatigue and weight loss	a) Demonstration of *Giardia* cysts in epidemiologically incriminated water. -OR- b) Demonstration of *Giardia* trophs or cysts in stools or duodenal aspirates of ill persons.
2. *Entameba histolytica*	a) Incubation period: usually 2-4 weeks b) Variable: gastrointestinal syndrome from acute fulminating dysentery with fever, chills, and bloody stools to mild abdominal discomfort with diarrhea	a) Demonstration of *Entamoeba histolytica* cysts in epidemiologically incriminated water. -OR- b) Demonstration of *Entamoeba histolytica* trophs or cysts in stools of affected persons.
3. Others	Clinical and laboratory data appraised in individual circumstances	
VIRAL		
1. Hepatitis A	a) Incubation period 14-28 days b) Clinical syndrome compatible with hepatitis—usually including jaundice, GI symptoms, dark urine	Liver function tests compatible with hepatitis in affected persons who consumed the epidemiologically incriminated water.

Etiologic Agent	Clinical Syndrome	Epidemiologic Criteria
2. Norwalk and Norwalk-like agents	a) Incubation period 24-48 hours (range 4-77 hours) b) Gastrointestinal syndrome: vomiting, watery diarrhea, abdominal cramps, and often headache	a) Significant rise in antiviral antibody in paired sera -OR- b) Demonstration of virus particles in stools of ill persons by immune electron microscopy.
3. Rotavirus	a) Incubation period 24-72 hours b) Gastrointestinal syndrome: vomiting, watery diarrhea, abdominal cramps, often with significant dehydration	a) Demonstration of virus in the stools of ill persons by ELISA or electron microscopy. -OR- b) Significant rise in antiviral antibody in paired sera.
4. Enterovirus	a) Incubation period: 5-10 days (range 3-15 days) b) Syndrome: Enteroviral gastroenteritis is uncommon, although it does occur. Enteroviral infection usually includes with other syndromes; poliomyelitis, aseptic meningitis, herpangina, etc.	a) Isolation of virus from ill persons. -OR- b) Isolation of virus from epidemiologically implicated water.
5. Others	Clinical and laboratory evidence appraised in individual circumstances	

I. References

1. Rosenberg ML, Koplan, JP, Wachsmuth IK, et al. Epidemic diarrhea at Crater Lake from enterotoxigenic Escherichia coli. Ann Intern Med 1977;86:714-8.

2. Center for Disease Control. Gastroenteritis--Yellowstone National Park, Wyoming. Morbidity and Mortality Weekly Rep 1977;26:283.

3. Vogt RL, Sours HE, Barrett T, Feldman RA, Dickinson RJ, Witherell L. Campylobacter enteritis associated with contaminated water. Ann Intern Med 1982;96:292-6.

4. Center for Disease Control. Shigellosis and Salmonellosis--Morocco. Morbidity and Mortality Weekly Rep 1963;12:438-9.

J. Listing of Waterborne Outbreak Articles, 1981, from the Morbidity and Mortality Weekly Report

Centers for Disease Control. Cholera on a gulf coast oil rig - Texas. Morbidity and Mortality Weekly Rep 1981;30:589-92.

III. DISEASE OUTBREAKS RELATED TO RECREATIONAL WATER USE, 1981

A. Sources of Data

As with disease outbreaks associated with drinking water, the sources of data for outbreaks associated with recreational water use are the state epidemiologists and their staffs. However, reporting of these disease outbreaks is not systematic; therefore, the outbreaks reported here also represent a small fraction of the total number that occur. The likelihood of an outbreak coming to the attention of health authorities varies considerably from 1 locale to another, depending largely upon consumer awareness and physician interest. We have included in this section infections or intoxications related to recreational water, but have excluded wound infections caused by water-related organisms.

B. Comments

Eight outbreaks related to recreational use of water were reported to CDC in 1981 (Section C); 7 were outbreaks of dermatitis, and 1 was an outbreak of Pontiac fever.

Six of the 7 dermatitis outbreaks were caused by Pseudomonas aeruginosa. This is the largest number of confirmed Pseudomonas dermatitis outbreaks reported to CDC since routine tabulation of outbreaks related to recreational water use began in 1978. The first such outbreak was reported in 1975 (5). This outbreak and the majority of outbreaks since have been related to whirlpool or hot tub use, although outbreaks related to swimming pool use have been reported (6). CDC recently published suggested health and safety guidelines for public spas and hot tubs (7). There are no known reports of outbreaks occurring at facilities in which the pool water has been continuously maintained at pH 7.2-7.8 with free residual chlorine levels of at least 1.0 mg/L (8). The seventh dermatitis outbreak was caused by algal toxins produced by the blue-green alga, Microcoleus lyngbyaceus. Affected persons were exposed to these toxins while swimming in the sea on the windward side of Oahu, Hawaii. Similar outbreaks occurring sporadically during the summer months in Hawaii have been recorded since 1958 (9), but have not previously been reported to CDC.

The Pontiac fever outbreak, caused by Legionella, is the first such outbreak to be associated with whirlpool use. The outbreak occurred in Vermont at a spa. Legionella was isolated from the whirlpool water.

C. Line Listing of Disease Outbreaks Related to Recreational Water Use, 1981

State	Month	Disease	Organism	Cases	Nature of Water
Colo	April	Dermatitis	Pseudomonas	10	hot tub
Ga	March	Dermatitis	Pseudomonas	110	whirlpool
Ha	Aug	Dermatitis	Microcoleus lyngbyaceus	14	sea
Mass	March	Dermatitis	Pseudomonas	39	whirlpool
Minn	May	Dermatitis	Pseudomonas	7	whirlpool
Tenn	Sept	Dermatitis	Pseudomonas	2	whirlpool
Vt	March	Pontiac Fever	Legionella	34	whirlpool
Wash	Jan	Dermatitis	Pseudomonas	460	whirlpool

D. References

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IV. OUTBREAKS OF ACUTE GASTROINTESTINAL DISEASE ON OCEAN-GOING VESSELS

A. Sources of Data

After shipboard outbreaks of typhoid fever (10), viral gastroenteritis, and shigellosis (11) occurred in 1971-1973, a review of ships' medical logs revealed an incidence of gastrointestinal illness on passenger cruise ships of 1% or less on 92% of cruises and 5% or greater on 2% of cruises (12). Shortly thereafter, the Bacterial Diseases Division and Quarantine Division, Bureau of Epidemiology, Center for Disease Control, established a surveillance system for shipboard gastrointestinal illness which required vessel masters to report all persons with diarrheal illness seen by the ship's physician as a part of his request for radio pratique (permission to enter a port). These reports are made by radio 4

to 24 hours before arrival in port and are logged by quarantine officers for forwarding to CDC monthly. In the event that 3% or more passengers on any 1 cruise visit the ship's physician with gastrointestinal illness, a quarantine officer will board and inspect the ship and then telephone a report to the Centers for Disease Control. Based on his report, the Enteric Diseases Branch, Division of Bacterial Diseases, Center for Infectious Diseases, may perform an in-depth investigation of the outbreak.

The Quarantine Division, Center for Prevention Services, performs a vessel sanitation inspection on each cruise ship semiannually or more frequently if indicated by poor sanitary ratings. Since the sanitation rating represents the results of an inspection carried out dockside on a given day, this rating may not reflect the sanitary conditions at sea. In 1978, however, results of the ships' reports of diarrheal illness since 1975 were compared with the vessel sanitation inspection reports for the same period. Outbreaks of diarrheal illness were significantly less frequent on vessels with sanitation scores that met the Public Health Service standards than on vessels which did not (13).

F. Comments

In 1981, CDC personnel investigated 5 outbreaks of diarrheal illness on cruise ships calling at U. S. ports. One ship was involved in 2 outbreaks. The first resulted after a Mexican luncheon on shore. Several pathogens were isolated from stools of the 98 ill passengers, including non-01 Vibrio cholerae, V. parahemolyticus, enterotoxigenic Escherichia coli, and Salmonella havana. Several of the food items consumed at the luncheon were associated with illness, suggesting generalized contamination of the food. The second outbreak on this ship involved 135 cases and was probably of non-bacterial etiology. The mode of transmission was not determined. Three other ships had 1 outbreak each. The first was a foodborne outbreak with 440 cases caused by V. parahemolyticus. Illness was associated with a seafood salad. The second was also a foodborne outbreak, with 47 cases and was caused by enteroinvasive E. coli. This was only the second reported foodborne outbreak caused by enteroinvasive E. coli in the U.S. (14,15). The third outbreak involved 224 cases and was of non-bacterial etiology. Person-to-person transmission was suspected or confirmed.

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