ANNUAL SUMMARY 1980
ISSUED FEBRUARY 1982

CENTERS FOR DISEASE CONTROL

Water-related Disease Outbreaks

SURVEILLANCE

DEPARTMENT OF HEALTH AND HUMAN SERVICES • Public Health Service

PREFACE

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

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

Enteric Bacteriology & Epidemiology Branch
Bacterial Diseases Division
Center for Infectious Diseases
Centers for Disease Control
Atlanta, Georgia 30333

SUGGESTED CITATION
Centers for Disease Control: Water-Related Disease Outbreaks
Annual Summary 1980, Issued February 1982

These organizational designations reflect the organization under which the were collected and analyzed.

*Through June 1981.

**Through August 1981.

WATER-RELATED DISEASES SURVEILLANCE ANNUAL SUMMARY 1980

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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, 1980

In 1980, 50 outbreaks of waterborne disease involving 20,008 cases were reported 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 of water, or after 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. 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 1980 remain unknown. 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 1980, 50 outbreaks involving an estimated 20,008 persons were reported to CDC and EPA. This is the largest number of outbreaks reported in a single year since the beginning of the current surveillance system in 1971 (Table 1).

Table 1 Waterborne Disease Outbreaks, by Year and Type of System, United States, 1971-1980

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	TOTAL	(%)
Community	5	10	5	11	6	9	12	10	23	23	114	(36)
Noncommunity	10	18	16	10	16	23	19	18	14	22	166	(53)
Private	4	2	3	5	2	3	3	4	4	5	35	(11)
TOTAL	19	30	24	26	24	35	34	32	41	50	315	
TOTAL CASES	5182	1650	1784	8363	10879	5068	3860	11435	9720	20008	77974	

Twenty-five states reported at least 1 outbreak. For the eighth consecutive year Pennsylvania reported more outbreaks than any other state (10/50-20.0%).

Table 2 shows the number of outbreaks and cases by etiology and type of water system. Of the 50 outbreaks, 28 (56.0%) 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 remaining 22 (44.0%) outbreaks were of a confirmed etiology:

G. lamblia (7), chemical (7), Shigella (1), Norwalk agent (5), Campylobacter (1), and hepatitis (1). In 2 of the 4 outbreaks with over 1000 persons affected, an etiologic agent was found.

Table 2 Waterborne Disease Outbreaks by Etiology and Type of Water System, 1980

	Public Water Systems				Private Water Systems		Total	
	Community		Noncommunity					
	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases
AGI*	11	12542	15	661	2	17	28	13220
Giardia	5	1689	2	35	0	0	7	1724
Chemical	4	2096	1	200	2	2	7	2298
Norwalk Agent	2	1690	3	224	0	0	5	1914
Shigella	0	0	1	4	0	0	1	4
Campylobacter	1	800	0	0	0	0	1	800
Hepatitis	0	0	0	0	1	48	1	48
Total	23	18817	22	1124	5	67	50	20008

*Acute gastrointestinal illness of unknown etiology

In the 43 nonchemical outbreaks, results of microbiologic tests of water samples were reported in 37; evidence of contamination (presence of coliforms or pathogens) was found in 32. Most outbreaks involved noncommunity (44.0%) and community (46.0%) public water systems. Outbreaks attributed to water from community public water systems affected an average of 818 persons compared with 51 persons in noncommunity public water system outbreaks and 13 persons in outbreaks involving individual water systems (Table 2). Use of untreated or inadequately treated water accounted for 29 (58.0%) of the outbreaks (Table 3). Outbreaks occurred most frequently from June through September (Table 4).

Table 3 Waterborne Disease Outbreaks, by Type of System and Type of Deficiency, 1980

	Public Water Systems		Private Water Systems	Total
	Community Outbreaks	Noncommunity Outbreaks	Outbreaks	Outbreaks
Untreated surface water	0	1	0	1
Untreated ground water	0	9	1	10
Treatment deficiencies	11	5	2	18
Deficiencies in distribution system	5	2	0	7
Miscellaneous	5	1	2	8
Uncertain	2	4	0	6
TOTAL	23	22	5	50

Table 4 Waterborne Disease Outbreaks, by Month of Occurrence, United States, 1980

Month	Number of Outbreaks	Month	Number of Outbreaks
January	3	July	12
February	0	August	9
March	3	September	7
April	2	October	1
May	1	November	1
June	8	December	3
		Total:	50

Outbreaks in recreational areas continued to be a problem in 1980, accounting for 24.0% of all outbreaks. Of the 22 outbreaks associated with noncommunity public water systems, implicated water supplies were in camps and campgrounds (8), schools (3), parks (2), towns (2), a restaurant (1), a store (1), a city (1), a rural area (1), a subdivision (1), a trailer park (1), and an apartment building (1).

In 10 of the 28 outbreaks of acute gastroenteritis of unknown etiology an incubation period was reported. In all but one instance the median incubation period was less than 48 hours, and the mean was approximately 46 hours.

E. Comments

The increase in the number of outbreaks reported in 1980 is probably due to more complete reporting rather than an actual increase. Intensive surveillance can identify relatively small waterborne disease outbreaks that often originate in noncommunity public water systems. It is hoped that increased investigation and reporting will define major deficiencies commonly affecting noncommunity public water systems, especially in recreational areas, so that they can be better understood and corrected. However, in many instances investigations have not been initiated until long after the outbreaks have occurred, precluding timely collection of specimens for determining the etiology.

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. Water supply systems in such areas, especially 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.

For the second year in a row, the number of outbreaks related to community systems exceeded the number related to noncommunity systems. The number of cases per outbreak in a community system (818) was 16 times that in a noncommunity system (51), underscoring the huge potential health risk of faults in community systems. Two agents that had not been recognized until relatively recently again caused outbreaks in 1980, Campylobacter jejuni, and Norwalk agent. Five outbreaks, the largest number ever, were attributed to the Norwalk agent. This upsurge in the number of cases attributed to this organism probably represents an increase in awareness and diagnostic ability rather than an actual increase in incidence. Hepatitis A virus was the etiology of at least some of the cases in 3 outbreaks. In all of these, there was evidence of fecal contamination of the implicated water.

Again, one cannot overemphasize the caution that must be exercised in interpretation of these data. The waterborne disease surveillance system is, for the most part, a passive surveillance system. There is evidence to suggest that this report contains only a small fraction of the outbreaks and cases that occur each year in the United States. Supporting this is the fact that one state, Pennsylvania, with its extremely well-developed suveillance system, reported a full 20% of all the outbreaks in 1980. Three states, Vermont, Colorado, and Washington, are receiving federal funds for surveillance in 1981 through contracts with EPA. In the future, analysis of data from these states and Pennsylvania may provide a much more accurate representation of the magnitude of waterborne disease.

In addition to 50 outbreaks related to drinking water systems, 3 outbreaks were reported that resulted from contaminated water not meant for drinking (Table 5). All 3 resulted from drinking untreated surface water. Two occurred in groups of hikers in back-country areas, 1 caused by Giardia, the other by Campylobacter. The third was of undetermined etiology. Water in natural springs and creeks should be considered nonpotable and should be disinfected before it is consumed.

Table 5 Waterborne Disease Outbreaks Not Related to Potable Water Systems, United States, 1980

State	Month	Etiology	Cases	Water Source	Location
Ohio	August	AGI	10	Creek	Rural Area
Washington	April	Giardia	6	Creek	Wilderness
Wyoming	May-August	Campylobacter	21	Creeks	Wilderness

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)*:

					(C) Treatment provided *(circle treatment of each source checked in B)*:
☐ Well	a	b	c	d	a. no treatment
☐ Spring	a	b	c	d	b. disinfection only
☐ Lake, pond	a	b	c	d	c. purification plant - coagulation, settling, filtration, disinfection *(circle those applicable)*
☐ River, stream	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. 4.461)
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) (71)

Pathogen _____ Suspected 1

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 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

State			
Alaska	Sept	Giardia	189
Arizona	July	AGI	40
California	May	AGI	41
California	Jan	Norwalk agent	190
Colorado	Mar	AGI	22+
Colorado	June	AGI	18
Colorado	July	AGI	5
Colorado	Aug	AGI	38
Colorado	Aug	AGI	34
Connecticut	Sept	Campylobacter	800
Georgia	Aug	Norwalk agent	1500
Georgia	Dec	Sodium Hydroxide	17 GI 34 skin 5 eye
Illinois	April	AGI	30+
Indiana+	Aug	Shigella	4+
Maryland	July	Norwalk agent	127
Michigan	July	AGI	6
Michigan	Sept	AGI	60
Minnesota	June	AGI	30
Montana	June	Giardia	780
New Mexico	July	AGI (?Giardia, ?Campy)	24+
New Mexico	June	nitrate	1
New York	Aug	Norwalk agent	42
Ohio	July	AGI	28
Ohio	Aug	AGI	25
Ohio	Aug	AGI	738
Oregon	June	Giardia	63
Pennsylvania	Jan	AGI	3
Pennsylvania	Mar	Giardia	15
Pennsylvania	July	Norwalk agent	55

C	barge	4	lake
NC	campground	2	well
C	Indian reservation	3	creek
C	resort community	3	lake
C	recreation area	? 3	creek
C	city	4	river
NC	store	2	well
NC	campground	3	well
NC	city	2	wells
C	college campus	5	reservoir
C	city	?4 or 5	springs
C	town	5	well

NC	school	2, 3, or 4	well?
NC	campground	2	well
NC	camp	4	well
NC	national park	1	surface
NC	school	2	well
NC	town	?2 or 4	well
C	city	3	stream
C	town	3	well and river
P	home	5	well
NC	campground	2	well
NC	state park	3 or 4	well
NC	camp	3	well
C	town	3	well
C	city	3	stream
B	towns	5	unknown
NC	apt building	3	spring
NC	restaurant	3	well
NC	camp	?2 or 3	

					rural area	2	well
Pennsylvania	July	AGI	90	C	sub-division	3	well
Pennsylvania	Oct	hepatitis	48	P	rural area	3	well
Rhode Island	Sept	trichlorethylene	20	C	town	5	well
South Carolina	July	AGI	106	NC	trailer park	2	well
Tennessee	Aug	AGI	5	P	town	3	well
Texas	July	AGI	2550	C	city	5	surface
Texas	June	AGI + hepatitis	8000?	C	city	3	wells
Utah	June	AGI	105	NC	sub-division	2	spring
Vermont	Sept	fluoride	?200	NC	school	3	surface
Vermont	June	AGI	990	C	city	3	springs/ surface
Washington	Jan	Giardia	?79	C	city	?3 or 4	river or stream
Washington	Mar	Giardia	578	C	town	3	river
Washington	July	AGI	23	C	town	4	well
Washington	Sept	Giardia	20	NC	camp	4	river
Washington	Sept	AGI	46+	C	city	4	well
Wisconsin	July	AGI + hepatitis	12(3)	P	plant	2	well

* AGI = acute gastrointestinal illness of unknown etiology

** C = community (municipal); NC = non-community (semi-public); P = private (individual); B = bottled water

*** (1) = untreated surface water (2) untreated ground water (3) treatment deficiencies (4) distribution system deficiencies (5) miscellaneous

\+ Illinois residents affected

H. Guidelines for Confirmation of Waterborne Disease Outbreaks

Etiologic Agent	Clinical Syndrome	Epidemiologic Criteria
1. *Escherichia coli*	a) Incubation period 6-36 hours	a) Demonstration of organisms of same serotype in epidemiologically incriminated water and stool of ill individuals and not in stools of controls
		-OR-
	b) Gastrointestinal syndrome: marjority 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 stool of most ill individuals.
2. *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 individuals
3. *Shigella*	a) Incubation period 12-48 hrs	a) Isolation of *Shigella* organism from epidemiologically implicated water.
		-OR-
	b) Gastrointestinal syndrome: majority of cases with diarrhea	b) Isolation of *Shigella* organism from stools of ill individuals.
4. *Campylobacter jejuni*	a) Incubation period usually 2-5 days	a) Isolation of *Campylobacter* organisms from epidemiologically implicated water
		-OR-
	b) Gastrointestinal syndrome: majority of cases with diarrhea	b) Isolation of *Campylobacter* organisms from stools of ill individuals.
5. *Yersinia enterocolitica*	a) Incubation period 3-7 days	a) Isolation of *Yersinia* organisms from epidemiologically implicated water
		-OR-
	b) Gastrointestinal syndrome: majority of cases with diarrhea or cramps	b) Isolation of *Yersinia* organisms from stools of ill individuals.
		-OR-
		c) Significant rise in bacterial agglutinating antibodies in acute and early convalescent sera.
6. 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 -OR- b) Gastrointestinal syndrome: chronic diarrhea, cramps, fatigue and weight loss	a) Demonstration of Giardia cysts in epidemiologically incriminated water b) Demonstration of Giardia trophs or cysts in stools or duodenal aspirates of ill individuals.
2. Entamoeba 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 individuals
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 food.

iologic Agent	Clinical Syndrome	Epidemiologic Criteria
. Norwalk and Norwalk-like agents	a) Incubation period 16-72 hours	a) Demonstration of virus particles in stool of ill individuals by immune electron microscopy -OR- b) Significant rise in antiviral antibody in paired sera
	b) Gastrointestinal syndrome: vomiting, watery, diarrhea, abdominal cramps	
. Rotavirus	a) Incubation period 24-72 hours	a) Demonstration of the virus in the stool of ill individuals b) Significant rise in antiviral antibody in paired sera
	b) Gastrointestinal syndrome: vomiting, watery diarrhea, abdominal cramps	
. Enterovirus	a) Incubation period: Variable	a) Isolation of virus from epidemiologically implicated water -OR- b) Isolation of virus from ill individuals
	b) Syndrome: Variable; poliomyelitis, aseptic meningitis, herpangina, etc.	
. 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;86:714-18.

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

3. Center for Disease Control. Shigellosis and Salmonellosis--Morocco. Morbidity and Mortality Weekly Rep 1963;12:438-439.

J. Listing of Waterborne Outbreak Articles, 1980, from the Morbidity and Mortality Weekly Report

Centers for Disease Control. Waterborne Illness - South Carolina. Morbidity and Mortality Weekly Rep 1980;29:585.

Centers for Disease Control. Community Water Supply Contaminated with Caustic Soda - Georgia. Morbidity and Mortality Weekly Rep 1981;30:67.

III. DISEASE OUTBREAKS RELATED TO RECREATIONAL WATER USE, 1980

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 certainly 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. Before 1978, outbreaks or cases of disease related to recreational use of water were not tabulated so comparisons with previous years cannot be made.

B. Comments

Twelve outbreaks related to recreational use of water were reported to CDC in 1980 (Section C).

Seven of the outbreaks were related to swimming. Six of these were gastroenteritis epidemics, 4 were caused by Shigella, and 2 were of unknown etiology. Transmission occurred in small fresh water lakes in 5 outbreaks and in a swimming pool in the other. One outbreak of conjunctivitis was caused by adenovirus acquired from a swimming pool.

Epidemic gastroenteritis in relation to swimming is not commonly reported in the medical literature. Examples of such reports include an outbreak of shigellosis after swimming in a river (4), an outbreak of shigellosis after swimming in a pool (5), an outbreak of viral gastroenteritis after swimming in a pool (Kappus, Karl, personal communication), and an outbreak of viral gastroenteritis after swimming in a lake (6). That such outbreaks occur more commonly than reported is suggested by Cabelli's data (7) which show a relationship between swimming water quality and gastrointestinal illness. Swimming-related outbreaks may go unnoticed, since the persons involved may be from diverse places so that public health authorities may not associate the illnesses with swimming. It is only when the epidemic is caused by a discrete and unusual organism or when the affected population is easily defined that public health authorities recognize that an epidemic is occurring.

Water was tested for coliforms after 5 of the 6 gastroenteritis outbreaks and met the current Environmental Protection Agency recommendation for recreational water quality in all but one case. These recommendations were primarily derived

from studies performed 3 decades ago (8). More recent studies indicate that appreciable rates of gastrointestinal illness may occur in persons who swim in water with much lower fecal coliform concentrations than the EPA maximum standard (7). If these findings are used to revise the recreational water quality standards, then recreational water quality may have to be more nearly the quality of drinking water to prevent transmission of enteric pathogens, especially when those which have small infective doses contaminate the recreational water. That more outbreaks do not occur as a result of contaminated recreational water may be due to failure to recognize outbreaks when they do occur and to the rarity with which pathogens contaminate recreational water.

Five outbreaks of dermatitis related to whirlpools and swimming pools were reported for 1980; four were attributed to Pseudomonas aeruginosa and the etiology of the fifth was not determined.

C. Line Listing of Disease Outbreaks Related to Recreational Water Use, 1980

State	Month	Disease	Cases	Nature of Water
ARK	March	Pseudomonas dermatitis	26	Swimming Pool
GA	June-Aug	Conjunctivitis - Adeno virus	15	Swimming Pool
ILL	May	Pseudomonas dermatitis	?	Whirlpool
ILL	June	Shigellosis	15	Lake
IOWA	March	Dermatitis	?	Whirlpool
KAN	July	Shigellosis	60	Lake
LOU	May	Shigellosis	133	Lake
MD	July	AGI	53	Lake
MASS	Jan	Pseudomonas dermatitis	5	Whirlpool
MINN	October	AGI	30	Swimming Pool
NY	July	Shigellosis	127	Lake
TENN	Nov	Pseudomonas dermatitis	47	Swimming Pool

D. References

4. Rosenberg ML, Hazlet KK, Schaefer J, et al. Shigellosis from swimming. JAMA 1976;236:1849-1852.

5. Center for Disease Control. Outbreak of shigellosis--Medford, Oregon. Morbidity and Mortality Weekly Rep 1969;18:403.

6. Center for Disease Control. Gastroenteritis associated with lake swimming--Michigan. Morbidity and Mortality Weekly Rep 1979;28:413-416.

7. Cabelli VJ. Health Effects Quality Criteria for Marine Recreational Waters. Cincinnati, Ohio: Health Effects Research Laboratory, U.S. Env. Prot. Agency. Sept. 1980. (EPA-600/80-031).

8. Stevenson AJ. Studies of bathing water quality and health. Am J Pub H. 1953;43:529-538.

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

A. Sources of Data

After shipboard outbreaks of typhoid fever (9), viral gastroenteritis, and shigellosis (10) 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 (11). 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 cases of 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 Bacteriology and Epidemiology Branch may perform an in-depth investigation of the outbreak.

The Quarantine Division 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 at 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. The number of outbreaks of diarrheal illness was significantly less frequent on vessels with sanitation scores that met the Public Health Service standards than on vessels which did not. (Dannenberg AL, Yashuk JC, Feldman RA. Gastrointestinal illness on passenger cruise ships, 1975-1978. Unpublished manuscript.)

B. Comments

In 1980, CDC personnel investigated 2 outbreaks of diarrheal illness on cruise ships that sailed between U. S. ports and Caribbean or Mexican ports. One was a foodborne epidemic with 108 cases caused by an unknown agent. The second was an outbreak of hepatitis which affected only crew members.

C. References

9. Davies JW, Cox KC, Simon WR, et al: Typhoid at sea: Epidemic aboard an ocean liner. Canad Med Assoc J 1972;106:877-83.

10. Merson MH, Tenney JH, Meyers JD, et al. Shigellosis at sea: An outbreak aboard a passenger cruise ship. Am J Epidemiol 1975;101:165-75.

11. Merson MH, Hughes JM, Wood BT, Yashuk JC, Wells JG. Gastrointestinal illness on passenger cruise ships. JAMA 1975;231:712-7.

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