

**WEST BRANCH: AN OUTBREAK OF JAUNDICE IN A RURAL COUNTY**

Objectives

After completing this case study, the student should be able to:

1. Define the term "epidemic."
  2. Create a case definition and explain its importance in an outbreak investigation.
  3. Draw and interpret an epidemic curve.
  4. Calculate an attack rate.
  5. Characterize an outbreak by time, place, and person.
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PART I

On Friday, May 17, 1968, the Centers for Disease Control (CDC) in Atlanta was contacted by the Michigan State Health Department. In the telephone conversation, state officials told CDC staff that, since April 30, 32 cases of jaundice had been reported to the district health department in the city of West Branch, Ogemaw County, Michigan.

QUESTION 1a: Can you conclude that this is an epidemic? If not, what additional information would you seek from the state officials to help you determine whether this is an epidemic?

QUESTION 1b: Other than an epidemic, what else could prompt an increase in reported cases?

### Background

Ogemaw County, located in central Michigan, has an area of 576 square miles and a population of 9,680 (1960 census). The area is predominantly rural, divided between farmland and forest. The county seat is West Branch city, with 2,025 residents. The only two other communities of notable size in Ogemaw County are Rose City (population 435) and Prescott (population 308). The remaining area is divided into 14 townships. Most of the permanent residents represent the lower or lower-middle socioeconomic class. In the summer there is also a large tourist population.

A 60-bed community hospital in West Branch serves Ogemaw County and the surrounding areas. There are five physicians (including one surgeon) practicing in West Branch. There is one osteopath practicing in Rose City and another in Prescott.

In the 12 months prior to April, 7 cases of jaundice had been reported to the District Health Department. Four of these 7 cases had occurred in one family outbreak in the previous August. The remaining 3 cases were scattered in time, and bore no apparent relationship to one another. There have been no recent changes in Health Department personnel or surveillance methods.

### Beginning the Investigation

Virtually all 32 cases of illness were characterized by the acute onset of fever, anorexia, nausea, malaise, and abdominal discomfort, followed by jaundice. The earliest case had onset of symptoms on April 2. All except 6 of these 32 cases occurred in residents of Ogemaw County.

Epidemic assistance was requested by state health officials. On Sunday, May 19, an Epidemic Intelligence Service (EIS) officer left for Ogemaw County to meet with state and local officials and begin the investigation.

QUESTION 2: What is the differential diagnosis?

QUESTION 3: How would you define a case?

QUESTION 4: How would you go about case finding?

## PART II

### Case Finding Methods

By May 19, when the first investigator from CDC arrived in West Branch, 39 cases of jaundice had been reported to the district health department. These case reports came from the medical practitioners in the area. The investigators decided to define a case as illness in:

any person who resided in Ogemaw County or visited Ogemaw since January 1968 who had either of the following criteria:

- (1) acute onset of jaundice; or
- (2) a compatible clinical syndrome and laboratory evidence of hepatitis (SGPT greater than twice normal) occurring on or after April 1.

Investigators identified additional cases by periodically calling each physician's office, and by asking reported cases about other people they knew with jaundice. In addition, since the epidemic generated considerable public concern, several cases were reported spontaneously by local residents. As a result, 24 more cases were reported by June 1 among Ogemaw County residents. Furthermore, 13 cases were reported in persons residing outside Ogemaw County.

All of these patients had symptoms and/or laboratory values compatible with hepatitis. One case without jaundice was uncovered; this patient had a compatible clinical syndrome and an SGPT of 1180 units.

### The Epidemic Investigation

The first step in the investigation consisted of interviewing all of the reported jaundice patients. All interviews were conducted at the patients' homes by the same two interviewers, using a standard questionnaire. Patients were asked about the date of onset and symptoms of illness, previous exposure to hepatitis, visits outside the community, and history of receiving blood products. In addition, all other family members were interviewed regarding recent illnesses and the administration of gamma globulin. The patients and their families were also asked about specific sources of water and food and attendance at large gatherings or public places. At the time of the interview, a tap water sample was taken from each home for bacteriologic analysis.

A line listing of the 76 reported cases is provided in Table 1. A line listing usually includes basic demographic information plus a few other variables of interest, such as date of reporting and date of onset of symptoms.

The information in Tables 1-3 and Figure 1 can be used to characterize the outbreak by time, place, and person. Your tables and graphs should help you generate or eliminate hypotheses about the source and mode of transmission.

QUESTION 5: From the information in Table 1, characterize the outbreak by time. Interpret these findings. What inferences may be drawn regarding the probable time of exposure?

QUESTION 6: From the information in Tables 1 & 2, complete Table 3 and characterize the outbreak by person.

QUESTION 7: From the information in Figure 1, Table 1, and Table 4 characterize the outbreak by place.

QUESTION 8: Summarize the findings. Based on your characterization of the outbreak, what hypotheses would you consider at this point, and what further information would you want?

Table 1  
 Linelisting of Cases of Jaundice,  
 Ogemaw County, April-May, 1968

<u>Case #</u>	<u>Age</u>	<u>Sex</u>	<u>Ogemaw Township / City</u>	<u>County</u>	<u>Date of Onset</u>
1	11	M	--	Iosco	4- 2
2	16	F	Rose Township	Ogemaw	4- 3
3	34	M	West Branch Township	Ogemaw	4- 6
4	10	F	--	Iosco	4- 8
5	37	F	--	Iosco	4-12
6	15	M	Mills	Ogemaw	4-28
7	46	M	West Branch Township	Ogemaw	4-30
8	21	F	West Branch City	Ogemaw	5- 1
9	14	M	West Branch Township	Ogemaw	5- 1
10	34	F	--	Wayne	5- 2
11	13	M	Edwards	Ogemaw	5- 2
12	43	M	West Branch Township	Ogemaw	5- 2
13	14	M	Ogemaw	Ogemaw	5- 3
14	22	M	--	Isabella	5- 3
15	37	M	Churchill	Ogemaw	5- 3
16	5	F	West Branch Township	Ogemaw	5- 3
17	11	F	Hill	Ogemaw	5- 3
18	19	M	West Branch Township	Ogemaw	5- 4
19	14	F	West Branch Township	Ogemaw	5- 4
20	35	F	West Branch Township	Ogemaw	5- 4
21	11	F	West Branch Township	Ogemaw	5- 4
22	14	M	Rose Township	Ogemaw	5- 4
23	14	M	Ogemaw	Ogemaw	5- 4
24	45	F	--	Arenac	5- 5
25	15	M	Ogemaw	Ogemaw	5- 5
26	12	M	West Branch Township	Ogemaw	5- 5
27	50	M	West Branch Township	Ogemaw	5- 5
28	56	M	--	Marion, IN	5- 6
29	50	M	Churchill	Ogemaw	5- 6
30	8	F	--	Wayne	5- 6
31	11	M	West Branch Township	Ogemaw	5- 7
32	15	M	West Branch City	Ogemaw	5- 7
33	18	F	West Branch Township	Ogemaw	5- 7
34	14	M	Churchill	Ogemaw	5- 7
35	15	M	West Branch Township	Ogemaw	5- 8
36	30	M	Logan	Ogemaw	5- 8
37	20	F	West Branch City	Ogemaw	5- 9
38	14	F	West Branch City	Ogemaw	5- 9
39	17	M	Edwards	Ogemaw	5- 9
40	15	M	West Branch Township	Ogemaw	5- 9

Table 1 (continued)

<u>Case #</u>	<u>Age</u>	<u>Sex</u>	<u>Ogemaw Township or City</u>	<u>County</u>	<u>Date of Onset</u>
41	37	F	Edwards	Ogemaw	5- 9
42	49	F	--	Oakland	5-10
43	16	M	Churchill	Ogemaw	5-10
44	19	M	--	Arenac	5-10
45	29	F	West Branch City	Ogemaw	5-10
46	5	M	West Branch City	Ogemaw	5-10
47	8	F	West Branch City	Ogemaw	5-11
48	15	F	Churchill	Ogemaw	5-11
49	14	M	Hill	Ogemaw	5-11
50	16	M	Logan	Ogemaw	5-11
51	46	M	--	Hartford, CT	5-12
52	16	M	West Branch City	Ogemaw	5-12
53	19	M	West Branch Township	Ogemaw	5-12
54	15	M	Ogemaw	Ogemaw	5-12
55	10	F	West Branch City	Ogemaw	5-12
*56	6	M	Edwards	Ogemaw	5-12
57	20	M	Mills	Ogemaw	5-12
58	43	M	Edwards	Ogemaw	5-12
59	15	F	Churchill	Ogemaw	5-12
60	12	F	Logan	Ogemaw	5-12
61	14	M	West Branch Township	Ogemaw	5-13
62	34	M	West Branch Township	Ogemaw	5-13
63	15	F	Churchill	Ogemaw	5-13
64	30	M	West Branch City	Ogemaw	5-13
65	16	M	West Branch Township	Ogemaw	5-13
66	15	M	West Branch City	Ogemaw	5-14
67	15	M	West Branch City	Ogemaw	5-14
68	16	M	West Branch City	Ogemaw	5-14
69	16	M	West Branch City	Ogemaw	5-14
70	18	F	West Branch City	Ogemaw	5-15
71	13	M	--	Roscommon	5-16
72	12	M	West Branch Township	Ogemaw	5-18
73	11	M	--	Iosco	5-18
74	22	F	Churchill	Ogemaw	5-20
75	15	F	Edwards	Ogemaw	5-24
76	14	M	West Branch City	Ogemaw	5-26

\* anicteric case

Table 2  
Population of Ogemaw County by Age and Sex, 1960 Census

<u>Age Group in Years</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
0-4	525	511	1,036
5-9	547	448	995
10-14	540	447	987
15-19	446	423	869
20-24	238	254	492
25-29	233	215	448
30-34	213	222	435
35-39	247	298	545
40-44	271	276	547
45-49	291	283	574
50-54	263	270	533
55+	1,143	1,076	2,219
TOTAL	4,957	4,723	9,680

Table 3  
Cases and Attack Rates (per 1000) of Jaundice,  
By Age and Sex, Ogemaw County, April-May 1968

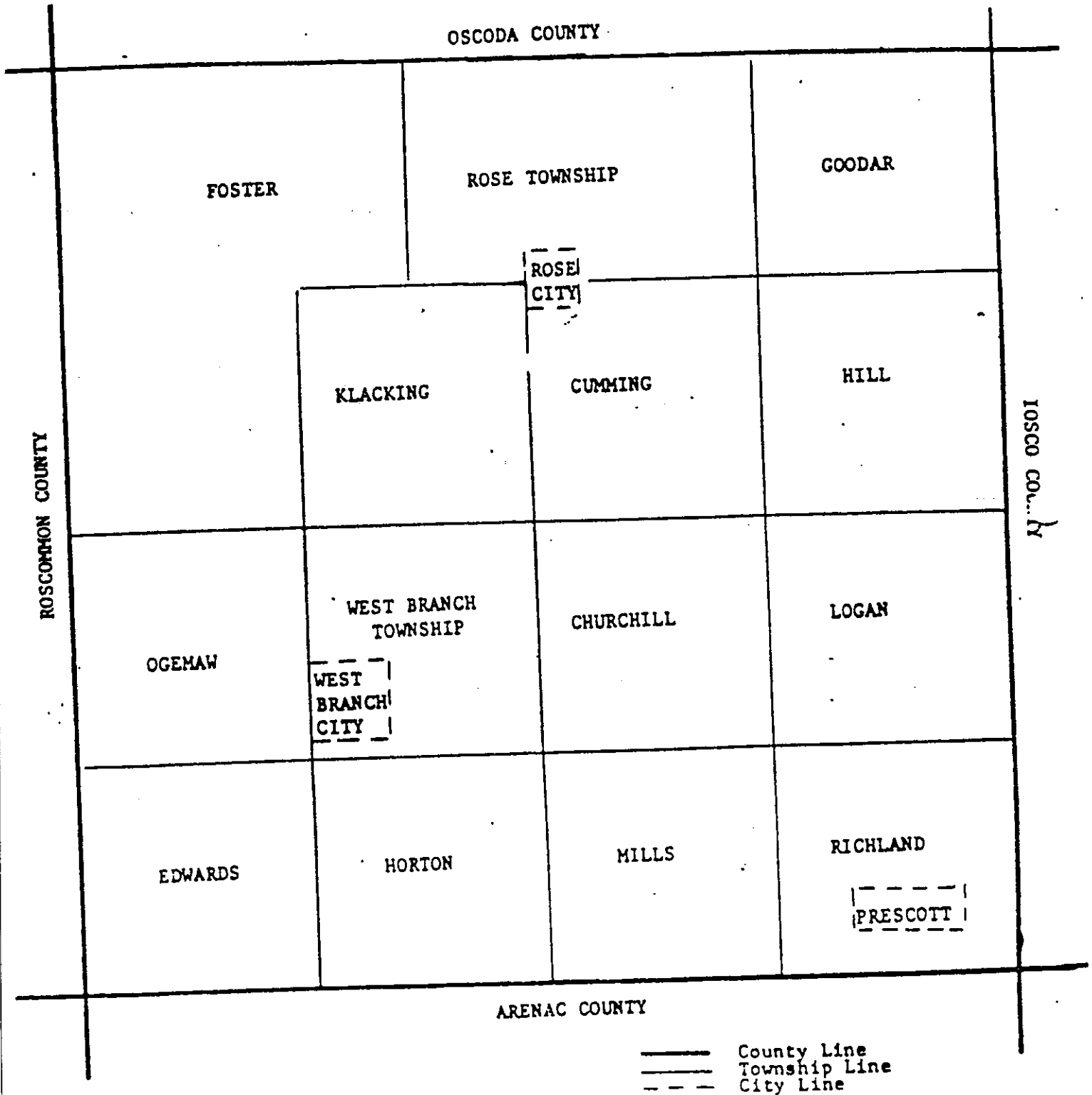
<u>Age (years)</u>	<u>Males</u>		<u>Females</u>		<u>Overall</u>	
	<u>Cases</u>	<u>Rate</u>	<u>Cases</u>	<u>Rate</u>	<u>Cases</u>	<u>Rate</u>
0-4	—	—	—	—	—	—
5-9	—	—	—	—	—	—
10-14	—	—	—	—	—	—
15-19	—	—	—	—	—	—
20-24	—	—	—	—	—	—
25+	—	—	—	—	—	—
TOTAL	—	—	—	—	—	—



Table 4  
 Population of Ogemaw County by Township and City, 1960 Census

<u>Township</u>	<u>Total</u>
Churchill	610
Cumming	344
Edwards	609
Foster	107
Goodar	145
Hill	519
Horton	382
Klacking	291
Logan	378
Mills	597
Ogemaw	569
Richland	704
Rose City	435
Rose Township	566
West Branch City	2,025
West Branch Township	1,399
<b>TOTAL</b>	<b>9,680</b>

Figure 1  
Number and Rate per 1,000 population of Cases of Jaundice,  
By Subdivision, Ogemaw County, April-May, 1968



### PART III

The configuration and duration of the epidemic curve suggested a common source of infection. By working backwards one incubation period from the bulk of cases, investigators estimated that exposure occurred at some time during the first 2 weeks in April. The outbreak appeared to center around West Branch and Churchill townships. The investigators considered possible sources such as municipal water; prepared foods which were available in local restaurants and groceries; milk; and clams or oysters.

Because of the high attack rates among 10-19 year olds, the investigators next focused their attention on the schools.

#### Ogemaw County Schools

Ogemaw County has four school districts, two of which are extensions from adjacent Iosco County. The largest district is the one served by the West Branch Public School, a single building complex located near downtown West Branch with 1,525 pupils in kindergarten through grade 12. Seventy percent of the pupils at the school use the school buses. West Branch City also has a Roman Catholic parochial school (St. Joseph) with 250 pupils, Grades 1 through 8. The parochial school students use the same school buses as the public school children.

Both West Branch and St. Joseph schools have cafeterias and use the municipal water supply system. At the public school, children who attend kindergarten through grade 6 are not allowed to leave the campus for lunch. They may eat food prepared at the school cafeteria or may bring a lunch from home. Children in grades 7 through 12 may leave the school grounds during lunch hour. Since the school is only one block from the main street of West Branch, many students go downtown for lunch each day.

At the parochial school, students must eat lunch from the cafeteria or bring lunch from home; they are not allowed to leave the school grounds during lunch.

Hale, Lincoln, and Jefferson schools are located in counties adjacent to Ogemaw County.

QUESTION 9: Would you have focused the investigation on the schools, given that about 25% of the cases were not of school-age?

QUESTION 10: Use the data in Table 5 to complete Table 6. Do these results help in narrowing the possible hypotheses?

Table 5  
 Cases of Jaundice among Students by School and Grade,  
 Ogemaw County and Surrounding Area, April-May, 1968

<u>Case #</u>	<u>School</u>	<u>Grade</u>	<u>Case #</u>	<u>School</u>	<u>Grade</u>
1	Hale	5	56	St. Joseph	1
2	Rose City	11	59	West Branch	10
4	Hale	5	60	West Branch	4
6	Unknown	Unknown	61	West Branch	8
9	West Branch	8	63	West Branch	10
11	West Branch	8	65	Prescott	10
13	West Branch	8	66	West Branch	10
16	West Branch	K	67	West Branch	10
17	Hale	5	68	West Branch	10
19	West Branch	9	69	West Branch	10
21	West Branch	5	71	Jefferson	Unknown
22	Rose City	8	72	West Branch	7
23	West Branch	8	73	Hale	5
25	West Branch	10	75	Prescott	9
26	West Branch	7	76	West Branch	9
30	Lincoln	Unknown			
31	West Branch	6			
32	West Branch	9			
33	West Branch	12			
34	West Branch	8			
35	West Branch	9			
38	West Branch	9			
39	West Branch	12			
40	West Branch	9			
43	Rose City	10			
44	West Branch	11			
46	West Branch	K			
47	St. Joseph	2			
48	West Branch	10			
49	West Branch	7			
50	West Branch	9			
52	West Branch	10			
53	West Branch	11			
54	West Branch	10			
55	West Branch	4			

Table 6  
 Cases and Attack Rates (per 1,000) of Jaundice,  
 By Grade, West Branch and St. Joseph Schools, Ogemaw County,  
 April-May, 1968

<u>Grade</u>	<u>WEST BRANCH SCHOOL</u>			<u>ST. JOSEPH SCHOOL</u>		
	<u># Cases</u>	<u>Enrollment</u>	<u>Attack Rate</u>	<u># Cases</u>	<u>Enrollment</u>	<u>Attack Rate</u>
K	—	126	—	—	0	—
1	—	128	—	—	37	—
2	—	121	—	—	41	—
3	—	107	—	—	37	—
4	—	106	—	—	26	—
5	—	120	—	—	30	—
6	—	111	—	—	32	—
7	—	110	—	—	26	—
8	—	120	—	—	21	—
9	—	143	—	—	0	—
10	—	128	—	—	0	—
11	—	112	—	—	0	—
12	—	93	—	—	0	—
TOTAL	36	1,525	23.6	2	256	7.8

## PART IV

### Investigating Possible Vehicles

Investigation of the West Branch School showed no association between occurrence of cases and the school cafeteria or other school-sponsored activities. Furthermore, about 25% of cases in school-age children occurred in students attending other schools in Ogemaw and surrounding counties. These students had no direct association with the West Branch School. Also, about a third of all cases occurred in the adult population. Therefore, the investigators turned their attention to possible common source exposures in the community.

There was no evidence of exposure to parenteral inoculations, transfusions, shellfish, or hepatotoxic drugs.

Residents of West Branch are served by municipal water and sewage systems. Most other Ogemaw County residents are served by individual wells and septic tanks.

Locally consumed milk comes from numerous commercial sources, all of which distributed their products throughout the state.

There are many establishments offering prepared foods in the area. Restaurants A and B are located in downtown West Branch. Restaurant A specializes in full-course meals and is patronized primarily by families and local civic groups. Restaurant B is a short-order cafe.

Dairy Queen restaurants are located in Rose City and West Branch City. These are especially popular with teenagers, but are also visited by families in the evenings and on weekends. Both Dairy Queens are similar in size, items served, and utilization.

The West Branch Bakery is located in downtown West Branch next to Restaurant A. It is the only bakery in Ogemaw County. It sells baked goods over-the counter and also distributes its products to some restaurants and food stores in Ogemaw and adjacent counties.

Patients with onset of jaundice between April 28 and May 26 were questioned about their exposure to these possible common sources. Because of the pattern of the epidemic curve, the questions were designed to ascertain exposure between April 1 and 14. Table 7 shows the results for the 41 interviewed persons with jaundice who were between the ages 10 and 19 years.

QUESTION 11: Interpret the information in Part IV and the data in Table 7.

**Table 7**  
**Frequency of Exposure to Water and Commercial Establishments**  
**in March and April Among 41 Persons with Jaundice Aged 10-19 years,**  
**Ogemaw County, May, 1968**

Exposure	Yes	No	Unknown	Percent Known Exposed
Restaurant A	15	25	1	36.6%
Restaurant B	13	27	1	31.7%
West Branch Dairy Queen	28	12	1	68.3%
Rose City Dairy Queen	8	32	1	19.5%
West Branch Bakery	37	3	1	90.2%
West Branch Water	36	5	0	87.8%

**PART V**

**Exposure Histories of Household Members**

The results of the food-and-water-source questionnaire revealed that the bakery and the municipal water were popular among the cases. Table 8 provides comparable exposure histories for 56 non-ill household members aged 10-19 years.

**Table 8**  
**Frequency of Exposure to Water and Commercial Establishments**  
**in March and April Among 56 Non-ill Household Members Aged 10-19 years,**  
**Ogemaw County, May, 1968**

Exposure	Yes	No	Unknown	Percent Known Exposed
Restaurant A	22	31	3	39.3%
Restaurant B	15	39	2	26.8%
West Branch Dairy Queen	39	17	0	69.6%
Rose City Dairy Queen	6	50	0	10.7%
West Branch Bakery	26	29	1	46.4%
West Branch Water	51	4	1	91.1%

**QUESTION 12:** What do you conclude from Tables 7 and 8?

**QUESTION 13:** Based on what you know now, what actions are now appropriate (additional studies, close establishments, etc.)?



PART VI

Evaluation of Possible Source Cases

The two cases of jaundice which occurred in early April were both in food-handlers. One was a woman who worked at the Rose City Dairy Queen, who became ill on April 4. The other was a 34-year old physically- and mentally-handicapped male who worked as a baker's assistant at the West Branch Bakery. He visited his physician on April 6, complaining of "vomiting and a cold." He went back to work, and on April 7 he noticed that his urine was dark. He continued to work until April 11, when the diagnosis of infectious hepatitis was made. He did not return to work until April 23.

Bakery product exposures

Investigators considered the bakery to be the most likely source because of the results of the exposure histories among 10-19 year old cases and family members, and because of the identification of a possible source case. Another questionnaire, focusing on specific bakery products, was administered to the 63 cases who said they had eaten a bakery product during April 1-April 14.

Table 9  
 Frequency of Exposure to Bakery Products  
 in March and April Among 63 Patients with Jaundice,  
 Ogemaw County, May, 1968

Exposure	Yes	No	Percent Known Exposed
Any glazed product	56	7	88.9%
Doughnuts, glazed	39	24	61.9%
Sweet roll, glazed	32	31	50.8%
Doughnuts, plain	17	46	30.0%
Bread	18	45	28.6%
Cake	18	45	28.6%
Cookies	11	52	17.5%
Pie	11	52	17.5%
Sweet roll, plain	10	53	15.9%
Pastry	8	55	12.7%

QUESTION 14: Table 9 presents patient responses to the bakery questionnaire. How do you interpret them?

## PART VII

### Selected Case Histories

In many investigations, information from "unusual" cases reveals important clues or good supporting evidence. In this investigation, the cases who lived outside the county but who were thought to be part of the outbreak were therefore interviewed at length. Most had infrequent contact with establishments inside the county.

#### Case Number 24

Case 24 is a 45-year-old female school teacher who lives about 60 miles east of West Branch in Arenac County. Her only contacts with Ogemaw County were when she passed through West Branch on March 20, April 5, and April 14 on the way to visit her father who lived on the other side of the state. On March 20, she stopped and had a cup of coffee in a West Branch restaurant. On April 5, she stopped and bought some glazed rolls and a coffee cake from the West Branch Bakery. She did not stop on April 14. On May 5, 1968, she became ill with hepatitis.

#### Case Numbers 10, 30, and 42

Case 10 is a 34-year-old homemaker who lives in Wayne County, and Case 30 is her 8-year-old daughter. Case 42, a 49-year-old homemaker, is the sister-in-law of Case 10 and the aunt of Case 30. Both Case 10's family and Case 42's family own summer cottages in Ogemaw County (10 to 15 miles from West Branch). They went to their cottages on April 8, 9, and 10 to open them for the season. At no time did Case 42 or Case 30 go in or near the city of West Branch. On April 9, Case 42 took care of Case 10's children while Case 10 went into the city to conduct some business. At that time, Case 10 bought some baked goods at the West Branch Bakery to bring to the cottage for lunch. All three patients had the same kind of cream-filled rolls which were glazed. Case 10 became ill on May 2, Case 30 became ill on May 6, and Case 42 became ill on May 10. No other member of either family is known to have been ill since the April trip to open the cottages.

#### Case Number 51

Case 51, a 46-year-old white male who lives in Wethersfield, Connecticut, came to Ogemaw County to visit his mother on April 4, 5, and 6. On April 5 or 6, he went to West Branch and visited one of his friends, the owner of the bakery. The owner made him a present of glazed doughnuts. On May 13, 1968, Case 51 became ill with hepatitis. Case 51's mother did not partake of the gift.

Case Number 20

Case 20 is a 35-year-old mother of six who purchased assorted glazed products at the bakery on April 6. She took the baked goods home, where she and her two older daughters ate some of them. Her two sons returned home later in the day and ate all but one glazed item. Still later, her 5-year-old twins came home and fought over the last pastry. To the victor went the pastry; the loser had none. One month later, the mother, her 2 daughters, 2 older sons, and the stronger twin became cases. The father and the other twin did not become ill.

Investigation of the bakery

The investigators visited the bakery. The West Branch Bakery has served the region for 34 years. The baker's assistant helped in several steps of the baked goods production. In particular, he was responsible for making and glazing doughnuts and for icing much of the pastry. Both glaze and icing may be kept for several days and old batches may be used to start new ones. Bakery items not sold in one day may be frozen for sale in the next one or two weeks. Therefore, contaminated foods could be available for consumption over a period of several days or weeks.

QUESTION 15: Would you now close the bakery? Why or why not? If not, what action would you take?

## PART VIII - CONCLUSION

### Bakery investigation, continued

Although none of the other bakery employees felt ill, a blood sample was taken from each employee. An SGPT (an enzyme test for liver function) was performed on each sample, and in each instance was within normal limits.

Because the outbreak appeared to be over, and because no ill employees were identified through SGPT testing, the bakery was allowed to remain open. Leftover glaze and baked goods were discarded, and proper hygiene was emphasized.

One investigator was skeptical that the bakery could account for the observed age-sex distribution of cases. Therefore, on June 3, he sat unobtrusively behind a counter in the bakery, and estimated the age and sex of each customer and noted the hour of the sale and the type of product purchased. The age distribution of bakery customers closely paralleled the age distribution of reported cases. Roughly equal numbers of males and females in each age group patronized the restaurant, in contrast to the 2:1 ratio among cases. The sex difference was more likely to have resulted from males eating more pastries than females (based on interviews from the household case-control study) than from a sex difference in patronage.

### Control Measures

During this epidemic, between 7,000 and 8,000 cc of gamma globulin (immune serum globulin) were administered. Gamma globulin was offered to all residents of the city of West Branch and the immediately surrounding area, as well as to all household contacts of cases. The Health Department made a special effort to provide gamma globulin to school children, both in the West Branch public school and St. Joseph's parochial school. Mass administration of gamma globulin did not start until Tuesday, May 14, 1968. The epidemic curve demonstrates that there was an abrupt decline in new cases after Wednesday, May 15, 1968. This decline cannot be wholly attributed to the widespread use of gamma globulin. No cases of infectious hepatitis with onset after May 26, 1968, were reported to the District Health Department. Undoubtedly, the mass administration of gamma globulin did play a role in suppression of secondary cases.

## REFERENCES

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2. Roueche B. The West Branch Study. In: *The Medical Detectives*. New York: Truman Talley / New York Times Books, 1981. p 217-235 (chapter 14).