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STUDIES OF THE ACUTE DIARRHEAL DISEASES [1]

IX A. *SHIGELLA DYSENTERIAE* INFECTIONS AMONG INSTITUTIONAL INMATES

By ALBERT V. HARDY, *Surgeon* (R), *United States Public Health Service*, and *Associate Professor of Epidemiology, DeLamar Institute of Public Health;* REBECCA L. SHAPIRO, *Laboratory Assistant, New York City Health Department;* HARRY L. CHANT, *District Health Officer, New York State Health Department;* and MORRIS SIEGEL, *Clinic Physician, New York City Health Department.*

OBJECTIVES

The study of *Shigella dysenteriae* infections has been limited almost exclusively heretofore to observations on clinical cases and their immediate contacts. This has not been adequate to provide a satisfactory epidemiological interpretation. Information is needed concerning the occurrence of these infections in healthy persons and in those with clinically insignificant enteric disturbances. The chief obstacles to extension of studies in these directions have been the difficulty of isolating *Shigella dysenteriae* from normal stools and of obtaining adequate numbers of satisfactory stool specimens for bacteriological examination. The recent introduction of highly selective media has done much to eliminate both problems. The use of desoxycholate citrate and S. S. (*Shigella-salmonella*) agars has not only increased the proportion of positive observations, but has made it possible to employ the simple rectal-swab technique for obtaining and plating fecal material as described by Hardy, Watt, and DeCapito (*1*).

The present study is part of an investigation of the occurrence of carriers of *Shigella dysenteriae*. Prevalence in the general population could be measured by single or infrequently repeated stool cultures. It was practicable to examine institutional inmates at weekly or biweekly intervals for prolonged periods and thus to observe the behavior of these infections in the course of time, also to study bacteri-

[1] From the Division of Infectious Diseases, National Institute of Health, the Bureau of Laboratories of the New York City Department of Health, the New York State Health Department (Middletown District) and the DeLamar Institute of Public Health, Columbia University.

ologically the mild diarrheal disorders which do not come to the attention of the physician or health officer serving the general population. The major objective of this investigation was to supplement the data which could be obtained from the study of the general population; the minor objective was to obtain a better understanding of the old problem of diarrheal disease among institutional inmates.

Section A of this report is concerned with the findings in a New York State institution for the mentally defective. The physical plant is justly regarded as a model and the care provided the inmates is of a correspondingly high order. Diarrheal disorders had been troublesome among the younger idiots and imbeciles. These were housed in two "cottages" (one for males and one for females), each designed to accommodate 120 individuals. The groups were isolated from each other since the cottages were at opposite ends of the spacious grounds. They were served food in their own cottages, did not attend school and rarely came in contact with other groups, except on admission to the institution's own hospital. These isolated units were selected for study. Within each group the inmates lived in the intimate relationships of children in one large family.

The investigation was undertaken in mid-June 1939, was fully established by the first of August, and was terminated the end of February 1941. The number of individuals under observation at one time averaged 123 males and 120 females and varied only slightly from this. However, the composition of the population was changed by the normal admissions, transfers, and discharges. A total of 210 males and 171 females entered the study.

METHODS

The planned procedure was to obtain stool cultures every two weeks on all members of these two groups. When the prevalence of infection was high weekly cultures were obtained, and during the fall of 1939, when the evidence indicated that *Shigella dysenteriae* infections had disappeared from the boys' cottage, monthly intervals were used. The routine was interrupted in December 1939, during the investigation of a *Salmonella typhi murium* outbreak. From that date to the end of the study the examinations were conducted at least every other week. All males and females currently in the groups were examined routinely on 42 and 50 occasions, respectively. During these times a total of 11,117 cultures were obtained. In addition, 684 diagnostic specimens were collected at irregular intervals from individuals ill with diarrhea. With the exception of a portion of the latter, all cultures were taken by the rectal-swab technique. The cultural and serological procedures previously described for the identification of *Shigella dysenteriae* were employed in the laboratory.

Satisfactory records of diarrheal disorders, particularly the mild ones, were difficult to obtain. The inmates could give no history. They were under the care of matrons and attendants, not trained nurses. Most of the observations as to illness were made by these workers. They were requested to keep a daily list of all persons with abnormal stools, including number of movements, descriptions of feces, and records of temperature. Additional reports were obtained from physicians' notes and hospital records. During weekly visits these various records were collected for entry on case cards. To a limited degree, the written reports were supplemented by information obtained directly from the physicians or matrons. It seems probable that through these channels reports were obtained of almost all moderately severe and most mild diarrheal disorders.

Agglutination tests were conducted on a limited series of unselected individuals. The only positive observations were in titers generally considered of little diagnostic significance. Since these tests were not promising, they were discontinued in favor of more extensive bacteriological studies.

CHRONOLOGY

Tables 1 and 2 are presented to show the observed course of *Shigella dysenteriae* infections in these groups. The findings on repeated cultures of all members of the groups are given first. These provide measures of the prevalence of the infection. The numbers are minimal rather than total since undoubtedly the organisms were not isolated from every individual who harbored them. The chronological distribution of the first positive cultures in each infection or reinfection is shown in the second part of the table. These were found in the routine tests on the date stated and in the diagnostic examinations between that time and the preceding routine cultures. These initial positive findings provide evidence as to rate of spread of the infection. Lastly, the number of acute attacks of diarrhea by dates of onset are given. The illnesses began in the period between the date as given and that of the preceding routine examination, or between the beginning of the study and the first examination.

It is evident that Flexner W infections were occurring commonly when the study was started. In the boys' cottage, by means of the diagnostic examinations and the first routine test on June 27, 1939, nine individuals were found to be infected. One additional boy without known illness was positive on his second routine test on August 2. This was the only evidence that this infection may have spread in this cottage later than June. This organism was last isolated from the boys on August 16, 1939.

This variety of *Shigella* was more prevalent among the girls in June and July 1939. Nineteen were found to be positive through the early

diagnostic tests and the first routine examination on July 19. On this date, 114 girls were cultured and 14 (12 percent) yielded *Shigella dysenteriae* (Flexner W). Five new infections were found during August but thereafter only three additional infections were discovered. Apparently one of the latter was acquired in the hospital dysentery ward, not in the cottage. The child, first positive on October 4, was hospitalized for a prolonged diarrheal disorder which was culturally negative until convalescence. The total number of infected persons as

TABLE 1.—*Observations on males by routine examinations, the discovered infections and reinfections and the reported diarrheal disorders by date and type of Shigella isolated*

Date	Routine examinations			Initial positive cultures for infections and reinfections including those found by diagnostic tests [1]		Number of reported acute diarrheal disorders	
	Number of individuals examined	Number positive for *Shigella dysenteriae*					
		Flexner	Sonne	Flexner	Sonne	Positive for *Shigella dysenteriae*	Negative for *Shigella dysenteriae*
June 27, 1939	77	5	0	9	0	2	1
August 2, 1939	116	3	0	1	0	0	4
August 16, 1939	122	1	0	0	0	0	3
August 30, 1939	132	0	0	0	0	0	5
September 13, 1939	121	1	0	1	0	0	3
October 11, 1939	116	0	0	0	0	0	0
November 8, 1939	115	0	0	0	0	0	0
December 20, 1939	0	0	0	0	6	9	1
December 28, 1939	0	0	0	0	4	1	0
January 3, 1940	107	0	24	0	20	0	0
January 10, 1940	118	0	20	0	12	1	0
January 19, 1940	123	0	14	0	4	0	3
January 31, 1940	121	0	11	0	4	1	0
February 14, 1940	117	0	6	0	1	0	0
February 27, 1940	117	0	4	0	0	1	0
March 13, 1940	112	0	4	0	2	0	1
March 26, 1940	113	0	6	0	4	1	0
April 10, 1940	116	0	7	0	5	0	0
April 25, 1940	118	0	22	0	21	2	1
May 1, 1940	117	0	24	0	11	2	0
May 8, 1940	118	0	18	0	0	0	0
May 21, 1940	124	0	6	0	2	0	3
May 29, 1940	124	0	5	0	1	2	1
June 12, 1940	121	0	1	0	0	0	0
June 26, 1940	125	0	5	0	2	0	2
July 10, 1940	120	0	1	0	0	0	0
July 24, 1940	122	0	0	0	0	0	1
August 7, 1940	128	0	1	0	0	1	0
August 21, 1940	126	0	7	0	7	2	0
August 28, 1940	127	0	15	0	12	3	0
September 4, 1940	129	0	18	0	10	0	0
September 11, 1940	130	0	16	0	7	0	0
September 18, 1940	135	0	13	0	1	0	0
October 2, 1940	136	0	8	0	4	0	0
October 16, 1940	134	0	1	0	0	0	0
October 30, 1940	127	0	2	0	0	0	0
November 13, 1940	120	0	3	0	2	0	0
November 27, 1940	129	0	2	0	1	0	2
December 11, 1940	127	0	2	0	1	1	2
December 27, 1940	129	0	5	0	5	0	0
January 8, 1941	129	0	10	0	9	2	0
January 22, 1941	134	0	13	0	9	1	0
February 4, 1941	139	0	3	0	3	0	0
February 20, 1941	126	0	6	0	2	2	0
Total	5,137	10	310	11	172	34	33

[1] Including the time interval subsequent to the preceding routine examination or from the beginning of the study to the first routine examination.

found on the routine tests gradually decreased through August, September, and October. After November 1, Flexner W was isolated only from one carrier, a child who had 43 positive cultures in a total of 46 successive diagnostic or routine examinations. Her last positive culture was on September 25, 1940. There was no evidence of any spread from this carrier for at least 11 months.

TABLE 2.—*Observations on females by routine examinations, the discovered infections and reinfections and the reported diarrheal disorders by date and type of Shigella isolated*

Date	Routine examinations					Initial positive cultures for infections and reinfections including those found by diagnostic tests [1]				Number of reported acute diarrheal disorders				
	Number of individuals examined	Number positive for *Shigella dysenteriae*								Positive for *Shigella dysenteriae* [1]				Negative for *Shigella dysenteriae*
		Fv [1]	Fw [2]	F unel. [3]	S [4]	Fv	Fw	F uncl.	S	Fv	Fw	F uncl.	S	
July 10, 1939	114	1	14	0	0	2	19	0	0	1	13	1	0	0
August 9, 1939	118	2	5	1	0	3	3	2	0	2	3	2	0	0
August 23, 1939	113	4	4	1	0	3	2	1	0	0	0	1	0	0
September 6, 1939	114	3	4	1	0	3	1	1	0	2	2	0	0	3
September 20, 1939	121	3	3	0	0	2	0	0	0	1	0	0	0	2
October 4, 1939	118	4	2	0	0	4	1	0	0	0	0	0	0	1
October 18, 1939	120	6	2	0	0	2	0	0	0	1	0	0	0	1
November 1, 1939	114	5	2	0	0	3	1	0	0	1	0	0	0	1
November 15, 1939	115	5	1	0	0	2	0	0	0	1	0	0	0	0
November 29, 1939	119	5	1	1	0	1	0	1	0	4	0	0	0	4
December 13, 1939	117	5	1	1	0	6	0	0	0	6	0	0	0	2
December 27, 1939	112	9	0	4	0	6	0	5	0	1	0	1	0	0
January 16, 1940	112	13	1	1	0	5	0	0	0	1	0	0	0	0
January 24, 1940	115	15	1	0	0	1	0	1	0	0	0	0	0	1
February 7, 1940	111	6	1	0	0	1	0	0	0	1	0	0	0	0
February 21, 1940	109	4	1	0	0	2	0	0	0	0	0	0	0	0
March 6, 1940	116	5	1	0	0	2	0	0	0	0	0	0	0	0
March 20, 1940	116	5	1	0	0	1	0	0	0	1	0	0	0	0
April 3, 1940	115	4	1	1	0	3	0	1	0	1	0	0	0	0
April 17, 1940	117	2	1	0	0	0	0	0	0	0	0	0	0	0
May 1, 1940	122	0	1	0	0	0	0	0	0	0	0	0	0	0
May 15, 1940	121	0	1	0	0	0	0	0	0	0	0	0	0	0
June 5, 1940	119	0	1	0	4	0	0	0	4	0	0	0	0	2
June 12, 1940	120	0	1	0	10	0	0	0	7	0	0	0	0	0
June 19, 1940	124	0	1	0	13	0	0	0	7	0	0	0	0	1
June 26, 1940	123	0	1	0	19	0	0	0	9	0	0	0	3	0
July 3, 1940	122	0	1	0	26	0	0	0	14	0	0	0	3	0
July 10, 1940	120	0	1	0	31	0	0	0	19	0	0	0	3	0
July 17, 1940	119	0	1	0	27	0	0	0	10	0	0	0	2	1
July 24, 1940	119	0	1	0	22	0	0	0	7	0	0	0	2	0
July 31, 1940	119	0	1	0	8	0	0	0	3	0	0	0	0	0
August 7, 1940	119	0	1	0	11	0	0	0	5	0	0	0	1	0
August 14, 1940	119	0	1	0	10	0	0	0	5	0	0	0	0	0
August 21, 1940	118	0	1	0	6	0	0	0	2	0	0	0	0	0
August 28, 1940	123	0	1	0	2	0	0	0	1	0	0	0	0	0
September 11, 1940	124	0	1	0	10	0	0	0	8	0	0	0	0	0
September 18, 1940	124	0	0	0	10	0	0	0	3	0	0	0	0	0
September 25, 1940	119	0	1	0	5	0	0	0	3	0	0	0	0	0
October 9, 1940	126	0	0	0	5	0	0	0	2	0	0	0	0	0
October 23, 1940	124	0	0	0	3	0	0	0	3	0	0	0	1	0
November 6, 1940	128	0	0	0	3	0	0	0	2	0	0	0	1	2
November 18, 1940	131	0	0	0	7	0	0	0	5	0	0	0	1	1
November 27, 1940	119	0	0	0	0	0	0	0	0	0	0	0	0	1
December 4, 1940	127	0	0	0	5	0	0	0	5	0	0	0	0	0
December 20, 1940	124	0	0	0	4	0	0	0	4	0	0	0	1	0
January 8, 1941	127	0	0	0	1	0	0	0	1	0	0	0	0	0
January 15, 1941	129	0	0	0	1	0	0	0	1	0	0	0	0	0
January 29, 1941	128	0	0	0	5	0	0	0	4	0	0	0	1	0
February 11, 1941	119	0	0	0	2	0	0	0	2	0	0	0	0	1
February 26, 1941	118	0	0	0	2	0	0	0	2	0	0	0	0	0
Totals	5,980	106	64	11	252	52	27	12	138	24	18	5	19	24

[1] Including the time interval subsequent to the preceding routine examination or from the beginning of the study to the first routine examination.

Flexner V was isolated from a boy on September 13, 1939. Only one positive culture was obtained. The infection was acquired and lost without any detected spread in the group. The course of Flexner V infection among the girls was very different. The microorganism was recovered from the early cultures of the girls and for a period of 9 months it was found on each routine examination. Through October 4, 1939 the number of persons found positive for *Shigella dysenteriae* on these routine examinations varied from 1 to 4; for the following five examinations there were 5 or 6. On December 27 there were 9. The two tests in January 1940, revealed 13 and 15 infected individuals. From this point the infection declined in prevalence and the last positive culture was found on April 17. The spread was slow but continuous. Each routine examination revealed from 1 to 6 newly infected individuals, with the higher numbers in December 1939, and early January 1940.

Prior to November 15, 1939 *Shigella dysenteriae* (Sonne) was not isolated. A specimen obtained on this date from a patient with diarrhea admitted to the hospital from a cottage not under observation, yielded this microorganism. Unfortunately there was delay in its identification because of preoccupation with a *Salmonella typhi murium* outbreak in the institution. During this period routine cultures on the boys were temporarily discontinued, but diagnostic specimens were obtained from all with illnesses. The introduction of Sonne infection into the study group was first detected through a culture taken on December 6 from a boy who had developed acute diarrhea on the preceding day. Additional diagnostic specimens were obtained on December 20 and 28. It was established through these examinations that 10 of the 11 boys who had symptoms in December were infected with this variety of *Shigella*. The dates of onset provided some indication of its spread during the month. A new case began on each of the following dates: December 1, 5, 11, 15 (2 cases), 16, 17, 20 (2 cases), 21, and 24.

Routine examinations were resumed on January 3, 1940, when 24 (22 percent) of the 107 tested were positive for Sonne. On this day no inmate had acute diarrhea. One week later 20 positives were found. Throughout the following 4 examinations over a period of 6 weeks the number of positives progressively decreased from the above to 14, 11, 6, and 4. The known new infections decreased more rapidly. There was some spread during January but in February only 1 new infection was found.

The early course of *Shigella dysenteriae* (Sonne) infection was more thoroughly studied in the girls' cottage. This variety of *Shigella* was not isolated from this group prior to June 5, 1940. The routine cultures taken on this date revealed 4 infected individuals. Because of

this finding, weekly bacteriological examinations were carried out during each of the following 12 weeks. The total number of infected persons and the rate of spread of the infection progressively increased for 5 weeks, reaching a maximum on July 10 when 31 (26 percent) of 120 inmates were positive. Nineteen of these were newly discovered infections. Thereafter there was a rapid decline in the rate of spread of the infection and a slow decline in the total number of infected individuals.

Subsequently, through a continuously changing group of infected individuals, Sonne was able to maintain itself in both groups to the end of the period of observation. There was one marked difference in the behavior of the infection in the two groups. The spread among the boys occurred in epidemic waves, separated by periods in which there were few new infections. As many as 21 initial positive cultures were revealed by a single examination at the crest of a wave (April 25, 1940), and as few as 5 in 8 examinations during an intervening interval (May 8 to August 7, 1940). This was in marked contrast to the slow but persistent spread of the infection among the girls which followed the initial epidemic wave. There were 20 routine examinations in this period of observation (July 31, 1940, to February 26, 1941); in 18 the discovered new infections varied from 1 to 5; once 8 were found, and once none.

INCIDENCE OF DIARRHEAL DISORDERS

In analyzing the reports of illnesses, as obtained, it was considered that an attack of diarrhea was clinically significant if the individual passed four or more abnormally soft or watery stools in 1 day, even though there were no other associated abnormalities. Similarly, two abnormal stools with any other associated abnormality, or any "bloody stools," were considered to indicate significant diarrheal disorders. Likewise, if an individual had been "in bed with diarrhea" the illness was similarly classified. Disturbances of lesser degree have been disregarded. Freedom from significant diarrhea for a period of 1 month was accepted as evidence of recovery.

On applying the above criteria it was found that 194 attacks of diarrhea had been reported, 84 involving 58 boys, and 110 affecting 78 girls. These attacks are classified on the basis of laboratory findings and clinical course in table 3. Incidence of illness due to *Shigella dysenteriae* was higher among the girls, but culturally negative acute disorders were slightly more common among the boys. Other varieties of diarrheal disorders were distributed equally among the two groups. Ten cases positive late in the disorder were classed as questionable, since all cultures taken early were negative.

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TABLE 3.—*Types of reported diarrheal disorders and annual attack rates in male and female groups July 1939–February 1941*

Clinical classification	Males (Average population 123)		Females (Average population 120)	
	Reported attacks	Annual rate per 100 inmates	Reported attacks	Annual rate per 100 inmates
Acute diarrheal diseases:				
Positive for *Shigella dysenteriae*	34	16	66	33
Negative for *Shigella dysenteriae*	33	16	24	12
Questionable [1]	4	2	6	3
Amebic dysentery	9	4	9	4
Chronic diarrheal disease	[2] 4	.5	[2] 5	.5
Total	84	41	110	55

[1] *Shigella dysenteriae* isolated during the course of disease but its etiological role was considered uncertain.
[2] One only in each group with onset during the period of observation.

We have listed as known or suspected amebic dysentery those cases so diagnosed in the clinical laboratory of the institution, also those diagnosed clinically which responded promptly to specific therapy. One of the males died from peritonitis, which was found at autopsy to be the result of the perforation of an amebic ulcer. A female died following a diarrheal disorder which had characteristics of a case of amebic dysentery. Recognized amebic infections were more common during the first half of the period of study.

In nine individuals diarrhea was a chronic complaint, in seven onset antedated the study. There was no uniformity in the clinical picture and the etiology was not satisfactorily determined. All but two had intercurrent infections with *Shigella dysenteriae*.

During the summer of 1939 the acute diarrheal disorders which prevailed among the males were distinct from those among the females. In the former the attacks were mild, fever was rarely present, and dysenteric stools were not observed. Among the females, the illnesses were quite severe, commonly associated with fever, and often with characteristic dysenteric stools. During the interval from the beginning of the study to September 30, 1939, *Shigella dysenteriae* was isolated from only 2 (11 percent) of 18 cases in males, whereas it was isolated from 28 (82 percent) of 34 cases in females. One positive case in a girl of 13 years terminated fatally.

During a second period, the late fall of 1939, the incidence of diarrhea in both groups remained high. Characteristically, the boys had short attacks (1 to 3 days) with watery stools and frequently a slight elevation of temperature. The girls had similar but more severe disorders. Another female, aged 7, died of a primary dysenteric infection and a terminal pneumonia. From October 1939 through February 1940 the total number of acute diarrheal attacks

was 18 for the boys and 26 for the girls, and the proportions positive for *Shigella dysenteriae* were 72 percent and 65 percent, respectively. Again the infections were distinct; in the males they were attributable to Sonne and in the females to Flexner V.

In table 4 the later months of the study have been divided to correspond with the dates for these first two periods. The acute attacks of diarrhea during the late periods were less than one-half the reported number for the preceding year. Furthermore, these cases were mild and of short duration. From June 1, 1940, only the Sonne variety of *Shigella dysenteriae* was found to be associated with these illnesses.

TABLE 4.—*Acute diarrheal disorders by cottage group, date of occurrence, and bacteriological findings*

Dates	Male					Female				
	Acute diarrheal disorders[1]	Positive for *Shigella Dysenteriae*				Acute diarrheal disorders[1]	Positive for *Shigella Dysenteriae*			
		Flexner		Sonne			Flexner		Sonne	
		Number	Percent	Number	Percent		Number	Percent	Number	Percent
June 15–Sept. 30, 1939	18	2	11	0	0	34	28	82	0	0
Oct. 1, 1939–Feb. 29, 1940	18	0	0	13	72	26	17	65	0	0
March 1–May 31, 1940	13	0	0	7	54	4	2	50	0	0
June 1–Sept. 30, 1940	8	0	0	6	75	16	0	0	14	87
Oct. 1, 1940–Feb. 28, 1941	10	0	0	6	60	10	0	0	5	50

[1] Exclusive of group classified as questionable (table 3).

PREVALENCE OF SHIGELLA DYSENTERIAE INFECTIONS

Many of the inmates had more than one infection with *Shigella dysenteriae*. In some instances different varieties were involved. When a single variety was isolated, an arbitrary standard was necessary to classify positive findings as due either to continuing infection or reinfection. An individual was considered as free of infection after 3 negative cultures at intervals of 2 weeks, or 4 at weekly intervals. This rule was rarely needed, since in most cases the individuals when positive were consistently positive, and these periods were separated by long intervals of regularly negative examinations. The total number of detected *Shigella dysenteriae* infections was 412, 183 for the boys' group and 229 for the girls'. The average populations were 123 and 120, respectively, giving minimal total infection rates of 89 and 115 per 100 inmates per annum. The minimal annual attack rates (percent) of *Shigella dysenteriae* infections with associated symptoms, as stated in table 3, were 16 and 33, respectively. If all other infections are regarded as carrier states, the minimal carrier incidence rates per annum are 73 per 100 in one group and 82 per 100 in the other.

The proportion of individuals found to be positive increased with an increasing number of examinations. For individuals tested less than 10 times the percentage positive for *Shigella dysenteriae* was 31 for the boys and 38 for the girls. With 10 to 19 observations the percentage for each was 58. A total of 126 boys and 127 girls were examined routinely 20 or more times, and of these 85 (67 percent) and 107 (84 percent), respectively, became positive.

SEX

The males and females in this study were not members of a mixed population as is usually the case. Differences in the two entirely distinct groups could not be evaluated on the basis of sex.

AGE

The age distribution for all individuals who entered the study is shown in table 5. The incidence of all diarrheal disorders and of those due to *Shigella dysenteriae* and of all detected infections was found to vary inversely with age. Since the younger children had been for the most part more recently admitted, the observed differences could be accounted for either by chronological age or duration of residence in the institution, or both.

TABLE 5.—*The distribution by age of the diarrheal disorder and of total Shigella dysenteriae infections for all individuals who entered the study*

Date of birth	Males							Females						
	Number of individuals entering study	With diarrheal disease		With illness due to *Shigella dysenteriae*		With infection by *Shigella dysenteriae*		Number of individuals entering study	With diarrheal disease		With illness due to *Shigella dysenteriae*		With infection by *Shigella dysenteriae*	
		Number	Percent	Number	Percent	Number	Percent		Number	Percent	Number	Percent	Number	Percent
1935 or later	41	21	51	14	34	31	76	13	11	85	7	54	12	92
1930–1934	110	31	28	17	15	69	63	70	44	63	33	47	59	84
1925–1929	38	5	13	1	3	13	34	57	16	28	15	26	40	70
1920–1924	1	0	0	0	0	0	0	12	3	25	0	0	8	67
1919 or earlier	8	1	13	0	0	3	38	15	4	27	2	13	5	33
Unknown	12					2	17	4					2	50
Total	210	58	28	32	15	118	56	171	78	46	57	33	126	74

The evidence as to the relative importance of these variables as found among persons present throughout the respective periods of Sonne or Flexner infections is given in table 6. There was no statistically significant difference in the discovered incidence of Sonne infections between individuals under 10 years of age and those over 10 years. There was a significant variation for both younger and older individuals dependent upon duration of residence in the institution.

The data for Flexner infections are limited and not conclusive. In contrast with the findings for Sonne, chronological age appeared to have more influence than the duration of residence in the institution.

TABLE 6.—*Individuals continuously studied compared by age, date of admission to the institution, the number of reported illnesses and the prevalence of infection by variety of Shigella dysenteriae*

Variety of *Shigella*	Age at beginning of study	Year of admission	Individuals examined	Known infected individuals		Discovered *Shigella* infections		Infections with illness		Infections without illness	
				Number	Percent	Number	Per 100 individuals	Number	Per 100 individuals	Number	Per 100 individuals
Sonne	Under 10	1937-1940	97	78	80	127	131	17	18	110	113
		1936 and earlier	25	14	56	19	76	3	12	16	64
	10 and over	1937-1940	17	15	88	21	124	3	18	18	106
		1936 and earlier	49	29	59	35	71	3	6	32	65
Flexner (V and W)	Under 10	1937-1940	25	20	80	28	112	17	68	11	44
		1936 and earlier	11	9	82	9	82	7	64	2	18
	10 and over	1937-1940	12	5	42	7	58	5	42	2	17
		1936 and earlier	42	8	19	12	29	4	10	8	19

NEW ADMISSIONS AND SENIOR INMATES

Forty-one males and 12 females were admitted to the respective groups during the period in which Sonne infections were being found. In table 7 the findings on the boys admitted before December 1939 are compared with those on individuals admitted after this date. The prevalence of *Shigella dysenteriae* among those newly admitted was consistently higher. In July and November the only discovered infected individuals were in this group. It was clear that the presence of persons recently admitted facilitated the maintenance of the infection in the group. Similar variations in prevalence were observed in the females. The incidence of illness due to *Shigella dysenteriae* (Sonne) was markedly affected by the newly admitted individuals. During the last 9 months of observation of the boys, 11 of the 12 cases were among this small proportion of the inmates.

The influence of the duration of exposure in the institution on the prevalence of infection and incidence of illness is analyzed by person months of exposure in table 8. The majority (86 percent) of culturally positive illnesses occurred in the first 3 months of exposure. The total prevalence of infection was also highest during this period. For those who were under observation for a longer time there was a rapid decline in the incidence of disease and a more gradual decrease in the prevalence of carriers. After 6 months of exposure the carrier rate reached a low level which in the males, who were observed up to 15 months, continued without further decline.

TABLE 7.—*The prevalence of infection and incidence of illness due to Shigella dysenteriae Sonne in male and female inmates admitted before and after this infection was discovered in the respective groups*

MALES

Year and months	Inmates admitted before Dec. 1, 1939					Inmates admitted after Dec. 1, 1939				
	Number of routine examinations	Positive Sonne		Known new infections	Illness due to Sonne	Number of routine examinations	Positive Sonne		Known new infections	Illness due to Sonne
		Number	Percent				Number	Percent		
1939										
December	0	0	0	[1] 10	[1] 10	0	0	0	0	0
1940										
January	462	67	15	38	1	7	2	29	2	1
February	227	8	4	1	1	7	2	29	0	0
March	221	10	5	6	1	4	0	0	0	0
April	222	26	12	24	2	12	3	25	2	0
May	456	42	9	10	2	27	13	48	4	2
June	229	3	1	1	0	17	3	18	1	0
July	222	0	0	0	0	20	1	5	0	0
August	337	12	4	12	0	44	11	25	7	6
September	341	30	9	12	0	55	17	32	6	0
October	329	4	1	1	0	68	7	10	3	0
November	201	0	0	0	0	48	5	10	3	0
December	204	3	1	2	0	52	4	8	4	1
1941										
January	207	11	5	10	0	56	12	21	8	3
February	223	9	4	5	1	42	5	12	0	1
	3,881	225	6	132	18	457	85	19	40	14

FEMALES

	Inmates admitted before June 1, 1940					Inmates admitted after June 1, 1940				
1940										
June–August	1,549	187	12	91	13	15	2	13	2	1
September–November	947	38	4	22	0	48	5	10	4	3
December 1940–February 1941	816	16	2	15	1	56	4	7	4	1
	3,312	241	7	128	14	119	11	9	10	5

[1] Discovered through diagnostic tests.

The incidence of illness and the prevalence of carriers was higher in each time period (table 8) for those admitted after the infection was found in the cottages as compared with the males and females admitted earlier. There was, however, a striking decline in illnesses after 3 months and a high carrier rate in the second 3 months of exposure.

The new admissions were distributed throughout the whole period of Sonne infection. In spite of the declining prevalence of detected infections among those under continuous observation, these newly admitted individuals continued to show a high rate of infection. Thirteen entered in the 6 months after the discovery of Sonne in the groups and 10 (77 percent) were found infected during their first 3 months in the institution. Thirty-one were admitted in the later months of the study and 21 (68 percent) yielded positive cultures within 3 months. Thus, irrespective of differences in the detected

prevalence in inmates who had been in the groups from the date of the first discovery of Sonne infections, it could be shown that two-thirds or more of those newly admitted acquired at least one infecting dose of organisms within 3 months. To provide comparable observations table 8 presents only the results of routine examinations at intervals of 2 weeks. For 12 weeks after Sonne was first found in the female group fecal cultures were collected each week. These extra tests increased the known infected individuals by 22 (33 percent). These data indicate that more frequent observations would have shown a very high percentage of newly-admitted persons to be infected within 3 months of their entry into the groups. These recent arrivals were subject only to the same exposure as the other inmates. It may be concluded, therefore, that almost all of the old residents, as well as the new arrivals, acquired *Shigella dysenteriae* (Sonne) in sufficient numbers to infect susceptible individuals at least once in each 3-month period. The decline in prevalence of infection and incidence of disease was presumably a manifestation of a change in the reaction of the individual to the infection.

TABLE 8—*Shigella dysenteriae (Sonne) infections with and without associated illness found on routine examinations at intervals of 2 weeks by time of admission and by months following the beginning of exposure*

Months following beginning exposure	Group	Person[4] month of exposure to possible infection	*Shigella dysenteriae* (Sonne) infections found by routine examination at intervals of two weeks					
			With illness		Without illness		Total	
			Number	Per 100	Number	Per 100	Number	Per 100
1	Old Adm. M[1]	115	[5] 10	9				
	Old Adm. F.[2]	110	3	3	14	13	17	15
	New Adm.[3]	36	9	25	7	19	16	44
2-3	Old Adm. M	156	3	2	46	29	49	31
	Old Adm. F	161	10	6	39	24	49	[7] 30
	New Adm. M. & F	38	8	21	7	18	15	39
1-3	Total	616	43	7	113	[5] 23	146	[5] 29
4-6	Old Adm. M	271	3	1	31	11	34	13
	Old Adm. F	275	0	0	21	8	21	8
	New Adm. M. & F	34	1	3	13	38	14	41
	Total	580	4	1	65	11	69	12
Over 6	Old Adm. M	853	2	(6)	31	4	33	4
	Old Adm. F	310	1	(6)	14	5	15	5
	New Adm. M. & F	38	0	0	4	11	4	11
	Total	1,201	3	(6)	49	4	52	4

[1] Males admitted before Dec. 1, 1939.
[2] Females admitted before June 1, 1940.
[3] Males admitted after Dec. 1, 1939, and females admitted after June 1, 1940.
[4] That time in which a positive stool culture would be counted as a new infection or a reinfection.
[5] No routine examinations during first month. Positives were found on diagnostic tests.
[6] Less than 0.5.
[7] If cultural examinations had been omitted during the first month in the female group as in the males the observations for this period would have been 147 person months with 56 (38 per 100) discovered infections.
[8] Excluding from the computation the person months when males were not examined routinely.

The newly admitted individuals had 146 person months of exposure, a total of 49 known infections and 18 clinical cases of diarrhea. In contrast, there were 56 seniors who had 672 person months of exposure with no known infections. Assuming an equal hazard of coming in contact with the organism, as seemed probable from the living conditions within the cottages, it was estimated, by applying the observed rates for total infections in newly admitted, that the 56 individuals had at least 226 exposures. The organisms did not multiply or were not maintained so that they were found on culture. Whether they were actively destroyed by some protective mechanism was not evident from these data. Between these extremes there were individuals who first developed disease, later had one or two demonstrable infections without symptoms, and still later were presumably exposed with no resulting positive cultural findings.

CLINICAL VS. SUBCLINICAL INFECTIONS

Three varieties of *Shigella* were found. There was a marked difference in the proportion of these infections which resulted in clinical illnesses (table 9). The organism which most frequently gave rise to clinical symptoms was Flexner W. Exclusive of those infections in which its role in the etiology of disease was considered questionable, it accounted for 22 known infections, 20 (91 percent) with associated symptoms. There were, similarly, 44 known Flexner V infections, of which 24 (55 percent) resulted in clinical cases of diarrhea. Only 51 (16 percent) of a total of 310 Sonne infections had associated diarrheal disorders.

TABLE 9.—*The relation of illness to infection with different varieties of Shigella dysenteriae and to repeated infections with Shigella dysenteriae (Sonne)*

Variety of *Shigella dysenteriae*	Known infections [1]								
	Male			Female			Male and female		
	Total	With illness		Total	With illness		Total	With illness	
		Number	Percent		Number	Percent		Number	Percent
Flexner W	3	2	67	19	18	95	22	20	91
Flexner V	1	0	0	43	24	56	44	24	55
Sonne—Total	172	32	19	138	19	14	310	51	16
First infection	111	29	26	109	19	17	220	48	22
Second infection	48	3	6	28	0	0	76	3	4
Third infection	13	0	0	1	0	0	14	0	0

[1] Exclusive of those in which the history as to illness was uncertain.

There was a difference in the individual's response to the first and subsequent infections. One hundred and eleven males were found to be infected with Sonne, 63 once only, 35 twice, and 13 three times. In the female group 109 were found infected with this organism, 81 once, 27 twice, and 1 three times. Symptoms were associated with 48 (22 percent) of the 220 first infections, but with only 3 (4 percent) of the 76 second infections. In the latter group there was an individual who after the initial attack had a persisting but very mild disorder not clinically significant according to our criteria. After 3 negative cultures the symptoms became clinically significant for a few days and the stool culture was again positive. In the others, the infections were clearly multiple but in 1 the first was without symptoms. No illness was observed with any of the 14 third infections. Flexner reinfections occurred in only 18 cases and two varieties of this organism were involved. This small number did not permit significant comparisons.

During the routine examinations, when specimens from all inmates, well and ill, were cultured, there were 191 isolations of Flexner and 562 of Sonne. Of these, 28 (15 percent) of the Flexner and 23 (4 percent) of the Sonne were obtained from individuals who were ill on the day the specimens were collected. The observed crude ratios of prevalence of clinical infection to carrier states (incubatory, convalescent, and passive) were 1:7 for Flexner and 1:24 for Sonne. Many of the illnesses, particularly those due to Sonne, were mild and of short duration. It would be possible for this infection to be widespread in a group such as those studied and remain undetected, since mild disorders are not usually examined bacteriologically.

During the first 10 months of the study *Shigella dysenteriae* (Flexner) infection was prevalent among the females. Approximately one-half of these inmates were found to have been infected within this period. Sonne was first isolated 1 month later. A comparison of individuals observed at least 10 times during each period is shown in table 10. Those individuals previously infected with Flexner had a crude incidence of Sonne infection which was somewhat higher than for those with no previous positive findings. The former, as a group, were younger than the latter. An age specific comparison revealed that Sonne infections occurred with equal frequency among those previously infected with *Shigella dysenteriae* (Flexner) and those who had had no known recent infection with these organisms.

MODES OF DISSEMINATION

Observations in this field are presented in connection with part B of this report bringing together the data on all institutions studied.

TABLE 10.—*Shigella dysenteriae (Sonne) infections and illnesses related to the previous known occurrence of Flexner infections*

History of preceding Flexner infections	Number of individuals [1]	Subsequent Sonne infections			
		Total		With illness	
		Number	Percent	Number	Percent
Positive	54	44	81	6	14
Negative	60	40	67	7	18
Total	114	84	74	13	15

[1] Examined 10 or more times both in the period of Flexner and of Sonne infections.

FOLLOW-UP

The study as reported was discontinued in February 1941. Follow-up observations were made 9 months later.

Endemic diarrhea had persisted among the boys, but the cases had been few in number. The girls had been notably free of diarrheal diseases. Cultural examinations were obtained rarely but two of the hospitalized cases in the boys had positive reports for Sonne. During late October and early November 1941, we secured three cultures at weekly intervals from all inmates of the two cottages. Sonne infection was found in both groups. At the time 5 males (2 cases and 3 carriers) and 1 female (a carrier) were positive.

The continuous occurrence of the infection is not established by our findings but we favor this interpretation for these reasons: (1) Preceding observations revealed the tendency of the infection to maintain itself in the groups; (2) the positive cases during the summer revealed the presence of the infection among the boys at that time; and (3) during 20 months there was only one known introduction of *Shigella* to this institution. If the groups had become free of infection, a reintroduction of Sonne to both cottages within the 9 months would be improbable.

The natural course of the infection was not followed further. All cases and carriers were isolated and treated with sulfaguanidine until they became negative. Subsequent observations during a 4-month period indicated that the groups remained free of all *Shigella dysenteriae* infections.

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STUDIES OF THE ACUTE DIARRHEAL DISEASES

IX B. *SHIGELLA DYSENTERIAE* INFECTIONS AMONG INSTITUTIONAL INMATES[1]

By JAMES WATT, *Passed Assistant Surgeon, United States Public Health Service,* ALBERT V. HARDY, *Surgeon* (R), *United States Public Health Service,* and *Associate Professor of Epidemiology, DeLamar Institute of Public Health, Columbia University,* and THELMA DECAPITO, *Junior Bacteriologist, United States Public Health Service*

In part A of this paper, Hardy and associates reported an investigation of *Shigella dysenteriae* infections among institutional inmates in New York State. The findings in other institutions located in New Mexico, Vermont, Georgia, Puerto Rico, and New York are presented here.

AN ORPHANAGE

Attention was called to this small institution late in the fall of 1937 through the occurrence of 4 severe cases of bacillary dysentery among the 20 infants then in residence. At that time it was planned to follow the inmates by repeated cultures during the ensuing summer and fall. Work was resumed in the field laboratory in late June 1938, and weekly stool examinations were begun. A nurse was assigned one day each week to collect specimens of all stools passed during the day and to bring them to the laboratory in glycerine-saline preservative. The specimens obtained were from stools passed normally, hence it was usual for one or more of the children to remain unexamined each week.

From July to late December 1938, 24 weekly observations were made, with findings as given in table 1. The maximum number of children on the ward was 23; the usual number was 2 to 4 less. In all, 25 infants or young children were studied, and of these, 18 (72 percent) were positive at some time during the period. The routine tests per person varied from 2 (in a debilitated infant who died shortly after admission) to 22. A total of 413 stool specimens was obtained during the routine examinations and 43 (10.7 percent) yielded recognized pathogenic varieties of *Shigella dysenteriae.* In addition, 16 diagnostic specimens were collected from children with diarrheal disorders and 10 (62.5 percent) of these were positive.

There were 25 known infections with *Shigella dysenteriae,* 16 subclinical, and 9 with clinical manifestations. These associated disorders (in all instances due to Sonne), were mild. In 5 there was diarrhea only, with 4 to 6 stools daily; in the others, the only additional symptoms were low-grade fever, loss of appetite, or vomiting. The

[1] From the Division of Infectious Diseases, National Institute of Health, and the DeLamar Institute of Public Health, Columbia University.

duration of the illnesses was less than 1 week and commonly 3 or 4 days. There were 6 attacks of diarrhea without related positive cultures. Three of these occurred with upper respiratory infections and 2 others in a young, malnourished infant diagnosed clinically as a feeding problem.

TABLE 1.—*Shigella dysenteriae infections and acute diarrheal disorders in the infant ward of an orphanage July–December 1938*

Age on entering study	Individuals		Fecal cultures		Infections with *Shigella dysenteriae* and reported diarrheal disorders				
	Examined	Positive for *Shigella dysenteriae*	Examined	Positive for *Shigella dysenteriae*	Total infections	Subclinical infections	Infections with related illness	Illness without known infection	Total diarrheal disorders
0–2 months	5	0	43	0	0	0	0	2	2
3–24 months	9	9	188	19	12	5	7	2	9
2–3 years	6	5	92	11	8	6	2	2	4
4 years	5	4	90	13	5	5	0	0	0
Total	25	18	413	43	25	16	9	6	15

The variation in findings by age is also shown in table 1. The 5 infants who were under 3 months of age on entering the study, were culturally negative. One had the two bouts of diarrhea mentioned above. The 9 infants of 3 to 24 months of age had 12 infections, with related symptoms in 7. The 6 children of 2 and 3 years had 8 attacks, with related symptoms in 2 only. The 5 infections in the children of 4 years of age occurred without noted symptoms. In this small series *Shigella dysenteriae* was found with equal frequency in children 3 months old or more, but there was a progressive decrease in related symptoms in older children.

Four known varieties of the *Shigella* group were isolated during the study. Flexner V was found on the initial test and recovered from the same individual on 8 of 9 successive examinations. It was not obtained from any other patient. Later, on August 29th, there was a single isolation of Flexner W. This was the only time this organism was found. Newcastle was identified in 4 of 6 successive examinations of a newly-admitted patient. The Sonne infection (present on the first test) was the only one which spread widely and persistently, infecting 16, and reinfecting 6 of these. It was found on 14 of the 24 weekly examinations, with a maximum of 3 successive weeks with negative findings.

In addition to these accepted "positive" organisms, two other varieties were isolated. On the basis of their biochemical characteristics they would be classified as *Shigella*. The cultural reactions of one of these were consistently those of Flexner strains, but the organisms failed to agglutinate in any of our Flexner antisera. They were isolated on November 15th from 4 individuals and on the following week from 2

different persons. The other strain did not ferment mannite and produced indol. It was not agglutinated by Schmidt's or any other known antisera and remained unclassified. It was isolated 29 times from 15 individuals throughout the period of observation. The presence of these organisms could not be related to the occurrence of diarrheal disorders.

A SCHOOL FOR THE MENTALLY DEFECTIVE

At the request of the Vermont State Board of Health, an investigation was made in a school for the mentally defective in which there had been an outbreak of diarrheal disease. This had occurred in the cottage which housed 58 male low-grade defectives. The majority of these individuals were adolescents, only 7 being under 10 and 6 over 20 years of age. The first case appeared on October 17 and during the next 10 days four additional cases developed. However, from October 27th to November 13th there were 27 new cases. Twelve additional individuals were attacked during the next 3 months. Three of the 44 cases terminated fatally. In the corresponding cottage for females there were two cases in November and three in March. From 4 other cottages there had been reported three cases in November and 1 in March.

Despite the lack of acute cases of enteric disorder when the institution was visited in March 1940, stool cultures were taken from the inmates of the two cottages for the low-grade defectives to determine the prevalence and distribution of *Shigella dysenteriae* infections. On the second visit, 1 month later, all of the 337 inmates of the 6 cottages were cultured. The findings are reported in table 2. Flexner strains only were isolated and with one exception these were the "W" variety. One boy yielded in April an atypical Flexner which was not typed with certainty. The findings do not establish the relationship between the organisms isolated and the outbreak of diarrheal disease. The absence of detected infection among the more normal inmates was in contrast to the observed high prevalence in the very defective individuals.

TABLE 2.—*Stool cultures for Shigella dysenteriae from inmates of a school for the mentally defective*

Groups	First test			Second test		
	Inmates cultured	Positive	Positive for Flexner	Inmates cultured	Positive	Positive for Flexner
Low grade inmates:		*Number*	*Percent*		*Number*	*Percent*
Male	50	4	8	48	3	6
Female	67	7	10	68	6	9
Other inmates				221	0	0
Total	117	11	9	337	9	3

TWO MENTAL HOSPITALS

During the spring and summer of 1940 five series of stool examinations were made on three groups of inmates in the Georgia State Hospital for the insane. One group, A, was selected because they were under especially careful observation by another group of workers, and a more accurate determination of the presence of diarrheal disorders was thus possible. Group B was entirely similar but under routine ward care and group C, examined only three times, was colored, and included to determine if there might be any difference in the two races. All groups were adult females with generally advanced psychoses.

No diarrheal disorders were reported during the period of observation but one patient, on culture, was found to have mushy feces with mucus.

A total of 910 cultures were taken and 19 (2.1 percent) of these yielded some variety of *Shigella dysenteriae* (Flexner) distributed as shown in table 3. Three strains were readily differentiated. All strains isolated from the inmates of group A during the first three examinations and one of the two in September were identical in cultural and serological reactions. Three of the four individuals positive on the first test were also positive on the second or third examination or both. The three organisms found in July in group B were of a second type and these were not encountered at any other time. The remaining five scattered positives in May, July, and September were Flexner W, one of the most commonly encountered varieties.

TABLE 3.—*Stool cultures for Shigella dysenteriae from inmates of a mental hospital in Georgia*

Month	White females				Colored females	
	Group A		Group B		Group C	
	Cultured	Positive	Cultured	Positive	Cultured	Positive
March	72	4	72	0	0	0
April	72	3	72	0	61	0
May	72	3	72	0	59	1
July	72	1	72	3	70	1
September	72	2	72	1	0	0
Total	360	13	360	4	190	2

The second mental hospital, in Puerto Rico, was studied in the spring of 1941. All inmates of five wards were cultured on one occasion only. The findings are given in table 4. Patients similar to those studied in the first hospital were cared for in wards A to D. There were 26 (7 percent) positive specimens in the 389 examined.

Accurate records of minor diarrheal disorders were not available but moderate and severe attacks were known. Two of the infected individuals were reported to have been sick within 1 month prior to examination. In contrast, on the "Dispensary Ward," with 73 patients, 29 (40 percent) were found to be infected, of which 16 had diarrhea when examined and 6 others were reported to have been ill recently.

TABLE 4.—*The occurrence of Shigella dysenteriae infections in five wards of a mental hospital in Puerto Rico*

Group	Individuals examined by single fecal cultures			Variety of *Shigella*				
	Number	Positive for *Shigella dysenteriae*		Flexner				Newcastle
		Number	Percent	V	W	Z	Other	
Ward A—Females	102	7	7	3	1	0	0	3
B—Females	105	3	3	0	0	1	1	1
C—Females	115	5	4	0	0	1	0	4
D—Males	67	6	9	0	3	0	0	3
E [1]—Males	73	26	36	.....	14	3	1	8
Total	462	47	10	3	18	5	2	19

[1] A ward used for the care of patients with mild to moderate physical ailments, including diarrheal disorders.

Five varieties of *Shigella dysenteriae* were found, four Flexner and Newcastle. One of these was isolated only from females. The others were distributed in both sections of the hospital.

SUBSEQUENT OBSERVATIONS

Our recent studies of chemotherapy in *Shigella* infections have been conducted largely in institutions. Further data on the subject of this report have accumulated. The high incidence and the multiple varieties of *Shigella* have continued in Puerto Rico. A mental hospital in New York State had *Shigella dysenteriae* infections in epidemic proportions from June through October 1941. Five months later survey cultures revealed that the infection was actively spreading in some wards (with few and mild clinical cases), but in others it was spreading little if at all. A majority of the wards were entirely free of infection. In contrast with this, and with findings reported above, in another New York State hospital and in a school for the mentally defective, diarrheal disease had not been a significant problem for at least 3 years. Survey cultures were obtained from a general sample of the inmates, from a larger sample of the young idiots and the disturbed and unclean patients, also from individuals with recent minor diarrheal disorders. *Shigella dysenteriae* was not found. Some, possibly many, institutions in northern States are maintained free of *Shigella dysenteriae.*

TABLE 5.—*The prevalence of Shigella dysenteriae infections in institutional inmates related to the relative incidence of diarrheal disease in the general population and to the sanitary conditions in the institutions*

Institution	Group(s) examined	Location	Month and year of study	Survey stool cultures			Relative incidence of diarrheal diseases in area served by institution	General sanitary condition in institutions					
				Number	Positive			Water	Milk	Excreta disposal facilities	Flies	Cleanliness	
					Number	Percent						Environmental	Personal
1. Orphanage.	Infants and young children.	New Mexico	June–Dec. 1938.	413	43	11	High	Safe public	Pasteurized and canned.	Satisfactory.	Few	Good	Fair.
2. For mentally defective.	Low grade defectives—Male and female.	New York	June 1939 to Feb. 1941.	11,117	755	7	Very low	Safe private	Pasteurized	Excellent.	Few to none.	Excellent.	Poor.
3. For mentally defective.	(*a*) Low-grade defectives; (*b*) High-grade defectives.	Vermont	March and April 1940.	(*a*) 233 (*b*) 221	20 0	9 0	Very low	Safe public	Raw private.	Satisfactory.	None	Satisfactory.	Poor.
4. Mental hospital.	Three wards for females.	Georgia	April-Oct. 1940.	910	19	2	Medium	Safe public.	Private	Poor	Moderate.	Fair	Poor.
5. Mental hospital.	(*a*) Four general wards-(*b*) The dispensary ward.	Puerto Rico	April-May 1941.	(*a*) 389 (*b*) 73	21 26	5 36	Very high	Probably safe public	Canned	Poor	Moderate.	Fair	Poor.

MODES OF DISSEMINATION

The prevalence of *Shigella dysenteriae* infections, as found by the examination of all individuals in the institutional groups studied, varied from 0 to 30 percent. For comparative purposes in table 5 the prevalence is shown in relation to the relative incidence of diarrheal diseases in the respective geographical areas and to the conditions of general sanitation and cleanliness in the institutions.

The prevalence of *Shigella dysenteriae* infection was high in all institutions studied (excluding recent surveys), in spite of the variation in incidence of diarrheal diseases in the general population from which these patients were drawn. In only one instance (Ward E, Mental Hospital II) were the infections concentrated in the group observed, through transferring to it patients with diarrheal disorders.

The water used in four of the five institutions was drawn from a public supply; the one private supply was filtered and chlorinated. In one instance only was its safety open to question. The milk was of satisfactory quality. The continuous spread of the infection was strongly against this or any other article of food being responsible for the dissemination of these infections. Excreta disposal in all institutions was by flush toilets, but these were inadequate in number in both mental hospitals. Flies were very rare in the two institutions for the mentally defective and were common only in Mental Hospital II. In their absence the infections spread readily.

The general cleanliness of the environment was excellent in the New York institution for mental defectives where a high prevalence of *Shigella dysenteriae* was observed. It was good in the orphanage and the school for the mental defectives but only fair in the two mental hospitals. A portion of the individuals examined gave some care to personal cleanliness. Many of them, particularly the low-grade mental defectives, those with advanced psychoses, and the young children in the orphanage frequently soiled themselves and their environment with feces. Person-to-person transfer of fecal pollution could occur easily in all of these institutional groups.

SUMMARY

(1) The prevalence of *Shigella dysenteriae* infection among institutional inmates was determined by 13,356 survey stool cultures, of which 885 (6.6 percent) were positive.

(2) The prevalence in the same group at different times was found to vary from no detected infections to a maximum of 26 percent known infected at one time.

(3) The detected infections in different groups varied from none to a maximum of 36 percent positive at one time.

(4) Different varieties of *Shigella* were found in the same and different groups.

(5) The course of *Shigella dysenteriae* (Sonne) infection as observed in two groups is described.

(6) Sonne infections were maintained by a constantly changing group of transient carriers.

(7) Flexner infections were not maintained with the same persistence as Sonne.

(8) Characteristically the *Shigella* infections spread slowly. In one group periods of more rapid spread and high prevalence alternated with intervals of little spread and low prevalence.

(9) Infection rates were determined for two groups through routine cultures at intervals of 2 weeks for 20 months. The minimal total annual infection rates in these groups were 87 and 115 per 100 inmates. The attack rates of clinical infections were 16 and 33, respectively. Thus the minimal carrier incidence rates were 73 and 82 per 100 inmates per annum.

(10) Attack rates were higher in newly-admitted individuals than in "senior" inmates.

(11) The ratio of clinical to subclinical infection was found to vary with the variety of *Shigella*, the occurrence of preceding infections with the same variety of microorganism, and the age of the individuals.

(12) The ratio of clinical infections to carrier states in one institution was 1:7 for Flexner and 1:24 for Sonne.

(13) Preceding Flexner infections conferred no detectable protection against subsequent Sonne invasions.

(14) The probable mode of dissemination in these groups was through person-to-person transmissal of fecal pollution.

DISCUSSION AND CONCLUSIONS

The observations presented in these papers (IX A and IX B) will be discussed in association with the findings in the surveys of general population groups and of household contacts. These and other data will be used in considering the epidemiology of *Shigella dysenteriae* infections.

A STUDY OF THE POLLUTION AND NATURAL PURIFICATION OF THE SCIOTO RIVER[1]

A Review

Hydrometric, bacteriological, chemical, plankton and bottom sediment studies were made of the Scioto River for 115 river miles below Columbus, Ohio, during a period of 30 months, involving three types of sewage treatment at Columbus, the point of heaviest pollution of the Scioto. These periods were, first, 10 months treatment, overloaded trickling filter; second, 8 months treatment, plain sedimentation; and third, 12 months treatment, activated sludge.

The bacteriological and chemical data were grouped according to three temperature and five discharge ranges and in addition, for the upper half of the river, the three periods of varying pollution at Columbus. Rates of decrease of bacteria in the river were linear when plotted on semi-log paper in the upper, heavily polluted stretch and, roughly so, at low stages downstream. At progressively higher discharges, rates of bacterial decrease were less in the relatively less polluted, lower half of the stream. Rates of bacterial decrease were greater at higher temperatures and were in the approximate range of previously observed rates on the Ohio and Illinois Rivers. Dissolved oxygen profiles at the different temperature and flow ranges, and periods of varying pollution, form a nicely graduated set of oxygen sag curves.

The Scioto proved to be highly productive of plankton algae and protozoa, exceeding both in the variety of species and in total plankton volume, that of previously reported streams.

Bottom sediments were found to form a stable record of the average quality of water in the stream during the period of their formation.

DEATHS DURING WEEK ENDED JULY 11, 1942

[From the Weekly Mortality Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended July 11, 1942	Corresponding week 1941
Data from 85 large cities of the United States:		
Total deaths	7,466	7,841
Average for 3 prior years	7,717	
Total deaths, first 27 weeks of year	229,248	233,409
Deaths per 1,000 population, first 27 weeks of year, annual rate	12.0	12.3
Deaths under 1 year of age	532	580
Average for 3 prior years	494	
Deaths under 1 year of age, first 27 weeks of year	14,752	13,758
Data from industrial insurance companies:		
Policies in force	65,388,272	64,375,458
Number of death claims	10,268	11,583
Death claims per 1,000 policies in force, annual rate	8.2	9.4
Death claims per 1,000 policies, first 27 weeks of year, annual rate	9.7	10.1

[1] Public Health Bulletin No. 276, A Study of the Pollution and Natural Purification of the Scioto River, by Past Assistant Sanitary Engineer Robert W. Kehr and others. Government Printing Office 1941. For sale by the Superintendent of Documents, Washington, D. C. Price 20 cents.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JULY 18, 1942

Summary

The incidence of meningococcus meningitis continues high for this season of the year. For the current week it is nearly twice as high as the 5-year (1937–41) median and higher than for the corresponding week of any other year since 1937. A total of 63 cases was reported currently, as compared with 61 cases for the preceding week. The largest numbers of cases are still occurring in the eastern States. The New England States (10), Middle Atlantic (17), South Atlantic (9), and East South Central States (8) reported 70 percent of the current total. Missouri, with 7 cases, was the only State outside these areas which reported more than 3 cases for the week.

A total of 83 cases of poliomyelitis was reported, as compared with 59 last week and a 5-year median of 143. The highest incidence is in the South Central States, which reported 38 cases, and the East North Central States, which reported 16 cases. Kentucky reported 17 cases (2 for the preceding week), and Arkansas reported 11 (12 for each of the two preceding weeks).

Of 16 cases of smallpox (9 last week, 13 for the corresponding week last year), 7 cases occurred in Tennessee.

Other reports include 6 cases of anthrax (2 each in Pennsylvania and Texas, and 1 each in Maine and Louisiana), 356 cases of bacillary dysentery (261 in Texas), 386 cases of unspecified dysentery (351 in Virginia), 17 cases of amebic dysentery, 13 scattered cases of infectious encephalitis, 17 cases of Rocky Mountain spotted fever (of which only 3 were in the northwestern Mountain States, 27 cases of tularemia, and 58 cases of endemic typhus fever (26 in Texas, 10 in Georgia, and 9 in Alabama).

The death rate for the current week in 88 large cities of the United States is 11.0 per 1,000 population, as compared with 10.6 for the preceding week and a 3-year (1939–41) average for the week of 10.2. The accumulated rate to date this year is 12.0, as compared with 12.2 for the corresponding period last year, when a record low rate of 10.5 for the entire year was reported by the Bureau of the Census.

Telegraphic morbidity reports from State health officers for the week ended July 18, 1942, and comparison with corresponding week of 1941 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1937–41	Week ended		Median, 1937–41,	Week ended		Median, 1937–41,	Week ended		Median, 1937–41
	July 18, 1942	July 19, 1941		July 18, 1942	July 19, 1941		July 18 1942	July 19, 1941		July 18, 1942	July 19, 1941	
NEW ENG.												
Maine	0	0	1	------	------	------	36	68	50	2	0	0
New Hampshire	0	0	0	------	------	------	3	6	6	0	0	0
Vermont	0	0	0	------	------	------	71	25	25	0	0	0
Massachusetts	8	1	3	------	------	------	232	307	307	4	0	1
Rhode Island	2	1	0	------	------	------	41	13	13	2	0	0
Connecticut	0	3	3	------	2	2	75	117	51	2	0	0
MID. ATL.												
New York	9	11	21	[1]3	[1]1	[1]3	368	491	615	9	4	3
New Jersey	5	3	6	2	------	------	170	251	247	2	0	0
Pennsylvania	12	2	15	1	------	------	121	679	480	6	2	2
E. NO. CEN.												
Ohio	4	7	7	12	5	4	64	250	233	0	0	1
Indiana	3	2	6	1	13	12	16	23	10	0	2	2
Illinois	14	15	17	9	7	7	51	106	106	1	1	1
Michigan [2]	2	3	6	1	1	------	42	253	241	1	0	1
Wisconsin	0	1	2	12	9	9	352	373	373	0	0	0
W. NO. CEN.												
Minnesota	0	1	1	1	2	1	54	6	23	0	0	0
Iowa	0	1	2	------	1	1	45	31	53	0	0	0
Missouri	0	3	4	1	------	------	31	49	15	7	0	0
North Dakota	1	1	1	------	------	------	9	8	8	1	0	0
South Dakota	1	5	1	------	------	------	8	2	2	0	1	0
Nebraska	2	0	1	5	3	------	55	7	8	0	0	0
Kansas	2	1	2	3	1	1	33	44	21	0	0	0
SO. ATL.												
Delaware	0	0	0	------	------	------	1	4	2	0	0	0
Maryland [2]	1	0	2	1	1	2	40	181	27	2	5	1
Dist. of Col	2	0	5	------	------	------	13	30	30	1	0	0
Virginia	5	1	11	76	36	17	24	182	65	2	0	4
West Virginia	2	3	3	1	1	7	23	55	41	1	1	1
North Carolina	4	7	7	------	1	1	31	176	86	0	0	2
South Carolina	8	3	3	67	78	69	8	116	8	1	0	1
Georgia	4	3	3	7	11	9	20	73	9	1	1	1
Florida	2	3	3	4	9	------	34	6	10	1	0	0
E. SO. CEN.												
Kentucky	0	4	4	------	------	------	8	49	24	3	2	2
Tennessee	2	0	3	4	12	12	15	67	25	0	0	0
Alabama	4	3	5	3	3	9	16	41	23	3	3	3
Mississippi [2]	6	1	3	------	------	------	------	------	------	2	0	0
W. SO. CEN.												
Arkansas	4	3	5	2	15	5	12	57	23	0	2	2
Louisiana	2	5	4	4	1	11	11	1	3	1	1	1
Oklahoma	3	2	3	10	16	7	2	11	14	0	0	0
Texas	13	22	22	106	348	87	52	103	103	3	0	0
MOUNTAIN												
Montana	0	2	1	4	1	------	31	6	8	0	0	0
Idaho	1	0	0	------	------	------	2	2	3	0	0	0
Wyoming	0	0	0	13	------	------	34	3	2	0	0	0
Colorado	1	11	9	34	5	------	40	24	29	1	0	0
New Mexico	0	1	0	1	------	------	2	17	17	0	0	0
Arizona	0	0	2	9	25	18	42	49	14	0	1	0
Utah [2]	0	0	0	------	2	------	169	8	32	1	0	0
Nevada	0	0	------	------	------	------	5	1	------	1	0	------
PACIFIC												
Washington	0	0	0	------	------	------	188	8	22	0	0	0
Oregon	2	0	0	6	1	4	43	30	30	0	0	0
California	10	13	16	28	30	16	512	146	146	2	0	1
Total	141	148	242	431	641	387	3,255	4,555	3,912	63	26	34
28 weeks	6,619	6,673	10,666	78,995	486,582	157,903	458,682	813,955	342,249	2,143	1,271	1,271

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended July 18, 1942—Continued

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median 1937–41	Week ended		Median 1937–41	Week ended		Median 1937–41	Week ended		Median 1937–41
	July 18, 1942	July 19, 1941		July 18, 1942	July 19, 1941		July 18, 1942	July 19, 1941		July 18, 1942	July 19, 1941	
NEW ENG.												
Maine	3	0	0	0	6	6	0	0	0	1	1	0
New Hampshire	0	0	0	4	3	3	0	0	0	0	0	0
Vermont	0	0	0	5	1	1	0	0	0	0	0	0
Massachusetts	2	0	1	85	37	51	0	0	0	2	0	1
Rhode Island	0	0	0	2	5	5	0	0	0	0	0	0
Connecticut	0	0	0	2	10	12	0	0	0	3	1	2
MID. ATL.												
New York	3	6	6	79	90	134	0	0	0	12	33	14
New Jersey	2	5	2	30	44	31	0	0	0	1	5	5
Pennsylvania	0	6	1	92	43	101	0	0	0	9	6	14
E. NO. CEN.												
Ohio	3	0	1	67	51	80	0	0	0	13	8	8
Indiana	3	2	1	10	9	18	1	0	2	0	2	8
Illinois	6	5	5	71	59	83	0	1	3	3	8	17
Michigan [3]	4	6	5	37	79	85	1	1	1	2	17	3
Wisconsin	0	0	0	34	29	42	0	2	2	4	0	0
W. NO. CEN.												
Minnesota	0	1	1	27	27	27	1	0	7	1	0	0
Iowa	2	4	1	7	13	13	0	0	6	5	8	2
Missouri	3	0	1	13	12	18	0	4	4	6	4	7
North Dakota	0	1	0	3	0	4	0	0	3	1	0	0
South Dakota	0	1	0	4	6	6	2	0	0	1	0	0
Nebraska	0	0	1	7	10	5	1	0	0	0	0	0
Kansas	1	0	0	19	9	20	0	0	1	2	1	6
SO. ATL.												
Delaware	0	0	0	3	0	0	0	0	0	0	0	1
Maryland [3]	0	4	0	11	14	14	0	0	0	4	20	12
Dist. of Col	1	1	0	12	1	3	0	0	0	1	0	3
Virginia	1	2	2	6	3	8	0	0	0	7	7	18
West Virginia	0	1	1	12	8	12	0	1	0	8	10	9
North Carolina	1	8	3	8	7	11	0	0	0	12	6	19
South Carolina	0	9	1	3	2	2	0	0	0	4	12	15
Georgia	2	91	4	1	11	8	0	0	0	19	23	24
Florida	0	13	1	4	3	3	0	0	0	7	1	1
E. SO. CEN.												
Kentucky	17	4	4	16	15	11	2	0	0	15	8	37
Tennessee	5	12	2	12	11	10	7	0	0	15	14	32
Alabama	3	46	3	12	8	8	0	0	0	10	6	13
Mississippi [3]	0	12	3	2	1	3	0	0	0	11	7	9
W. SO. CEN.												
Arkansas	11	1	1	3	4	4	1	1	0	14	14	28
Louisiana	1	2	2	5	8	7	0	0	0	11	13	21
Oklahoma	0	0	1	10	13	7	0	1	1	6	8	20
Texas	1	8	8	14	14	17	0	0	0	27	38	40
MOUNTAIN												
Montana	0	1	0	3	10	8	0	0	0	0	0	1
Idaho	0	0	0	0	2	2	0	0	0	1	0	2
Wyoming	0	0	0	5	2	1	0	0	0	2	0	0
Colorado	0	0	0	9	8	9	0	0	3	2	4	4
New Mexico	1	1	1	3	1	3	0	0	0	4	7	5
Arizona	0	0	0	1	0	2	0	1	1	0	0	4
Utah [3]	0	0	0	5	4	6	0	0	0	0	1	1
Nevada	1	0	------	0	0	------	0	0	------	1	0	------
PACIFIC												
Washington	0	0	0	14	11	13	0	0	0	2	1	2
Oregon	0	0	0	6	1	10	0	0	1	0	4	4
California	3	1	15	53	42	64	0	1	7	5	10	10
Total	83	249	143	831	747	960	16	13	74	254	308	437
28 weeks	751	1,186	1,024	85,950	86,675	112,675	593	1,122	7,557	2,846	3,201	4,601

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended July 18, 1942—Continued

Division and State	Whooping cough		Week ended July 18, 1942								
	Week ended—		Anthrax	Dysentery			Encephalitis, infectious	Leprosy	Rocky Mt. spotted fever	Tularemia	Typhus fever
	July 18, 1942	July 19, 1941		Amebic	Bacillary	Unspecified					
NEW ENG.											
Maine	21	28	1	0	0	0	0	0	0	0	0
New Hampshire	3	7	0	0	0	0	0	0	0	0	0
Vermont	57	0	0	0	0	0	0	0	0	0	0
Massachusetts	195	172	0	0	0	0	0	0	0	0	0
Rhode Island	6	28	0	0	0	0	0	0	0	0	0
Connecticut	54	38	0	0	0	0	0	0	0	0	0
MID. ATL.											
New York	393	291	0	3	6	0	1	0	0	0	0
New Jersey	353	118	0	1	0	0	0	0	1	0	0
Pennsylvania	235	336	2	0	1	0	0	0	0	0	0
E. NO. CEN.											
Ohio	224	337	0	0	0	0	0	0	0	2	0
Indiana	51	14	0	0	0	0	0	0	0	0	0
Illinois	310	158	0	0	0	0	2	0	0	1	0
Michigan [2]	198	302	0	0	4	0	0	0	0	0	0
Wisconsin	208	161	0	0	0	0	1	0	0	1	0
W. NO. CEN.											
Minnesota	71	92	0	0	0	0	0	0	0	2	0
Iowa	44	45	0	0	0	0	0	0	1	1	0
Missouri	21	56	0	0	0	2	0	0	1	0	0
North Dakota	0	19	0	0	0	0	0	0	0	0	0
South Dakota	1	19	0	0	0	0	0	0	0	0	0
Nebraska	25	13	0	0	0	0	0	0	0	0	0
Kansas	63	147	0	0	0	0	2	0	0	2	0
SO. ATL.											
Delaware	2	5	0	0	0	0	0	0	0	0	0
Maryland [2]	35	103	0	0	0	2	0	0	4	0	0
Dist. of Col	15	9	0	0	0	0	0	0	0	0	0
Virginia	49	101	0	0	0	351	0	0	0	2	0
West Virginia	35	29	0	0	0	0	0	0	0	0	0
North Carolina	87	297	0	0	0	0	0	0	5	0	3
South Carolina	42	106	0	0	0	0	0	0	0	0	2
Georgia	49	46	0	0	8	0	0	0	0	2	10
Florida	29	1	0	3	1	0	0	0	0	0	9
E. SO. CEN.											
Kentucky	72	49	0	1	1	0	0	0	1	2	0
Tennessee	40	39	0	0	0	20	0	0	0	2	1
Alabama	42	23	0	0	0	0	1	0	0	0	5
Mississippi [2]			0	0	0	0	0	0	0	1	1
W. SO. CEN.											
Arkansas	52	23	0	2	28	0	0	0	0	3	0
Louisiana	12	43	1	1	36	0	1	0	0	0	0
Oklahoma	5	38	0	0	0	0	0	0	1	2	0
Texas	187	190	2	3	261	0	0	0	0	1	26
MOUNTAIN											
Montana	16	35	0	0	0	0	2	0	0	0	0
Idaho	15	26	0	0	0	0	0	0	0	0	0
Wyoming	4	15	0	0	0	0	0	0	1	3	0
Colorado	38	165	0	0	0	0	0	0	0	0	0
New Mexico	26	37	0	1	1	0	0	0	1	0	0
Arizona	14	24	0	0	0	11	0	0	0	0	0
Utah [2]	28	112	0	0	0	0	0	0	0	2	0
Nevada	3	9	0	0	0	0	0	0	0	0	0
PACIFIC											
Washington	52	110	0	0	0	0	2	0	0	0	0
Oregon	27	46	0	0	0	0	0	0	1	0	0
California	190	408	0	2	9	0	1	0	0	0	1
Total	3,699	4,464	6	17	356	386	13	0	17	27	58
28 weeks	105,735	128,402									

[1] New York City only.
[2] Period ended earlier than Saturday.

PLAGUE INFECTION IN CALIFORNIA AND OREGON

Plague infection has been reported proved in specimens collected in California and Oregon as follows:

CALIFORNIA

Kern County: April 30, in a pool of 200 fleas from burrows of ground squirrels, *C. beecheyi*, and in a pool of 28 fleas from 3 ground squirrels, same species, taken 1 mile south of California State Institution for Women; May 6, in a pool of 276 fleas from 34 ground squirrels, also *C. beecheyi*, taken 1 mile east of Lebec, Castac Lake area.

Lassen County: May 31, in a pool of 120 fleas from a burrow of ground squirrels, *C. beldingi*, 3 miles south and 9 miles east of Amedee; June 20, in a pool of 22 fleas from 43 ground squirrels, *C. oregonus*, taken 2 miles north and 2½ miles west of Janesville.

Monterey County: In tissue from ground squirrels, *C. beecheyi*, as follows: May 14, in a pool of tissue from 5 ground squirrels taken 3 miles northeast of Lockwood, and May 15, in a pool of tissue from 3 ground squirrels from the same location. In pools of tissue and ectoparasites from ground squirrels, *C. beecheyi*, taken on the Fort Ord Military Reservation, 12 miles southwest of Salinas, as follows: June 13, 180 fleas from 15 squirrels and tissue from 15 squirrels; June 18, 27 fleas from squirrel burrows, 103 fleas from 11 squirrels, and 118 fleas from 18 squirrels; June 19, 113 fleas from 21 squirrels and 200 fleas from 14 squirrels; June 20, 72 fleas from 9 squirrels and organs from 1 squirrel; June 22, 112 lice from 19 squirrels and 175 fleas from 19 squirrels.

Placer County: June 20, in a pool of 9 fleas from 4 chipmunks taken at Talawanda Girls Camp, ½ mile north of Tahoe Vista.

Siskiyou County: In pools of tissue and ectoparasites from ground squirrels, *C. douglasii*, as follows: June 3, tissue from 7 squirrels taken 4 miles north of Montague; June 11, 200 fleas from 22 squirrels taken ½ mile north of Hilt; June 12, 122 fleas from 5 squirrels taken 4 miles east and 1 mile north of Yreka, 132 fleas from 5 squirrels taken 1 mile south and 1 mile east of Yreka, and 91 fleas from 3 squirrels taken 1½ miles east of Yreka; June 17, 198 fleas from 20 squirrels taken at Montague Airport, 1¼ miles west of Montague, and 74 fleas from 6 squirrels taken 4 miles east of Yreka.

Ventura County: June 16, in a pool of 311 lice from 21 ground squirrels, *C. beecheyi*, taken 1 mile east and 1 mile north of Oxnard, and a pool of 96 lice from 9 ground squirrels, same species, from the same location; June 23, in a pool of 253 fleas from 4 ground squirrels, *C. beecheyi*, taken 5 miles northeast of Santa Paula.

OREGON

Malheur County: June 9, in a pool of 1 flea and 10 lice from 9 ground squirrels, *C. mollis*, taken 2 to 6 miles north of McDermott on Highway No. 95.

Harney County: June 19, in a pool of 89 fleas from 161 ground squirrels, *C. oregonus*, taken 13 to 18 miles southeast of French Glen (Fish Lake).

WEEKLY REPORTS FROM CITIES

City reports for week ended July 4, 1942

This table lists the reports from 90 cities of more than 10,000 population distributed throughout the United States, and represents a cross section of the current urban incidence of the diseases included in the table.

	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
Atlanta, Ga.	1	0	------	0	0	0	2	0	2	0	0	2
Baltimore, Md.	1	0	3	2	21	2	7	0	8	0	1	35
Barre, Vt.	0	0	------	0	0	0	0	0	0	0	0	4
Billings, Mont.	0	0	------	0	10	0	1	0	0	0	0	2
Birmingham, Ala.	0	0	------	1	4	0	1	0	0	0	0	4
Boise, Idaho	0	0	------	0	4	0	0	0	0	0	0	0
Boston, Mass.	0	0	------	0	65	0	3	0	20	0	1	32
Bridgeport, Conn.	0	0	------	0	1	0	1	0	2	0	0	0
Brunswick, Ga.	0	0	------	0	0	0	0	0	0	0	0	0
Buffalo, N. Y.	0	0	------	0	20	1	5	0	3	0	0	6
Camden, N. J.	1	0	------	0	0	0	1	0	1	0	0	10
Charleston, S. C.	0	0	1	0	1	0	1	0	0	0	1	0
Charleston, W. Va.	0	0	------	0	0	0	0	0	0	0	1	0
Chicago, Ill.	16	0	1	1	16	0	25	1	34	1	1	166
Cincinnati, Ohio	0	0	------	1	1	0	1	0	4	0	0	7
Cleveland, Ohio	0	0	1	1	3	0	3	0	16	0	1	31
Columbus, Ohio	1	0	1	1	19	0	1	0	3	0	0	12
Concord, N. H.	0	0	------	0	3	0	0	0	2	0	0	0
Cumberland, Md.	0	0	------	0	0	0	0	0	1	0	0	0
Dallas, Tex.	1	0	------	0	1	0	3	0	2	0	0	11
Denver, Colo.	6	0	3	0	26	0	2	0	9	0	0	13
Detroit, Mich.	1	0	------	0	17	0	5	0	32	0	0	65
Duluth, Minn.	0	0	------	0	2	0	0	0	6	0	0	0
Fall River, Mass.	5	0	------	0	6	0	0	0	9	0	0	2
Fargo, N. Dak.	0	0	------	0	0	0	0	0	0	0	0	0
Flint, Mich.	0	0	------	0	0	0	2	0	1	0	0	4
Fort Wayne, Ind.	0	0	------	0	0	0	1	0	0	0	0	3
Frederick, Md.	0	0	------	0	0	0	0	0	0	0	0	0
Galveston, Tex.	0	0	------	0	0	0	2	0	0	0	0	2
Grand Rapids, Mich.	0	0	------	0	0	0	0	2	1	0	0	5
Great Falls, Mont.	0	0	------	0	5	0	0	0	1	0	0	1
Hartford, Conn.	0	0	------	0	26	0	1	0	1	0	0	4
Helena, Mont.	0	0	------	0	2	0	0	0	0	1	0	0
Houston, Tex.	2	0	------	0	1	0	10	0	1	0	1	11
Indianapolis, Ind.	1	0	------	0	15	0	0	1	4	0	0	8
Kansas City, Mo.	0	0	------	1	15	0	2	0	3	0	2	9
Kenosha, Wisc.	0	0	------	0	8	0	0	0	0	0	0	10
Little Rock, Ark.	0	0	------	0	0	0	1	0	0	0	0	0
Los Angeles, Calif.	3	0	4	0	131	1	3	0	14	0	1	10
Lynchburg, Va.	0	0	------	0	1	0	0	0	0	0	0	4

See footnotes at end of table.

City reports for week ended July 4, 1942—Continued

	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
Memphis, Tenn.	0	0	------	0	18	0	1	2	1	0	0	9
Milwaukee, Wisc.	0	0	1	1	332	0	6	0	15	0	0	46
Minneapolis, Minn.	2	0	------	0	11	1	1	0	5	0	1	2
Missoula, Mont.	0	0	------	0	0	0	0	0	2	0	0	0
Mobile, Ala.	0	0	------	0	0	0	1	0	1	0	1	0
Nashville, Tenn.	0	0	------	0	0	0	0	0	0	0	0	3
Newark, N. J.	1	0	1	0	47	0	2	0	12	0	0	25
New Haven, Conn.	0	0	------	0	13	0	1	0	0	0	0	14
New Orleans, La.	1	0	2	0	7	0	8	0	1	0	5	0
New York, N. Y.	13	2	3	0	39	5	34	1	67	0	0	194
Omaha, Nebr.	0	0	------	0	6	0	1	0	0	0	0	0
Philadelphia, Pa.	2	0	------	0	26	0	15	0	50	0	3	83
Pittsburgh, Pa.	1	0	------	0	5	1	5	0	7	0	0	19
Portland, Me.	0	0	------	0	20	0	2	0	1	0	0	1
Providence, R. I.	0	0	------	0	43	0	0	0	2	0	1	43
Pueblo, Colo.	0	0	------	0	2	0	2	0	0	0	0	0
Racine, Wisc.	0	0	------	0	40	0	0	0	4	0	0	18
Raleigh, N. C.	0	0	------	0	2	0	0	0	0	0	0	1
Reading, Pa.	0	0	------	0	0	0	0	0	0	0	0	19
Richmond, Va.	0	0	------	0	2	0	0	0	0	0	1	1
Roanoke, Va.	0	0	------	0	0	0	0	0	0	0	0	0
Rochester, N. Y.	0	0	------	0	3	0	0	0	4	0	0	7
Sacramento, Calif.	0	0	------	0	3	0	1	0	2	0	0	13
Saint Joseph, Mo.	0	0	------	0	0	0	0	0	0	0	0	0
Saint Louis, Mo.	0	0	------	0	12	0	8	0	5	0	0	7
Saint Paul, Minn.	0	0	------	0	19	0	3	0	1	0	0	20
Salt Lake City, Utah	0	0	------	1	95	0	2	0	1	0	0	9
San Antonio, Tex.	0	0	------	0	0	0	2	0	1	0	0	3
San Francisco, Calif.	0	0	------	0	137	2	7	0	3	0	0	2
Savannah, Ga.	0	0	2	0	0	0	0	0	0	0	0	7
Seattle, Wash.	1	0	------	1	195	0	1	0	0	0	0	12
Shreveport, La.	0	0	------	0	0	0	0	0	0	0	0	0
South Bend, Ind.	0	0	------	0	3	0	0	0	0	0	0	4
Spokane, Wash.	0	0	------	0	68	0	2	0	1	0	0	5
Springfield, Ill.	0	0	------	0	0	0	0	0	0	0	0	0
Springfield, Mass.	0	0	------	0	17	0	3	0	4	0	0	3
Superior, Wis.	0	0	------	0	2	0	0	0	1	0	0	0
Syracuse, N. Y.	0	0	------	0	232	1	0	0	0	0	2	20
Tacoma, Wash.	0	0	------	0	41	0	0	0	0	0	0	6
Tampa, Fla.	0	0	------	0	4	0	1	0	1	0	0	0
Terre Haute, Ind.	0	0	------	0	0	0	1	0	0	0	0	0
Topeka, Kans.	0	0	------	0	4	0	3	0	0	0	0	2
Trenton, N. J.	0	0	1	1	0	0	1	0	2	0	0	9
Washington, D. C.	0	0	------	0	25	0	6	0	1	0	0	22
Wheeling, W. Va.	0	0	------	0	0	0	0	0	1	0	0	9
Wichita, Kans.	0	0	------	0	6	0	3	0	1	0	0	3
Wilmington, Del.	0	0	------	0	3	0	1	0	0	0	1	1
Wilmington, N. C.	0	0	------	0	1	0	1	0	0	0	0	10
Winston-Salem, N. C.	0	0	------	0	3	0	0	0	0	0	0	2
Worcester, Mass.	0	0	------	0	1	1	6	0	11	0	0	46

Anthrax.—Cases: New Orleans, 1.
Dysentery, amebic.—Cases: Los Angeles, 1; New York, 2.
Dysentery, bacillary.—Cases: Columbus, 1; Los Angeles, 1; Memphis, 1; Nashville, 1; New York, 1; Richmond, 1; San Francisco, 1; Shreveport, 1.
Rocky Mountain Spotted Fever.—Cases: Baltimore, 1; Great Falls, 1; Richmond, 1.
Typhus Fever.—Cases: Birmingham, 1; Charleston, S. C., 2; Houston, 1; Nashville, 1.

Rates (annual basis) per 100,000 population, for the group of 90 cities in the preceding table (estimated population, 1942, 34,134,198)

Period	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
		Cases	Deaths						
Week ended July 4, 1942	9.17	3.67	1.83	291.16	32.84	57.90	0.31	3.82	179.19
Average for week, 1937–41	12.04	4.48	2.01	[1] 330.23	41.84	93.87	0.93	5.56	197.15

[1] Median.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended June 20, 1942.—During the week ended June 20, 1942, cases of certain communicable diseases were reported by the Dominion Bureau of Statistics of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis			2	1	3			2	1	9
Chickenpox		7	2	171	248	32	8	16	56	540
Diphtheria		18	2	19		5	4		1	49
Dysentery				18						18
German measles			1	8	46	6	7	5	30	103
Influenza		3			2		1		3	9
Lethargic encephalitis		1				1				2
Measles		1	1	238	307	52	10	10	8	627
Mumps		19		95	393	39	138	10	324	1,018
Pneumonia		7			4	2	1		6	20
Poliomyelitis			1			1		1		3
Scarlet fever	1	15	14	74	152	26	23	43	42	390
Tuberculosis	2	1	10	90	51				50	204
Typhoid and paratyphoid fever			1	18	1					20
Undulant fever					1				1	2
Whooping cough			2	172	57				37	268
Other communicable diseases		8		5	282	28	2		5	330

Province of Alberta—Plague infection in ectoparasites.—Under date of July 21, 1942, plague infection, demonstrated bacteriologically, was found in 3 flea specimens taken from ground squirrels collected, respectively, 6 miles north of Stanmore, at Sunnybrook, and 10 miles north of Sunnybrook.

CHILE

Cerebrospinal meningitis.—According to information received, a total of 666 cases of cerebrospinal meningitis have been reported in Chile up to July 9, 1942, when there were still 180 cases in Santiago and 60 in Valparaiso, Chile.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—Except in cases of unusual prevalence, only those places are included which had not previously reported any of the above-mentioned diseases, except yellow fever, during the current year. All reports of yellow fever are published currently.

A cumulative table showing the reported prevalence of these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

(Few reports are available from the invaded countries of Europe and other nations in war zones.)

Plague

Peru.—During the month of May 1942, plague was reported in Peru, by Departments as follows: Lima, 13 cases, 4 deaths (Lima city, 12 cases, 4 deaths); Piura, 1 case, 1 death.

Typhus Fever

Bulgaria.—During the week ended June 20, 1942, 10 cases of typhus fever were reported in Bulgaria. For the preceding week, 7 cases of typhus fever were reported.

Irish Free States—Mayo County—Westport.—Information dated June 10, 1942, states that for the period April 24, 1942, to May 18, 1942, a total of 5 cases of typhus fever with 2 deaths were reported in Westport Urban District, Mayo County, Irish Free State.

Morocco.—During the week ended June 20, 1942, 820 cases of typhus fever were reported in Morocco.

Rumania.—During the week ended July 4, 1942, 19 cases of typhus fever were reported in Rumania. During the week ended June 27, 1942, 22 cases were reported.

Yellow Fever

British East Africa—Kenya.—On May 15, 1942, 1 fatal case of yellow fever was reported in Kitale, Kenya, British East Africa.

Gold Coast—Kibi.—On June 13, 1942, 1 suspected case of yellow fever was reported in Kibi, Gold Coast.

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COURT DECISION ON PUBLIC HEALTH

Milk—prohibition of sale in city when pasteurized outside of county in which city is located.—(Texas Court of Civil Appeals; *Prescott* v. *City of Borger et al.*, 158 S. W. 2d 578; decided January 12, 1942, rehearing denied February 9, 1942.) In 1940 the commission of the city of Borger enacted an ordinance which in substance provided that no milk or cream should be sold in the city that had been pasteurized outside of Hutchinson County, in which the city was located, except as might be authorized by the city health officer. When the ordinance was passed the plaintiff was engaged in the business of selling and distributing grade A pasteurized milk in Borger. He neither produced nor pasteurized the milk he sold but procured it at wholesale prices from a creamery located in Potter County and sold it to his customers in Borger in the bottles in which it had been placed by the creamery. The plaintiff brought suit against the city and its mayor and other officials for an injunction against the enforcement of the ordinance, alleging that the ordinance was invalid and unenforceable.

The Court of Civil Appeals of Texas, after reviewing a 1937 enactment of the State legislature regulating the pasteurization, handling, and sale of milk and its products, said that from such review it would be seen that the legislature had entered the field of legislation covered by the city ordinance and that it was well-established law in Texas that, generally, the governing authorities of cities were prohibited by the constitution and the statutes from entering a field of legislation that was occupied by general legislative enactments. Therefore, a city could not legally enact an ordinance which conflicted or was inconsistent with either the constitution or statutes, but the limitation placed upon local bodies did not extend, of course, to those ordinances which were permitted by or were in harmony with constitutional and statutory provisions. According to the court, the defendants had authority, under specified provisions of the milk statute above-mentioned, to enact an ordinance regulating the pasteurization of milk and the handling and sale of pasteurized milk in the city but they could not go beyond the limits of the authority given them in the statute. "We do not think the requirements of the ordinance come within the limitation of such enactments as, under the statute, the city's governing body had authority to adopt. The power to provide facilities by which the grades of milk may be determined does not include the power to dictate the location of the plants in which the milk is pasteurized." The court held that the ordinance was unconstitutional and void since it transcended the general statutes of the State and went beyond those specific powers extended to city authorities by the milk statute above referred to.

The appellate court also sustained the plaintiff's contention that the ordinance was unconstitutional and void because it clothed the city health officer with arbitrary and unreasonable discretion in the granting or refusing of permits to sell pasteurized milk in the city.

The injunction prayed for by the plaintiff was granted.

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