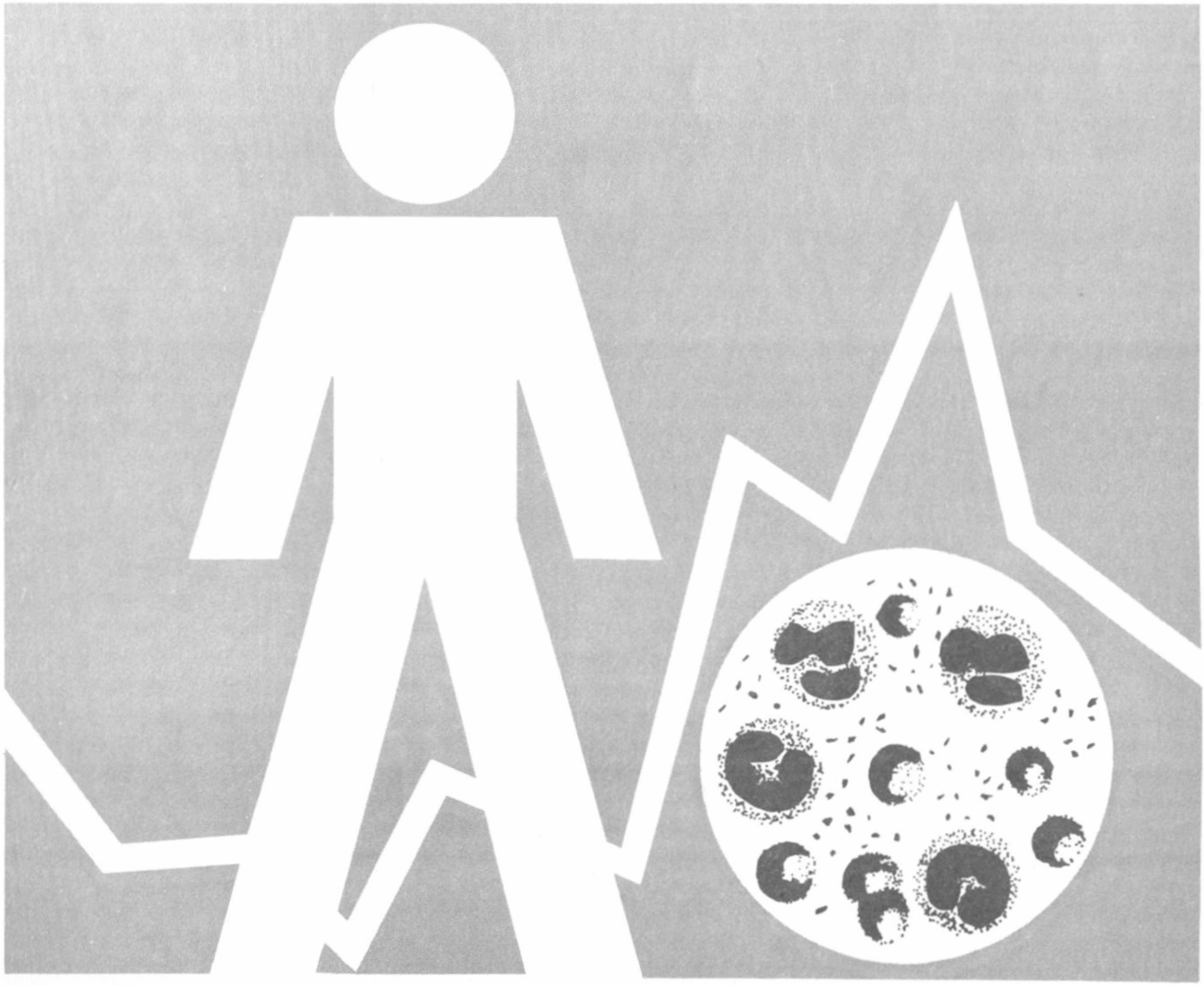
REPORT NO. 18
March 3, 1969

national communicable disease center

SHIGELLA

surveillance

TABLE OF CONTENTS
for the
Fourth Quarter 1968



U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE : PUBLIC HEALTH SERVICE
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION

PREFACE

This report summarizes data voluntarily reported from participating state, territorial, and city health departments. Much of the information is preliminary.

National Communicable Disease Center ..... Dr. David J. Sencer, Director

Epidemiology Program .....Dr. Alexander D. Langmuir, Director

Bacterial Diseases Branch ..... Dr. Philip S. Brachman, Chief
Dr. John V. Bennett, Deputy Chief

Enteric Diseases Section ..... Dr. Eugene J. Gangarosa, Chief
Dr. L. Barth Reller
Dr. Joseph A. Donadio

Statistics Section ..... Mrs. Ida L. Sherman, Chief
Mr. Stanley M. Martin
Mr. Arthur L. Michelson

Epidemiologic Services Laboratory Section
Salmonella – Shigella Unit ..... Dr. George K. Morris, Chief

Collaborators

Laboratory Division
Bacteriology Section
Enteric Bacteriology Unit ..... Dr. William H. Ewing, Chief
Dr. William J. Martin, Assistant Chief

TABLE OF CONTENTS

I. Summary

In the fourth quarter of 1968, 2,776 isolations were reported from humans. This number represents an increase of 6.3 percent from the 2,612 isolations in the third quarter of 1968 and a decrease of 17.4 percent* from the 3,362 isolations in the fourth quarter of 1967 (Table I).

II. Reported Isolations

A. Human

1. General Incidence

During the fourth quarter of 1968, 71.0 percent of isolations were from children under 10 years of age (Table II); this is consistent with previous patterns. The highest attack rate was in the age group 1-4 years.

2. Serotype Frequencies

Fifty-two of the 53 reporting centers participating in the Shigella Surveillance Program reported isolations of shigella. Eighteen different serotypes were reported.

The six most frequently reported serotypes during the 3-month period were the following (Table III):

Rank	Serotype	Reported	Calculated Number*	Calculated Percent	Rank Last Quarter
1	*S. sonnei*	1,665	1,675	60.32	1
2	*S. flexneri 2a*	177	413	14.87	2
3	*S. flexneri 3a*	122	279	10.05	3
4	*S. flexneri 6*	106	130	4.68	4
5	*S. flexneri 4a*	46	90	3.24	5
6	*S. flexneri 2b*	36	84	3.02	6
Subtotal		2,152	2,671	96.18	
Total (all serotypes)		2,776	2,777		

* from Table III

---

* If allowances are made for the fact that California has not reported since February 1968, this decrease is only 3 percent.

Tables III and IV, calculated from data compiled during the fourth quarter of 1968 and from data compiled since the beginning of the Shigella Surveillance Program in October 1963, respectively, show the relative importance of the various serotypes. In these tables the isolations in each of the unspecified categories have been distributed in their subgroups in the same proportions as the completely specified isolations of that group. The resulting distributions in these tables are called the "calculated number," and from these are derived a "calculated percent" for each serotype. These provide approximate indices of the relative frequencies of the more common shigella serotypes in the United States. S. sonnei now accounts for slightly over half of all isolations, and S. flexneri 2a and b combined for slightly less than a quarter.

3. Geographical Observations

In the northern United States there are proportionately more reported cases of S. sonnei than S. flexneri; however, the opposite is true in most of the rest of the United States (Figure 1). The proportion of S. sonnei in the southeastern United States was a little higher than in previous periods.

Figure 4 portrays attack rates by states for October-December 1968, utilizing population estimates for July 1, 1968. The overall United States attack rate was 1.4 cases per 100,000 for the fourth quarter of 1968 as compared to 1.3 cases per 100,000 for the third quarter of 1968, and 1.6 cases per 100,000 for the fourth quarter of 1967.

Table V shows that 19.6 percent of reported cases of shigella were not reported by residence at time of onset. This is a marked improvement over the 57.2 percent indicated in the third quarter 1968 report.

B. Nonhuman

For the fourth quarter of 1968 no isolations of shigella from nonhuman sources were reported to the National Communicable Disease Center.

III. Current Investigations

Review of foodborne shigellosis 1964-1968. By Enteric Diseases Section, Bacterial Diseases Branch, Epidemiology Program, NCDC.

Although shigella does not rival salmonella, staphylococcus, or Clostridium perfringens as a leading cause of food poisoning in this country, common-source foodborne or waterborne outbreaks of shigellosis do occur[1]. In the 5-year period 1964-1968, 25 foodborne or waterborne outbreaks of shigellosis were reported to NCDC.

In each of these outbreaks the source of contamination was a human carrier who, through carelessness and faulty hygiene, contaminated the food that became the vehicle of infection. The vehicle was identified in 13 of 25 outbreaks (62 percent) (Table A). In eight (62 percent) a salad was responsible; potato salad was responsible for six (46 percent) of the outbreaks in which the vehicle was known. The special importance of salads, and possibly potato salad in particular, in foodborne shigellosis is suggested by these data and other reports[2,3].

Salads prepared for large groups usually require extensive handling of ingredients. Hands soiled with feces from an infected carrier provide the inoculum as the salad is mixed. Improper refrigeration permits incubation of the organism, resulting in

massive growth. The combination of events leading to a typical outbreak is illustrated by the following epidemic recently investigated in collaboration with Ohio health authorities*.

During September and October 1968, at least 98 persons were affected with acute febrile gastroenteritis in a prosperous industrial community in Ohio. Epidemiologic investigation uncovered four separate outbreaks of shigellosis and traced them to a single catering establishment whose products--predominantly delicatessen items--were distributed widely in a populous area.

The first outbreak of febrile gastroenteritis (Figure 7) involved 19 persons. The mean incubation period was 17.1 hours with a range of 6½-66 hours. The incriminated vehicle of infection was chicken salad.

The second outbreak followed a meal attended by grammar school teachers. Of 44 persons who attended a dinner, 32 became ill, giving an overall attack rate of 73 percent. Clinical histories were again compatible with shigellosis. The mean incubation period was 56 hours, range--25 hours to 9 days. The mean duration of illness was 5.5 days, range--3 to 10 days. In this group there were two secondary cases. Potato salad was considered the most likely vehicle, although ham could not be excluded (Table B).

The third outbreak affected six households with 19 persons at risk. Twelve became ill with dysentery, for an overall attack rate of 63 percent. The mean incubation period was 12 hours, range--9½-19½ hours; the mean duration of illness was 8.3 days, range--3 days to 3 weeks. Chicken salad was again the vehicle.

In the fourth outbreak, 47 members of a political group attended a picnic. Of the 45 who ate there, 28 became ill with severe dysentery, for an overall attack rate of 62 percent. The mean incubation period was 59 hours, range--24-196 hours, the mean duration of illness was 6.4 days, range--less than 1 day to 10 days. There were three secondary cases. Again potato salad was responsible.

In these four outbreaks S. sonnei was isolated from 30 people. Although the number of individuals reporting illness to the health departments numbered less than 100, the wide dissemination of the contaminated products and the relatively dense population served by the catering firm suggest that the actual numbers affected were considerably higher.

Two different vehicles were incriminated--chicken salad and potato salad; ham was also suspect in one of the outbreaks. Since all suspect food was prepared and distributed by one catering company, detailed investigation of the food handlers was instituted. Six food handlers working in a crowded environment that lacked

---

* This epidemic is reported by Calvin B. Spencer, M.D., Acting State Epidemiologist, Jack Russell, D.V.M., Public Health Veterinarian, and Charles Croft, M.S., Dr.Sc., Chief, Public Health Laboratories, Ohio Department of Health; Robert A. Vogel, M.D., Health Commissioner, Montgomery County Health Department; Robert F. McConaughy, Health Commissioner, Butler County Health Department; Joseph E. Orthoefer, D.V.M., Administrative Assistant to the Commissioner of Health, Dayton City Health Department; Joseph A. Donadio, M.D., and Robert G. Sharrar, M.D., EIS Officers, James B. Sprague, Medical Student Trainee, and Judith Koehler, Technician, Epidemiology Program, NCDC.

adequate equipment were responsible for preparing the foods that were incriminated. At least two of these handlers reported having had diarrheal illnesses compatible with shigellosis when these salads were prepared. Since handlers mixed salad with their bare hands instead of wearing gloves, there was nothing to compensate for breaches of personal hygiene. Stool cultures from one of these women were positive for S. sonnei 3 weeks after the onset of her illness. The freshly prepared food, cooled by a fan positioned on top of a block of dry ice, was delivered in two small panel trucks.

In summary, as exemplified by this epidemic, the requisites for a foodborne outbreak of shigellosis are (1) human carrier who has poor sanitary habits and handles liquid or moist food that is not thoroughly cooked, (2) a storage area where the food is left at a temperature conducive to replication of the organism, and (3) people to ingest the food or liquid thus contaminated, completing the cycle of transmission.

Table A

Common-Source Outbreaks of Shigellosis Reported to NCDC, 1964-1968

Year	Serotype	No. ill	No. at risk	Attack rate (%)	Location	Food responsible for outbreak
1964	S. flexneri 4a	100	300	33	California	Potato salad
1964	S. flexneri	17	NA*	NA	North Carolina	Water
1964	S. flexneri 6	220	526	42	Georgia	Unidentified
1964	S. sonnei	22	NA	NA	North Carolina	Unidentified
1964	S. flexneri 2a	13	25	52	Hawaii	Potato salad
1965	S. sonnei	67	96	69	Iowa	Water
1965	S. sonnei	230	NA	NA	Kansas	Unidentified
1965	S. flexneri 4a	196	320	61	Texas	Potato salad
1965	S. flexneri	250	NA	NA	New York	Shrimp salad
1965	S. flexneri 2a	20	21	95	Hawaii	Macaroni salad and/or rice
1966	S. flexneri 4b	30	NA	NA	New York	Unidentified
1966	S. flexneri 2a	201	326	62	Hawaii	Unidentified
1966	S. sonnei	30	NA	NA	New York	Unidentified
1966	S. flexneri 2a	99	NA	NA	Florida	Milk
1967	S. sonnei	140	450	31	Vermont	Water
1967	S. sonnei	39	84+	46	Ohio	Unidentified
1967	S. sonnei	84	NA	NA	Pennsylvania	Unidentified
1967	S. sonnei	63	239	26	Ohio	Unidentified
1967	S. sonnei	40	NA	NA	Ohio	Unidentified
1968	S. sonnei	195	NA	NA	Arizona	Unidentified
1968	S. sonnei	44	NA	NA	Georgia	Unidentified
1968	S. flexneri	60	105	57	Washington	Potato salad
1968	S. sonnei	3	8	38	Pennsylvania	Chicken and potato salad
1968	S. flexneri 2a	158	1,456	11	North Carolina	Ground diet (Mental institution)
1968	S. sonnei	91	127+	NA	Ohio	Chicken and potato salad

* Information not available

Table B

Food Specific Attack Rates

OUTBREAK Number 2

		Number persons who ate specified food				Number who did not eat specified food			
Food Items	Total Persons	Ill	Not Ill	Total	Rate	Ill	Not Ill	Total	Rate
Potato salad	43	32	9	41	78	0	2	2	-
Ham	44	33	11	44	75	0	0	0	-
Beans	44	26	9	35	74	7	2	9	78
Pie (11 unknown)	33	23	8	31	74	1	1	2	50

OUTBREAK Number 3

		Number persons who ate specified food				Number who did not eat specified food			
Food Items	Total Persons	Ill	Not Ill	Total	Rate	Ill	Not Ill	Total	Rate
Chicken salad	19	12	2	14	85.7	0	5	5	0
Macaroni & cheese	4	3	1	4	75	0	0	0	-
Lobster salad	4	2	0	2	100	1	1	2	50
Tuna salad	4	1	1	2	50	2	0	2	100
Tomatoes	2	1	1	2	50	0	0	0	-

OUTBREAK Number 4

		Number persons who ate specified food				Number who did not eat specified food			
Food Items	Total Persons	Ill	Not Ill	Total	Rate	Ill	Not Ill	Total	Rate
Potato salad	45	28	2	30	93	2	13	15	13
Hamburger	45	28	10	38	74	2	5	7	35
Hot dog	45	4	5	9	44	26	10	36	72
Potato chips	44	27	13	40	67	2	2	4	50
Baked beans	3	24	9	33	72	6	6	12	50

References

1. National Communicable Disease Center. Foodborne Outbreaks: Status Report for 1967. Department of Health, Education, and Welfare, Public Health Service, Atlanta, Gerogia.
2. Ehrenkranz, N. J., et al.: An epidemic of Shigella sonnei arising in a general hospital. New Engl. J. Med. 259:375-377, 1958.
3. Kaiser, R. L., and Williams, L. D.: Tracing two bacillary dysentery outbreaks to a single food source. Penn. Med. J. 65:351-354, 1962.

IV. Reports from the States

A. Institutional shigellosis in North Carolina.

Reported by Dorothy Shearin, M.D., Medical Director, Murdock Center, and the Medical Staff at Murdock Center, North Carolina; Martin P. Hines, M.D., D.V.M., Director, Division of Epidemiology, and J. N. MacCormack, M.D., Consultant in Communicable Diseases, North Carolina State Board of Health; and two EIS Officers, John D. Hamilton, M.D., and James A. Merchant,M.D.

An epidemic of shigellosis involving 158 of 1,456 residents in an institution for the mentally retarded in North Carolina occurred in mid-September 1968. The illness was characterized primarily by fever, myalgia, mild nausea and vomiting, and severe bloody diarrhea. Two deaths occurred. S. flexneri 2a was cultured from rectal swabs or stool specimens obtained from patients with clinical dysentery. Although the outbreak occurred almost entirely in residents of the institution, approximately 22 employees were also affected. The overall attack rate was 10.8 percent, and sex specific attack rates were 6.9 percent for males and 14.0 percent for females. The epidemic curve suggests a common-source outbreak with an incubation period of 1 to 7 days (Figure 8).

Investigation found that the population could be divided into three groups according to the diet received, which is determined by severity of retardation. Food histories revealed an attack rate of 3.8 percent for those on a regular diet, 5.2 percent for those on a bowl diet, and 23.0 percent for those on the ground diet. The ground diet is entirely different in content and/or preparation from the other diets and involves more handling.

Although no definite source for contamination of the incriminated common vehicle was found, several breakdowns in accepted sanitary procedures were noted. Exposed soiled diapers were stored adjacent to cottage kitchens, limited quantities of garbage were returned from the cottage kitchens to the central kitchen for disposal, and flies were present. Environmental cultures from the kitchen and cultures from 114 full-time food handlers were negative. No food was available for culture. It was postulated that contamination was probably transmitted from the cottages, where shigellosis has occurred previously, to the central kitchen and then redistributed through food to the residents.

Control measures for the outbreak included antibiotic therapy for acute clinical cases, isolation of patients with dysentery insofar as practical, and renewed efforts at better sanitary practices in the institution.

B. Shigella sonnei in Burlington, Vermont.

Reported by Linus J. Leavens, M.D., Division of Communicable Disease Control, State of Vermont Department of Health; Joseph A. Donadio, M.D., EIS Officer, George K. Morris, Ph.D., and James B. Sprague, Medical Student Trainee, Epidemiology Program; and Corwin R. Dunn, M.D., Laboratory Division, NCDC.

During the months of September through November 1968, 92 persons in Burlington, Vermont, and a nearby suburb were known to have developed dysentery. Symptoms consisted of diarrhea, fever, abdominal cramps, occasionally vomiting, and less frequently, tenesmus and nausea. S. sonnei was cultured from the feces of 33 of those persons ill.

Despite a deligent and prolonged search, no common causal source for these cases could be found. Of the 28 index cases (first case of illness in a family) 18 were under 10 years of age. Some of these children had the opportunity to play together, and most of the cases occurred in the lower socioeconomic section of the city. In 1967 no isolates of S. sonnei were reported to NCDC from Vermont. It was postulated that either there was an unrecognized smoldering endemic focus which flared or that the organism was introduced into the community from an unknown outside source and then propagated by person-to-person spread.

Those known to be ill or harboring the shigella organism were treated with ampicillin, to which the strain of S. sonnei was shown to be sensitive by disk testing. Furthermore, the importance of personal hygiene in preventing further spread was stressed. It was also recommended that enteric isolation be observed for those ill with febrile gastroenteritis.

V. Current Trends and Developments

The relative importance of shigella subgroups in the United States and abroad.

During 1968 two reviews were published in the foreign literature which discussed the changing pattern of shigella subgroups in the epidemiology of shigellosis. One report was from Poland and also surveyed the European trends[1]; the other came out of Japan and included data from other countries in the Far East as well[2]. In addition, a summary of the first 5 years of data for the United States gathered through the national system of shigella surveillance is now available.

In order that the epidemiological trends of shigellosis in the United States might be compared to those in other areas of the world, the foreign reviews previously cited are abstracted below. There follows a presentation of the data from the United States as well as a discussion of its possible importance.

1. Changes in the epidemiology of dysentery in Poland and the situation in Europe by Jan Kostrzewski and Hanna Stypulkowska-Misiurewicz, National Shigella Center, Department of Epidemiology, State Institute of Hygiene, Warsaw Provincial Sanitary-Epidemiological Laboratories, Poland. Published in Archivum Immunologiae et Therapie Experimentalis, 1968, 16, 429.

The clinical and epidemiological features of shigellosis (bacillary dysentery) in Europe have changed during the years since 1900. Concomitant changes in the relative importance of the different shigella subgroups as the causative organism have also occurred. During the first 25 years of this century, dysentery was considered to be a more severe disease fraught with complications and mortality rates as high as 20 percent. At that time S. shigae (S. dysenteriae 1) was the most frequent etiologic agent. In the years 1926-1938, S. dysenteriae was gradually displaced by a wave of S. flexneri infections proceeding from the west of Europe to the east. By 1939-1949, S. flexneri infections dominated over S. dysenteriae, and by 1950 only sporadic cases of the later were observed in Europe.

The present situation is one of the ascendency of S. sonnei, which now predominates over S. flexneri west of the Elba River. This trend began before World War II in the western European countries.

These trends have also been evident in Poland. During the years 1954-1956, S. flexneri was responsible for 71.7 percent of reported cases. This percentage fell to 50.1 percent in 1965. At the time, percentages of patients from whom S. sonnei was isolated increased dramatically--from 21.6 percent in the years 1954-1956 to 49.2 percent in 1965.

The hypothesis has been proposed that better socioeconomic and sanitary conditions have contributed both to the milder course of the disease and change of the etiologic agent. The subgroup changes in the etiology of shigellosis in the past 50 years in Europe have indicated a transition from highly pathogenic strains such as S. dysenteriae to less pathogenic forms such as S. sonnei.

2. Serological groups of shigella in Japan and neighboring countries. A review by Yoshio Aoki, Department of Bacteriology, Nagasaki University, School of Medicine, Nagasaki, Japan. Published in Tropical Medicine, 10(2):116-126, September 1968, Nagasaki, Japan.

At present Japan is the sole country in Asia where the predominant group among reported shigella isolates is S. sonnei. The proportion of S. sonnei gradually increased through 1963 and by 1964 occupied the dominant position previously held by S. flexneri. S. dysenteriae (group A) and S. boydii (group C) are seldom detected in urban communities of Japan, but S. dysenteriae is found at a rate of 5 to 10 percent in Korea, Mainland China, and the Philippines. In 1965 S. sonnei S. flexneri, S. dysenteriae, and S. boydii contributed respectively, 72.8 percent, 24.1 percent, 1.5 percent, and 0.1 percent to the total isolates in Japan. The corresponding percentages in 1951, in contrast, were 0.3 percent, 86.9 percent, 0, and 4.2 percent.

The trend of increasing S. sonnei isolates accompanied by decreasing numbers of S. flexneri is also evident in Korea*, Taiwan, Hong Kong, and Mainland China. Although the sources are different, an approximation of the trend can be arrived at by comparing earlier figures with later ones, as in Table A.

* See also IV. Reported Isolations, page 3, Shigella Surveillance Report, No. 9, Fourth Quarter 1965.

Table A

Relative Importance of Shigella Groups in Asia

Area and Year		Group Distribution in Percent A	B	C	D	No. Strains
Korea	1951	1.5	97.2	0.7	0.3	734
	1962	13.1	76.1	2.8	7.3	109
Taiwan	1950	3.6	96.4			140
	1963		75.4		24.6	102
Hong Kong	1960		61.4	1.2	37.4	
	1963	0.1	76.5	0.2	23.2	
Mainland China	1954	7.4	71.8	0.1	20.7	811
	1957		57.4		42.6	396
Japan	1951	0.3	86.9	-	4.2	25,451
	1965	1.5	24.1	0.1	72.8	26,750

The author acknowledged the difficulties in comparing data from Japan with that of other areas where only patients revealing distinct clinical signs of dysentery were cultured. Although it has been generally accepted that the pathogenicity of S. dysenteriae and S. flexneri is greater than that of S. sonnei, Japanese law requires that ill patients as well as carriers be isolated as long as shigellae are cultured from their stools.

3. United States

The situation with regard to the relative importance of shigella subgroups in the United States during the first 5 complete years of a national system of shigella surveillance is illustrated in Figure 5. S. dysenteriae (group A) and S. boydii (group C) are unusual isolates in the United States and each accounts for less than 1 percent of the total isolates each year. Indeed their presence raises the suspicion of foreign acquisition which is not infrequently confirmed (see IV. Reports from the States, A.2 and 3, page 4, Shigella Surveillance Report (SSR) No. 17, Third Quarter 1968 and D.1 and 2, page 6, SSR, No. 15, Third and Fourth Quarters 1967). Of great interest, in light of a similar trend in Europe and the Far East, is the changing pattern of S. flexneri (group B) and S. sonnei (group D). In 1964 and 1965 S. flexneri demonstrated a distinct autumnal peak and was the predominant etiologic organism reported to NCDC. After a gradual increase, S. sonnei matched S. flexneri in numbers of isolates during the fourth quarter of 1966 and since has continued its rise to ascendency. During 1968 S. sonnei accounted for 54 percent of all reported shigella isolations and S. flexneri contributed 44.3 percent.

Discussion: It has been shown that S. sonnei has become the most frequently isolated and reported subgroup of shigella in Western Europe, Japan, and the United States. The most obvious difference between these nations and those discussed where S. flexneri is still the dominant subgroup is their greater industrialization, level of economic development, and higher standard of living. Figure 6 illustrates the ratio of S. flexneri to S. sonnei in the United States by state. With a few exceptions, where the total number of isolates reported

are small, S. flexneri predominates, in general, in states sparsely populated, poorly industrialized, or with a large Indian population.

Reporting systems may also play an important role in the ascendency of S. sonnei. For over 20 years in Great Britain, S. sonnei has been responsible for most cases of diarrhea in which an etiologic agent has been incriminated[1]. In Japan, where a national system of shigella reporting has been operative since 1955, S. sonnei became dominant in 1963[2]. As stated previously, this change occurred in the United States as late as 1966, in the third year of a national system of shigella surveillance.

Besides the obvious scientific interest in understanding the prevalent patterns of the distribution of shigella subgroups, practical considerations are also involved. Vaccine development depends on knowledge of the causative subgroup because immunity has been shown to be serotype specific[3]. For example, institutional shigellosis continues to be a problem in the United States, and S. flexneri 2a is the most common isolate reported (see III. Current Investigations, page 2, Shigella Surveillance Report, No. 17, Third Quarter 1968). Now that S. sonnei accounts for most shigella isolations in the United States, the need for an epidemiologic marker to differentiate the various S. sonnei strains within the group becomes a practical necessity for epidemiologic investigations. Lacking the distinct epidemiological markers available for the group B (S. flexneri) organisms, S. sonnei has been subdivided into different strains using colicine susceptibility typing[1]. This method has already proved its usefulness as an epidemiological tool in Great Britain[4]. As S. sonnei figures more prominently in outbreaks in the United States, it is hoped that colicine typing will also be employed here. Phage typing of S. sonnei has also proved useful[5].

References

1. Gillies, R. R., Colicine production as an epidemiological marker of Shigella sonnei, J. Hyg. Camb. 62:1, 1964.
2. Aoki, Y., Serological groups of shigella in Japan and neighboring countries, Trop. Med. 10:116, 1968.
3. Mel, D. M., et al., Studies on vaccination against bacillary dysentery, Bull. WHO 32:647, 1965.
4. Green, D. M., et al., Water-borne outbreak of viral gastroenteritis and sonne dysentery, J. Hyg. Camb. 66:383, 1968.
5. Hammarstrom, E., Bacteriophage classification of Shigella sonnei, Lancet i:102, 1947.

VI. Yearly Summary for 1968

During the year 1968, a total of 9,277 isolations of shigella were reported to NCDC. This was a decrease of 18.7 percent* from the 11,405 isolations reported in 1967. Utilizing the population estimates for July 1967, the overall United States attack rate was 46.1 cases per million population in 1968, as compared to 57.3 cases per million population in 1967. The attack rate by state is depicted in Figure 9.

* Allowing for the fact that no reports were received from California after March 1, 1968, this decrease is in the order of 12.4 percent.

The age and sex distribution of individuals from whom shigella was isolated in 1968 is presented in Table VII. Children 1-4 years and 5-9 years of age were at greatest risk, with attack rates of 37.4 percent and 22.6 percent, respectively. A preponderance of isolates occurred in adult females, particularly in the child-bearing years, compared to males in the same age group (Table VII).

A seasonal distribution persisted with the greatest number of isolates being reported each autumn (Figure 3).

The six most frequently reported serotypes during 1968 are presented in Table A and compared to the cumulative distribution for the 5-year period 1964-1968.

Table A

The Six Most Frequently Reported Serotypes of Shigella from Humans, 1968

Serotype	Reported Number	Calculated* Number	Calculated* Percent	Rank	1964-1968 Cumulative Percent	Rank
S. sonnei	4,976	5,016	54.0	1	45.3	1
S. flexneri 2a	686	1,616	17.4	2	22.8	2
S. flexneri 3a	377	978	10.5	3	10.2	3
S. flexneri 6	367	456	4.9	4	5.9	4
S. flexneri 4a	158	332	3.6	6	5.5	5
S. flexneri 2b	174	388	4.2	5	3.9	6
Subtotal	6,738	8,786	94.6		93.6	
Total	9,277	9,281				

* See Footnote Table III

Since the fourth quarter of 1966, S. sonnei has been the most frequently isolated shigella subgroup reported to NCDC (Figure 5). The rising importance of S. sonnei is a trend which has been documented since 1964 in the United States. In 1968, 54.0 percent of all shigella isolates were S. sonnei versus 50.8 percent in 1967 (see V. Current Trends and Developments, 3. United States, page 9, for further discussion of this subject).

During 1968, six common-source foodborne outbreaks of shigellosis were reported. These outbreaks caused illness in a total of 551 persons. In 1967 there were 366 persons with shigellosis acquired from a common source. In four outbreaks food was the vehicle, and in one water was the incriminated cause (see also III. Current Investigations, page 2.

TABLE I
SHIGELLA SEROTYPES ISOLATED FROM HUMANS
FOURTH QUARTER 1968

SEROTYPE	NORTHEAST																								NORTHWEST												North Total
	Conn	Del	DC	Ill	Ind	Iowa	Ky	Me	Md	Mass	Mich	Minn	Mo	NH	NJ	NY-A	NY-C	Ohio	Pa	RI	Vt	Va	W. Va	Wisc	North-east Total	Colo	Idaho	Kans	Mont	Neb	Nev	ND	Ore	SD	Utah	Wash	Wyo	North-west Total	
A. S. dysenteriae Unspecified																									0												0	0
1	1																								1												0	1
2										1															1												0	1
3																									0												0	0
4																									0												0	0
9																									0												0	0
Total	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
B. S. flexneri Unspecified		1	5		7	1				2	1		23			6	67					6		3	122	1	1		1	1		1	3	6		3		17	139
1 Unspecified										1															1										3		3	4
1 A												1													1	1			1								2	3
1 B	1			4																					5	8											8	13
2 Unspecified									8			2	2					7	1			1			21				2					7	13		22	43
2 A	1			27							2	1							1		1				33	8	2	4	3			2		2			21	54
2 B	1			9						1									1						12	11											11	23
3 Unspecified									2	1	3		1					2	2						11			1						1	2		4	15
3 A	1			71											1					1					74												0	74
3 B																									0												0	0
3 C																									0												0	0
4 Unspecified												5													5									1			1	6
4 A				2																					2	3											3	5
4 B											2														2												0	2
5			1	1																					2	1											1	3
6				7					4	3					2			2	1						19	3		2	1								6	25
Total	4	1	6	121	7	1	0	0	14	8	8	9	26	0	3	6	67	11	6	1	1	6	1	3	310	36	3	7	8	1	0	3	3	8	9	21	0	99	409
C. S. boydii Unspecified																									0							3			1		4	4
1																							1		1												0	1
2				3																					3												0	3
4				2																			2		4										1		1	5
Total	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	8	0	0	0	0	0	0	3	0	0	2	0	0	5	13
D. S. sonnei	39	0	28	143	17	17	17	5	128	174	74	21	34	14	12	2	46	39	38	4	47	18	12	33	962	66	4	13	10	3	1	2	33	24	7	69	0	232	1,194
Unknown			4			6											2								12							2						2	14
TOTAL	44	1	38	269	24	24	17	5	142	183	82	30	60	14	15	8	115	50	44	5	48	24	15	36	1,294	102	7	20	18	4	1	10	36	32	18	90	0	338	1,632

TABLE I (CONTINUED)
SHIGELLA SEROTYPES ISOLATED FROM HUMANS
FOURTH QUARTER 1968

SOUTHEAST										SOUTHWEST						OTHER							PREVIOUS QUARTER		SEROTYPE
Ala	Ark	Fla	Ga	La	Miss	NC	SC	Tenn	South west Total	Ariz	NM	Okla	Tex	South West Total	South Total	Alaska	Calif	Hawaii	Virgin Islands	Other Total	Total	Percent of Total	Total	Percent of Total	
									0					0	0					0	0		2	0.1	A. S. dysenteriae Unspecified
									0				1	1	1					0	2	0.1	0	-	1
									0	2				2	2					0	3	0.1	11	0.4	2
			1						1					0	1					0	1	0.0	1	0.0	3
									0					0	0					0	0		1	0.0	4
									0					0	0					0	0		1	0.0	9
0	0	0	1	0	0	0	0	0	1	2	0	0	1	3	4	0	0	0	0	0	6	0.2	16	0.6	Total
16	2	4			11	2	5	1	41		4		1	5	46	5				5	190	6.8	256	9.8	B. S. flexneri Unspecified
		1	10					2	13		1			1	14	1				1	19	0.7	37	1.4	1 Unspecified
				4					4	1				1	5					0	8	0.3	17	0.7	1 A
	3								3				5	5	8					0	21	0.8	21	0.8	1 B
	1	17	18			33		10	79	3	61		7	71	150					0	193	7.0	244	9.3	2 Unspecified
	8			11					19	10		5	80	95	114			9		9	177	6.4	163	6.2	2 A
				3					3				9	9	12	1				1	36	1.3	20	0.8	2 B
	6	5	53			1		19	84	1	10		1	12	96					0	111	4.0	140	5.4	3 Unspecified
	5			10					15	5			28	33	48					0	122	4.4	102	3.9	3 A
				1					1				1	1	2					0	2	0.1	3	0.1	3 B
	2			2					4					0	4					0	4	0.1	4	0.2	3 C
		2	5					4	11	2	10			12	23					0	29	1.0	54	2.1	4 Unspecified
	3			1					4	4		6	27	37	41					0	46	1.7	24	0.9	4 A
									0					0	0					0	2	0.1	5	0.2	4 B
									0	3				3	3					0	6	0.2	7	0.3	5
	1	5	10	2				6	24	13	20		13	46	70	11				11	106	3.8	128	4.9	6
16	31	34	96	34	11	36	5	42	305	42	106	11	172	331	636	18	0	9	0	27	1,072	38.6	1,225	46.9	Total
									0					0	0					0	4	0.1	1	0.0	C. S. boydii Unspecified
									0					0	0					0	1	0.0	0	-	1
		1							1		1		1	2	3					0	6	0.2	8	0.3	2
									0					0	0					0	5	0.2	0	-	4
0	0	1	0	0	0	0	0	0	1	0	1	0	1	2	3	0	0	0	0	0	16	0.6	9	0.3	Total
9	11	82	120	35	4	16	4	27	308	8	37	3	104	152	460		1	8	2	11	1,665	60.0	1,336	51.1	D. S. sonnei
					2		1		3					0	3					0	17		26	1.0	Unknown
25	42	117	217	69	17	52	10	69	618	52	144	14	278	488	1,106	18	1	17	2	38	2,776		2,612		TOTAL

Table II

Age and Sex Distribution of Individuals Infected with Shigellae in the United States Fourth Quarter, 1968

Age (Years)	Male	Female	Sex Unknown	Total	Percent	Cumulative Percent	Attack Rate/ Million Population*
< 1	67	87	1	155	8.5	8.5	43.8
1 - 4	352	351	2	705	38.7	47.2	45.0
5 - 9	221	213		434	23.8	71.0	20.8
10 - 19	104	103	1	208	11.4	82.4	5.5
20 - 29	47	95		142	7.8	90.2	5.2
30 - 39	41	51		92	5.0	95.2	4.1
40 - 49	9	21	1	31	1.7	96.9	1.3
50 - 59	9	16		25	1.4	98.3	1.2
60 - 69	10	7		17	.9	99.2	1.2
70 - 79	2	8		10	.5	99.7	1.1
80 +	2	2		4	.2	99.9	1.2
Subtotal	864	954	5	1,823			
Child (unspec)	6	6	1	13			
Adult (unspec)	7	11		18			
Unknown	422	419	81	922			
Total	1,299	1,390	87	2,776			
Percent of Total	48.3	51.7					

* Based on provisional data from Population Estimates, Series P25, No. 380, November 24, 1967.

Table III

Relative Frequencies of Shigella Serotypes
Reported Fourth Quarter, 1968

	Serotype	Number Reported	Calculated Number*	Calculated Percent	Rank
A.	S. dysenteriae				
	1	2	2	.07	15
	2	3	3	.11	14
	3	1	1	.04	16
	unspecified				
B.	S. flexneri				
	1a	8	16	.58	8
	1b	21	43	1.55	7
	1 unspecified	19			
	2a	177	413	14.87	2
	2b	36	84	3.02	6
	2 unspecified	193			
	3a	122	279	10.05	3
	3b	2	5	.18	12
	3c	4	9	.32	9
	3 unspecified	111			
	4a	46	90	3.24	5
	4b	2	4	.14	13
	4 unspecified	29			
	5	6	7	.25	11
	6	106	130	4.68	4
	unspecified	190			
C.	S. boydii				
	1	1	1	.04	16
	2	6	8	.29	10
	4	5	7	.25	11
	unspecified	4			
D.	S. sonnei	1,665	1,675	60.32	1
	Unknown	17			
	Total	2,776	2,777		

* Calculated number is derived by distributing the unspecified isolations in each group to their subgroups in the same proportions as the distribution of the specified isolations of that group.

Table IV

Relative Frequencies of Shigella Serotypes
Cumulated from October 1963 to Present

	Serotype	Number Reported	Calculated Number*	Calculated Percent	Rank
A.	S. dysenteriae				
	1	9	12	.03	24
	2	186	238	.52	14
	3	35	45	.10	20
	4	1	1	0.00	35
	6	1	1	0.00	35
	9	4	5	.01	27
	unspecified	64			
B.	S. flexneri				
	1a	376	454	.99	11
	1b	328	396	.86	12
	1 unspecified	522	630	1.37	10
	2a	4,493	5,427	11.80	3
	2b	787	950	2.07	9
	2 unspecified	4,688	5,662	12.31	2
	3a	1,166	1,408	3.06	6
	3b	78	94	.20	17
	3c	87	105	.23	16
	3 unspecified	3,092	3,734	8.12	4
	4a	1,119	1,351	2.94	7
	4b	53	64	.14	18
	4 unspecified	1,009	1,219	2.65	8
	5	193	233	.51	15
	6	2,251	2,718	5.91	5
	variant x	1	1	0.00	35
	variant y	17	21	.05	21
	unspecified	4,016			
C.	S. boydii				
	1	11	17	.04	22
	2	168	253	.55	13
	3	1	2	0.00	31
	4	34	51	.11	19
	5	7	11	.02	25
	6	2	3	.01	29
	7	3	5	.01	27
	8	1	2	0.00	31
	9	2	3	.01	29
	10	11	17	.04	22
	11	1	2	0.00	31
	12	1	2	0.00	31
	14	4	6	.01	26
	unspecified	125			
D.	S. sonnei	20,683	20,845	45.33	1
	unknown	358			
	TOTAL	45,988	45,988		

* See footnote Table III

Table V

Sources of Reported Isolations of Shigella
by Residence at Time of Onset

Source	Oct	Nov	Dec	Total	Percent of Subtotal	Percent of Total
Mental Institutions	99	44	73	216	10	
Indian Reservations	35	15	7	57	3	
Other Residences	779	612	535	1,958	88	
Subtotal	913	671	615	2,231		80.4
Residences Unknown	231	213	101	545		19.6
Total	1,144	884	716	2,776		

Table VI

Shigella Serotypes from Mental Institutions
Number of Isolations by State
Fourth Quarter 1968

State	flexneri unspecified	flexneri 2 unspecified	flexneri 2a	flexneri 2b	flexneri 3 unspecified	flexneri 3a	flexneri 6	boydii 2	sonnei	TOTAL
Conn	0	0	0	0	0	0	0	0	1	1
Fla	1	0	0	0	0	0	2	1	21	25
Ga	0	3	0	0	1	0	0	0	1	5
Ill	0	0	4	6	0	29	1	0	7	47
Kans	0	0	0	0	0	0	0	0	2	2
Md	0	2	0	0	0	0	1	0	8	11
Mass	0	0	0	0	0	0	1	0	0	1
Mich	1	0	0	0	1	0	0	0	40	42
Miss	2	0	0	0	0	0	0	0	0	2
NY	53	0	0	0	0	0	0	0	0	53
NC	0	22	0	0	0	0	0	0	1	23
Okla	0	0	0	0	0	0	0	0	1	1
SC	2	0	0	0	0	0	0	0	0	2
SD	1	0	0	0	0	0	0	0	0	1
Total	60	27	4	6	2	29	5	1	82	216

Table VII

Age and Sex Distribution of Individuals
Infected with Shigellae in the United States 1968

Age (Years)	Male	Female	Sex Unknown	Total	Percent	Cumulative Percent	Attack Rate/ Million Population*
1	251	227	3	481	7.5	7.5	135.9
1 - 4	1,203	1,179	21	2,403	37.4	44.9	153.5
5 - 9	730	717	6	1,453	22.6	67.5	69.5
10 - 19	398	373	5	776	12.1	79.6	20.6
20 - 29	234	362	5	601	9.4	89.0	22.0
30 - 39	140	169	-	309	4.8	93.8	13.7
40 - 49	67	77	1	145	2.3	96.1	6.0
50 - 59	45	62	-	107	1.7	97.8	5.3
60 - 69	32	59	-	91	1.4	99.2	6.3
70 - 79	12	34	-	46	.7	99.9	5.1
80 +	7	8	-	15	.2	100.1	4.5
Subtotal	3,119	3,267	41	6,427			
Child (unspec)	24	19	3	46			
Adult (unspec)	19	31	2	52			
Unknown	1,183	1,196	373	2,752			
Total	4,345	4,513	419	9,277			
Percent of Total	49.1	50.9					

* Based on provisional data from Population Estimates, Series P25, No. 385, February 14, 1968.

Figure 1

PERCENTAGE *S. flexneri* AND *S. sonnei* OF TOTAL SHIGELLA ISOLATIONS REPORTED FROM INDICATED REGIONS

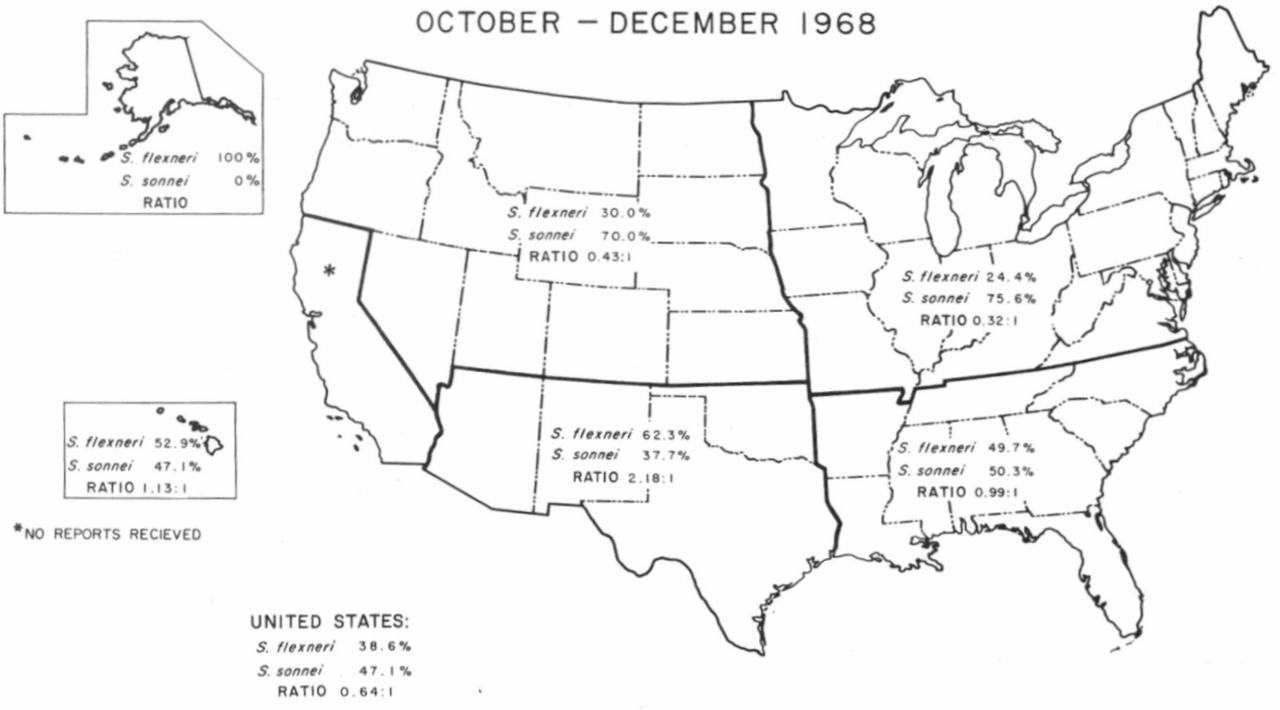
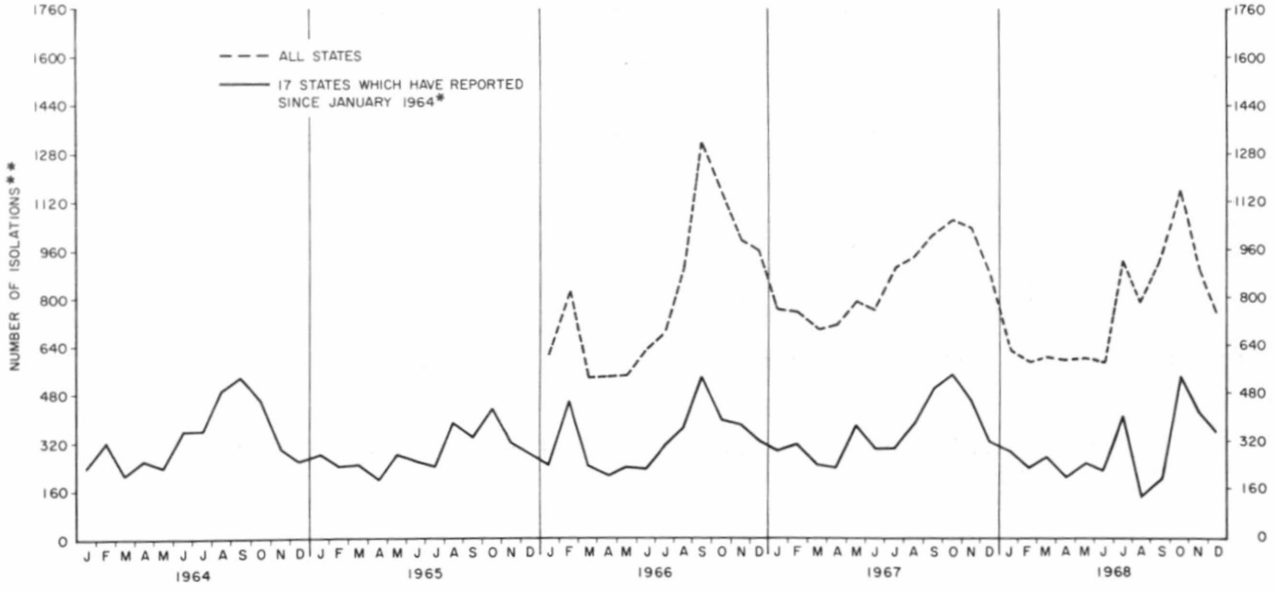


Figure 2

REPORTED ISOLATIONS OF SHIGELLA IN THE UNITED STATES

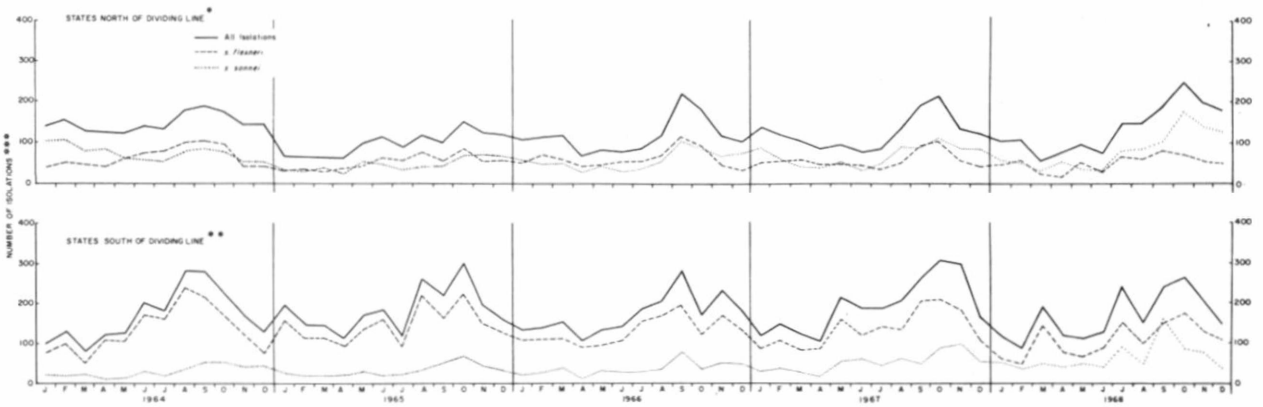


*ALASKA, ARIZONA, HAWAII, ILLINOIS, KANSAS, MARYLAND, NEW JERSEY, NEW MEXICO, NORTH CAROLINA, NORTH DAKOTA, OHIO, OKLAHOMA, OREGON, SOUTH DAKOTA, TENNESSEE, TEXAS AND VERMONT

**ADJUSTED TO FOUR-WEEK MONTHS.

Figure 3

SEASONAL DISTRIBUTION OF SHIGELLA ISOLATIONS
BY SEROTYPE AND REGION
15 STATES WHICH HAVE REPORTED SINCE JANUARY 1964



* ILLINOIS, KANSAS, MARYLAND, NEW JERSEY, NORTH DAKOTA, OHIO, OREGON, SOUTH DAKOTA, AND VERMONT.
** ARIZONA, NEW MEXICO, NORTH CAROLINA, OKLAHOMA, TENNESSEE AND TEXAS.
*** ADJUSTED TO 4-WEEK MONTHS

Figure 4 ATTACK RATES OF SHIGELLOSIS BY STATE
OCTOBER – DECEMBER 1968

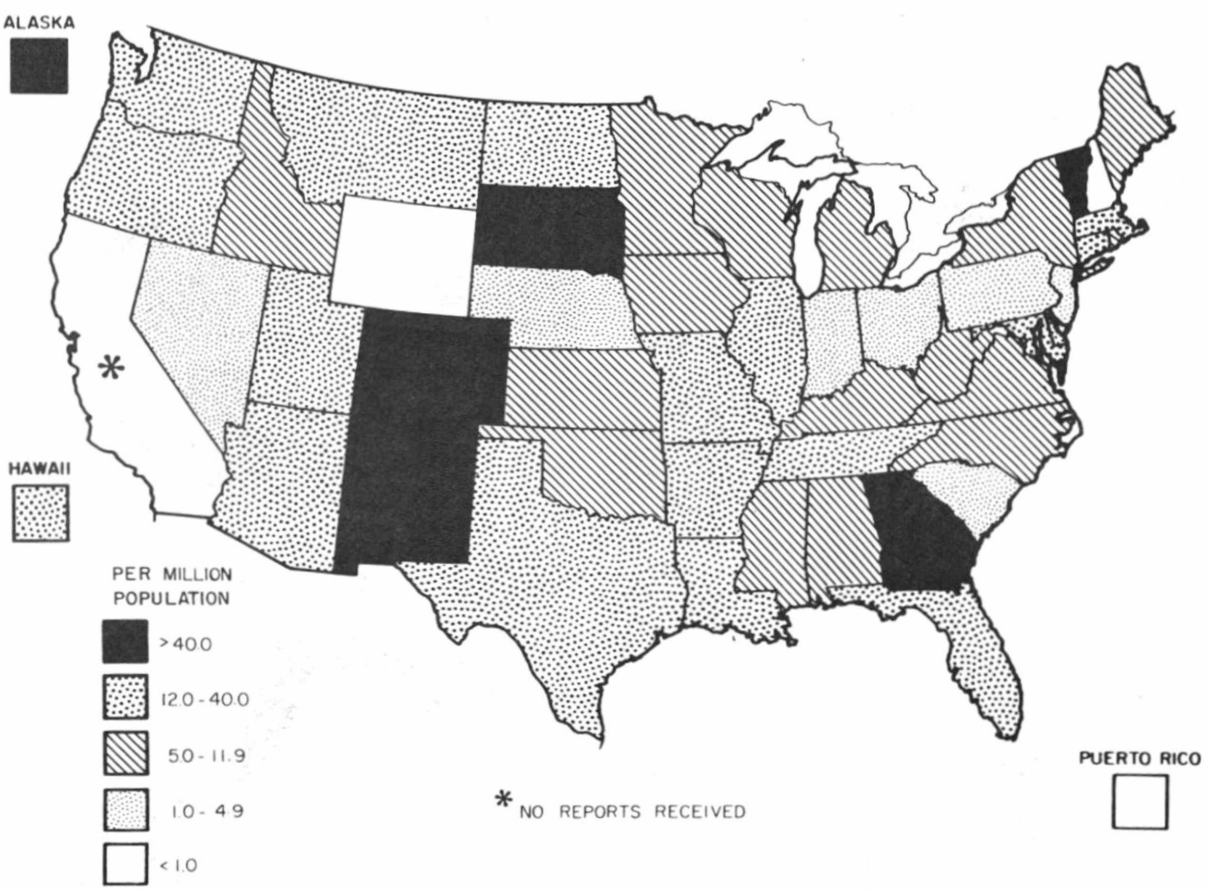
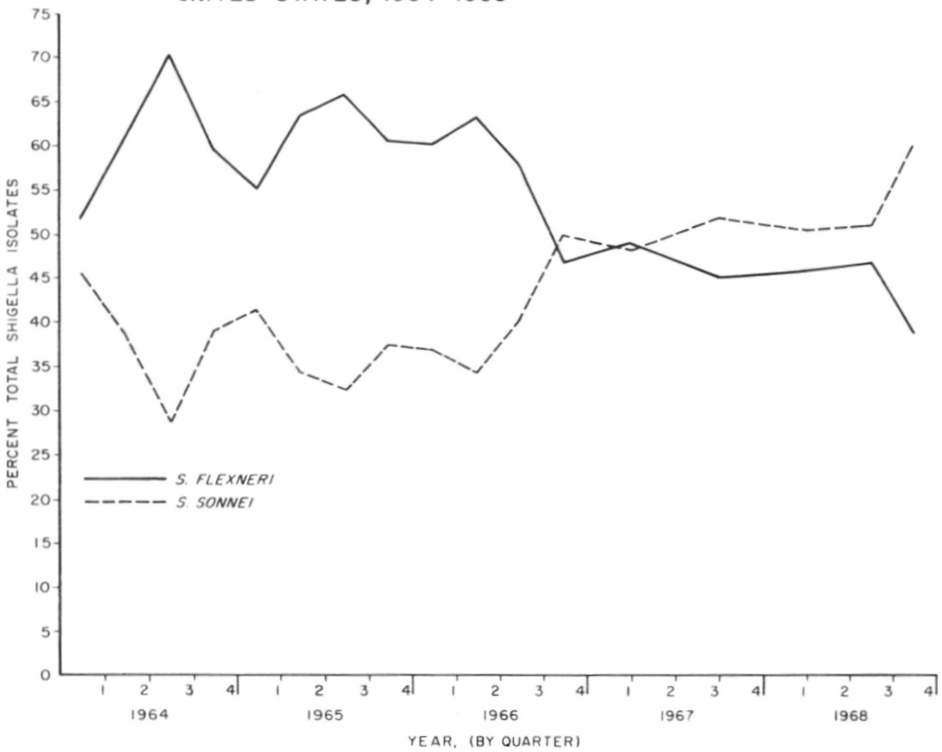


Figure 5 RELATIVE IMPORTANCE OF SHIGELLA SUBGROUPS* IN THE UNITED STATES, 1964-1968



* *S. DYSENTERIAE*, *S. BOYDII* } EACH ACCOUNT FOR LESS THAN 1% OF TOTAL SHIGELLA ISOLATES EACH YEAR

Figure 6 RATIO OF *S. FLEXNERI* TO *S. SONNEI* BY STATE, 1968

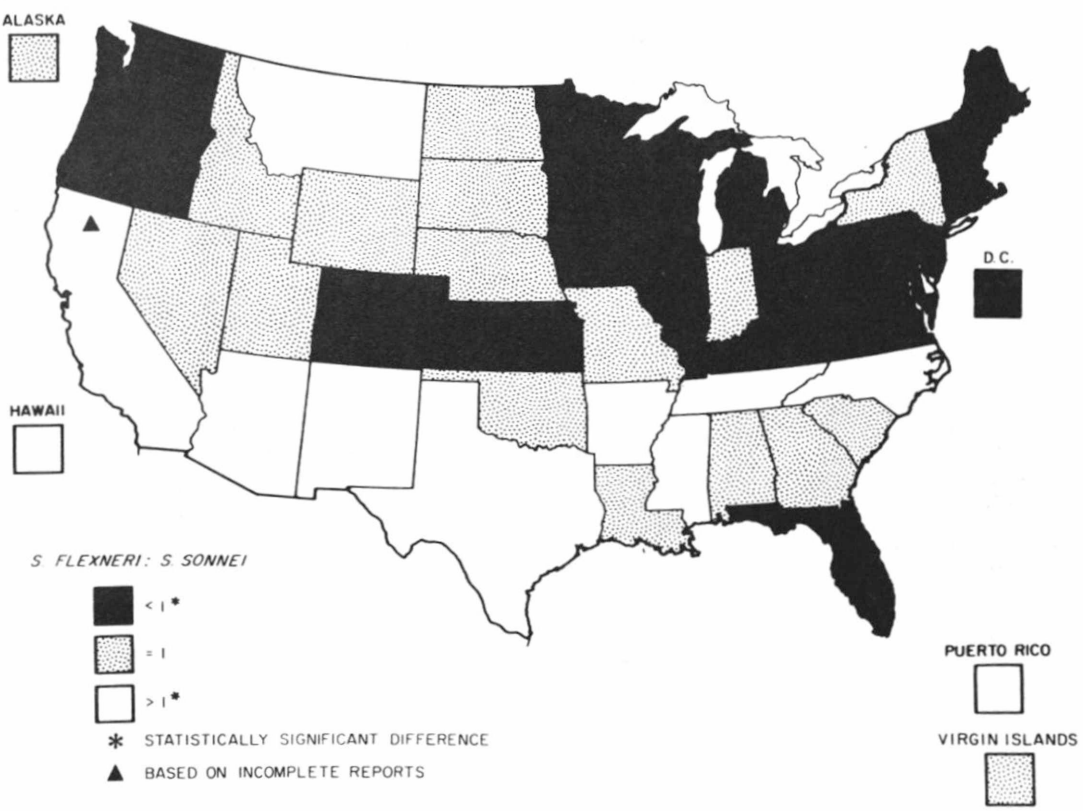


Figure 7 SHIGELLOSIS BY DATE OF ONSET* IN FOUR OUTBREAKS TRACED TO A COMMON SOURCE

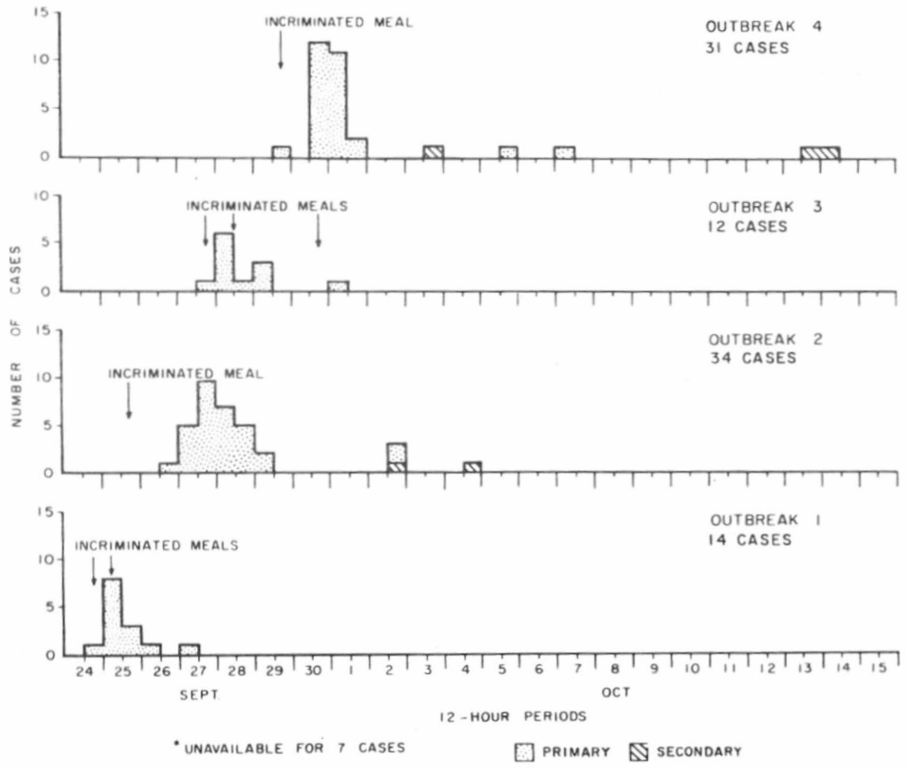


Figure 8 FOODBORNE SHIGELLOSIS BY DATE OF ONSET IN AN INSTITUTION, NORTH CAROLINA, SEPTEMBER 10-28, 1968

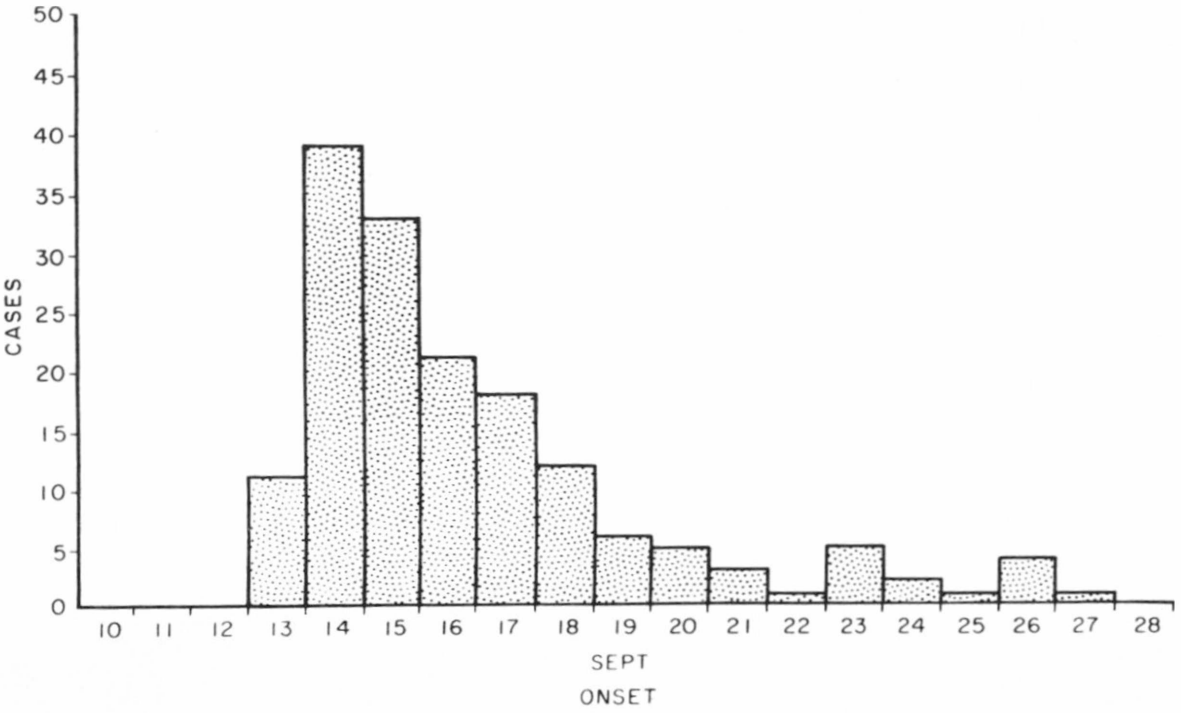
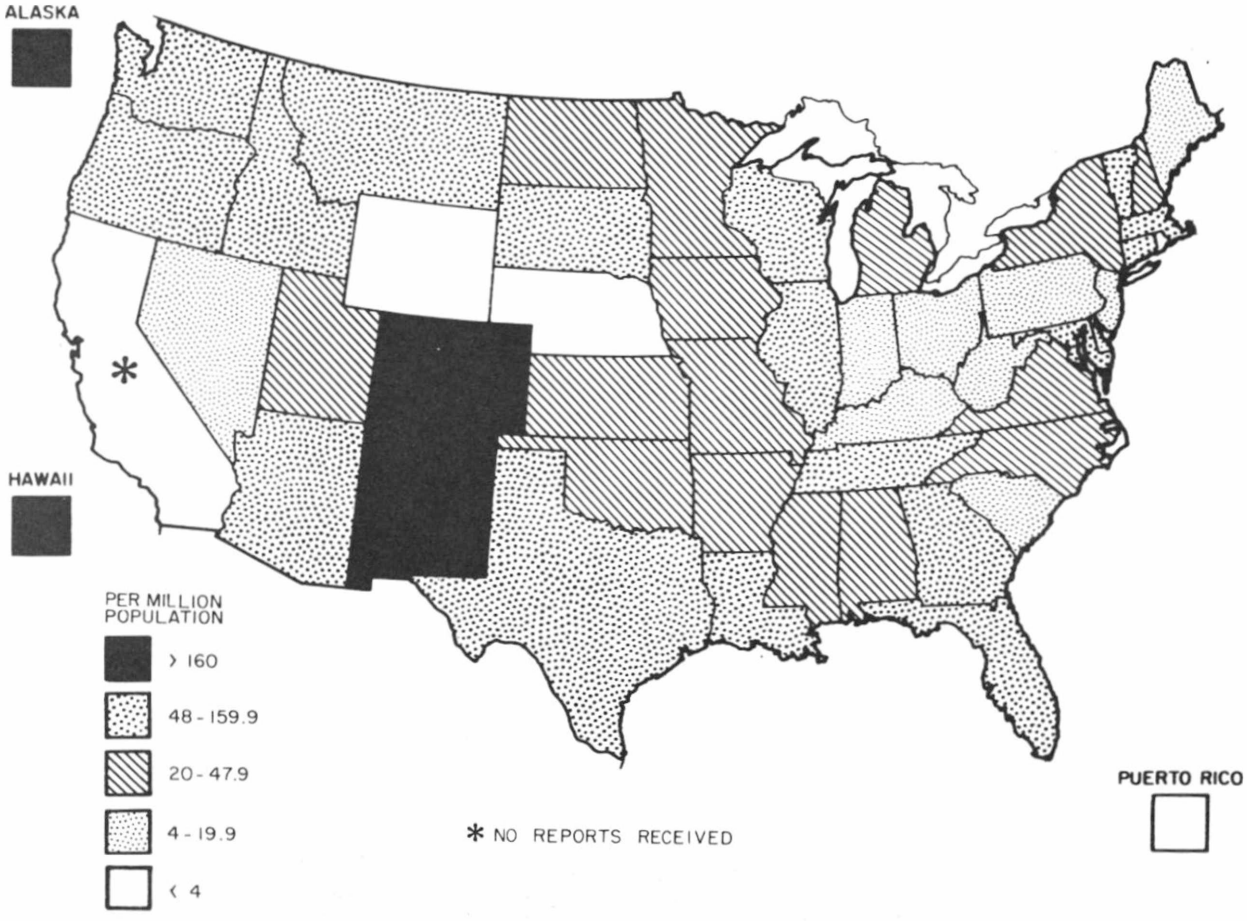


Figure 9 ATTACK RATES OF SHIGELLOSIS BY STATE, 1968



STATE EPIDEMIOLOGISTS AND STATE LABORATORY DIRECTORS

Key to all disease surveillance activities are the physicians who serve as State epidemiologists. They are responsible for collecting, interpreting, and transmitting data and epidemiological information from their individual States; their contributions to this report are gratefully acknowledged. In addition, valuable contributions are made by State Laboratory Directors; we are indebted to them for their valuable support.

STATE	STATE EPIDEMIOLOGIST	STATE LABORATORY DIRECTOR
Alabama	W. H. Y. Smith, M.D.	Thomas S. Hosty, Ph.D.
Alaska	Donald K. Freedman, M.D.	Ralph B. Williams, Dr.P.H.
Arizona	Melvin H. Goodwin, Ph.D.	H. Gilbert Crecelius, Ph.D.
Arkansas	J. T. Herron, M.D.	Eugene Potts, M.D.
California	Philip K. Condit, M.D.	Howard L. Bodily, Ph.D.
Colorado	C. S. Mollohan, M.D.	C. D. McGuire, Ph.D.
Connecticut	James C. Hart, M.D.	
Delaware	Floyd I. Hudson, M.D.	Irene V. Mazeika, M.D.
District of Columbia	William E. Long, M.D.	Gerrit W. H. Schepers, M.D.
Florida	E. Charlton Prather, M.D.	Nathan J. Schneider, Ph.D.
Georgia	John E. McCroan, Ph.D.	Earl E. Long, M.S.
Hawaii	Robert Penington, Jr., M.D.	Kingston S. Wilcox, Ph.D.
Idaho	John A. Mather, M.D.	Darrell W. Brock, Dr.P.H.
Illinois	Norman J. Rose, M.D.	Richard Morrissey, M.P.H.
Indiana	Daniel G. Bernoske, M.D.	Josephine Van Fleet, M.D.
Iowa	Arnold M. Reeve, M.D.	W. J. Hausler, Jr., M.D.
Kansas	Don E. Wilcox, M.D.	Nicholas D. Duffett, Ph.D.
Kentucky	Calixto Hernandez, M.D.	B. F. Brown, M.D.
Louisiana	Charles T. Caraway, D.V.M.	George H. Hauser, M.D.
Maine	Dean Fisher, M.D.	Charles Okey, Ph.D.
Maryland	John H. Janney, M.D.	Robert L. Cavenaugh, M.D.
Massachusetts	Nicholas J. Fiumara, M.D.	Geoffrey Edsall, M.D.
Michigan	George H. Agate, M.D.	Kenneth R. Wilcox, Jr., M.D.
Minnesota	D. S. Fleming, M.D.	Henry Bauer, Ph.D.
Mississippi	Durward L. Blakey, M.D.	R. H. Andrews, M.S.
Missouri	E. A. Belden, M.D.	Elmer Spurrier, Dr.P.H.
Montana	Mary E. Soules, M.D.	David B. Lackman, Ph.D.
Nebraska	Lynn W. Thompson, M.D.	Henry McConnell, Dr.P.H.
Nevada	Mark L. Herman, M.D.	Thomas Herbenick, B.S.
New Hampshire	William Prince, M.D.	Robert A. Miliner, Dr.P.H.
New Jersey	Ronald Altman, M.D.	Martin Goldfield, M.D.
New Mexico	Bruce D. Storrs, M.D.	Daniel E. Johnson, Ph.D.
New York City	Vincent F. Guinee, M.D.	Morris Schaeffer, M.D.
New York State	James O. Culver, M.D., Acting Chief	Donald J. Dean, D.V.M.
North Carolina	Martin P. Hines, D.V.M.	Lynn G. Maddry, Ph.D.
North Dakota	Kenneth Mosser, M.D.	C. Patton Steele, Ph.D.
Ohio	Calvin B. Spencer, M.D.	Charles C. Croft, Sc.D.
Oklahoma	R. LeRoy Carpenter, M.D.	F. R. Hassler, Ph.D.
Oregon	Gordon Edwards, M.D.	Gatlin R. Brandon, M.P.H.
Pennsylvania	W. D. Schrack, Jr., M.D.	James E. Prier, Ph.D.
Puerto Rico	Carlos N. Vicens, M.D.	Angel A. Colon, M.D.
Rhode Island	H. Denman Scott, M.D., acting	Malcolm C. Hinchliffe, M.S.
South Carolina	Donald H. Robinson, M.D.	Arthur F. DiSalvo, M.D.
South Dakota	G. J. Van Heuvelen, M.D.	B. E. Diamond, M.S.
Tennessee	C. B. Tucker, M.D.	J. Howard Barrick, Ph.D.
Texas	M. S. Dickerson, M.D.	J. V. Irons, Sc.D.
Utah	Robert Sherwood, M.D.	Russell S. Fraser, M.S.
Vermont	Linus J. Leavens, M.D.	Dymitry Pomar, D.V.M.
Virginia	Paul C. White, Jr., M.D.	W. French Skinner, M.P.H.
Washington	B. John Francis, M.D.	W. R. Giedt, M.D.
West Virginia	N. H. Dyer, M.D.	J. Roy Monroe, Ph.D.
Wisconsin	H. Grant Skinner, M.D.	S. L. Inhorn, M.D.
Wyoming	Herman S. Parish, M.D.	Donald T. Lee, Dr.P.H.