Based on reports received by the National Communicable Disease Center from the fall of 1963 to mid-1966, a picture is presented of the current status of shigellosis in the United States.

THE CURRENT STATUS OF SHIGELLOSIS IN THE UNITED STATES

Edward R. Eichner, M.D.; Eugene J. Gangarosa, M.D., F.A.P.H.A.; and James B. Goldsby, M.S.

THE studies of Hardy and Watt[1,2] underlined the importance of shigellosis as a public health problem in the United States. More recently it has been stated that, along with a diminution of enteric disease in the United States, there has been a relative decrease in shigellosis in the Southwest.[3] Nevertheless, shigellosis and other diarrheal diseases are common. Each year, enteric disease accounts for several thousand deaths in infants in the United States.[3] Several states (New Mexico, Arizona, Tennessee) consistently report more shigellosis than salmonellosis; others (Texas, Mississippi) reported as much shigellosis as salmonellosis in 1965.[4] Recent foodborne epidemics of shigellosis have occurred in schools, a hospital, and among military personnel.[5-8] Large community epidemics include one in Omaha in 1961-1962, which involved person-to-person spread,[9] and one in Utah in 1956 in which one-third of a town's population became ill from drinking contaminated water.[10]

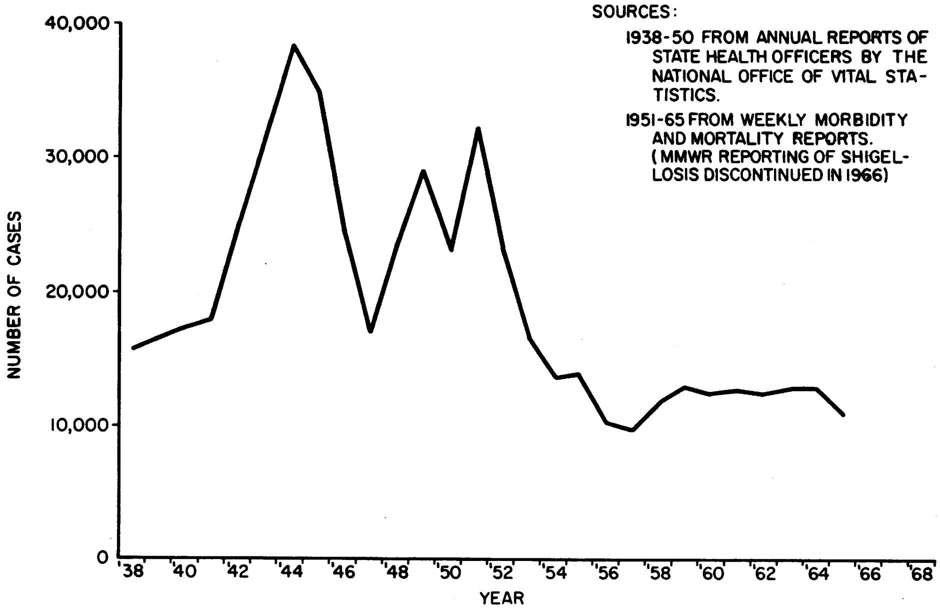
The only information available on the national incidence of enteric disease prior to 1963 was that published annually by the National Office of Vital Statistics and, after 1950, by the Morbidity and Mortality Weekly Report. Bacillary dysentery was included in this system from 1938-1965. The sources of these data were reports from state health officers; these reports included both clinical and laboratory diagnoses. In 1951, for the first time, the states were asked to specify whether the cases of bacillary dysentery had been confirmed by culture. In subsequent years, the incidence of bacillary dysentery dropped almost by half (Figure 1). Thus the decrease in yearly incidence of shigellosis in the United States in the early 1950's is probably more apparent than real.

In 1962, the National Communicable Disease Center (NCDC), US Public Health Service, and the Association of State and Territorial Epidemiologists and Laboratory Directors jointly established a program of surveillance of salmonellosis in the United States. This system helped define the extent of salmonellosis and added to the knowledge of its epidemiology through analysis of surveillance data and investigation of epidemics in cooperation with the states.[11] It was felt that a similar system for shigellosis would be useful, and shigellosis was added to the NCDC surveillance system in the fall of 1963. Initially, 13 states agreed to report Shigella isolations. Currently, all 50 states, the Virgin Islands, New York City, and the District of Columbia are reporting.

Method of Shigella Surveillance

Surveillance activities are coordinated by the Enteric Diseases Unit, Bacterial Diseases Section, Epidemiology Pro-

Figure 1—Cases of bacillary dysentery (shigellosis)* reported annually in the United States



* DURING 1960 THE TERM "DYSENTERY, BACILLARY" WAS CHANGED TO "SHIGELLOSIS (BACILLARY DYSENTERY)".

gram, National Communicable Disease Center. Weekly reports of laboratory isolations of Shigella are sent to the NCDC by a reporting official designated by the state and/or region. These reports include isolations from both human and nonhuman sources. Isolations of human origin are currently identified by serotype, patient's name, sex and age, county of origin, type of residence of the patient at time of onset of illness (e.g., hospital, home for the aged, mental institution, Indian reservation, boarding school, camp, private home), and by type of specimen cultured. Isolations from nonhuman sources are identified by source, serotype, and county of origin. All reports are submitted without regard to the clinical status of the patient. Isolations are usually confirmed by laboratories of the respective agencies cooperating in the program.

The contact between members of the Enteric Diseases Unit and the various state health officers and epidemiologists brought about by this system stimulates deeper inquiry into shigellosis, and often outbreaks of shigellosis are investigated by a team consisting of state and NCDC members.

Data from this reporting system are analyzed quarterly and published in a Shigella Surveillance Report which is sent to all participating agencies and other interested persons. Besides the surveillance data, the reports include accounts of epidemiologic investigations and other data on shigellosis submitted by local or state health departments.

This report is an analysis of data from the inception of the Shigella Surveillance Program, in the fall of 1963, through the middle of 1966. During this time, 11 quarterly reports were compiled. The

Table 1—Isolations of Shigella reported to the National Communicable Disease Center, fourth quarter, 1963, through second quarter, 1966

Reporting quarter	Isolations from human beings	Isolations from other sources*	No. of reporting centers
1963			
Fourth	932	2	13
1964			
First	838	0	17
Second	1,192	4	25
Third	1,895	11	25
Fourth	2,101	1	46
1965			
First	1,752	1	46
Second	1,515	15	46
Third	2,248	26	52
Fourth	2,429	11	52
1966			
First	2,099	38	53
Second	1,856	17	53
Subtotals	18,857	126	
Total	18,983		

* See Table 4.

data from the last half of 1966 are not included, although preliminary analysis shows they support the trends presented below.

Results

During the first 11 quarters of the Shigella Surveillance Program, a total of 18,983 isolations of Shigella were reported to the NCDC. Table 1 shows the number of isolations from human and nonhuman sources for each of these 11 quarters, along with the number of centers (states and/or regions) reporting.

The monthly isolations of Shigella reported to the NCDC since January, 1965, when nationwide reporting was achieved, are shown in Figure 2. It can be seen that the total monthly isolations range from just over 400 to over 950. Figure 3 shows monthly isolations from 15 states which have reported since January, 1964. These figures are discussed below.

Figure 2—Total isolations of Shigella by month, reported to NCDC, January, 1965-June, 1966

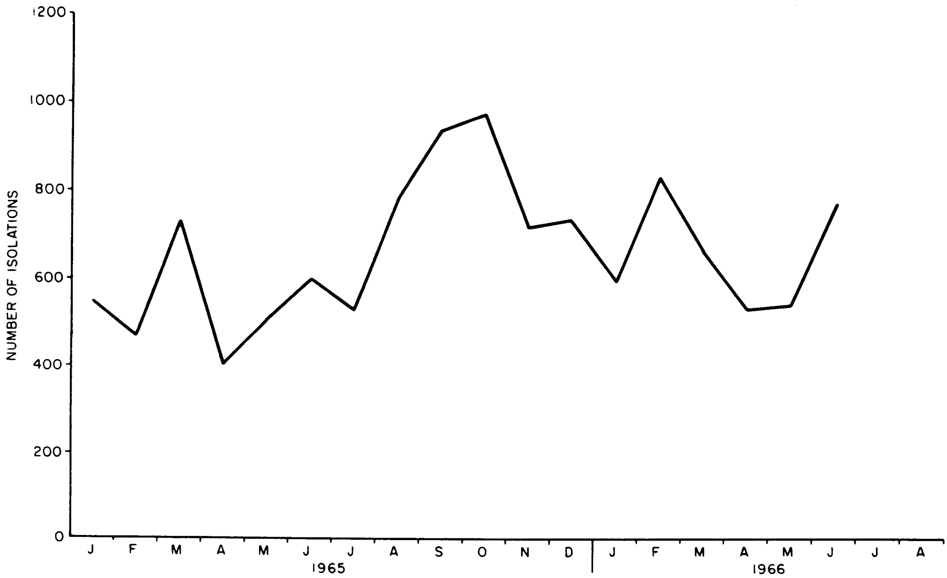
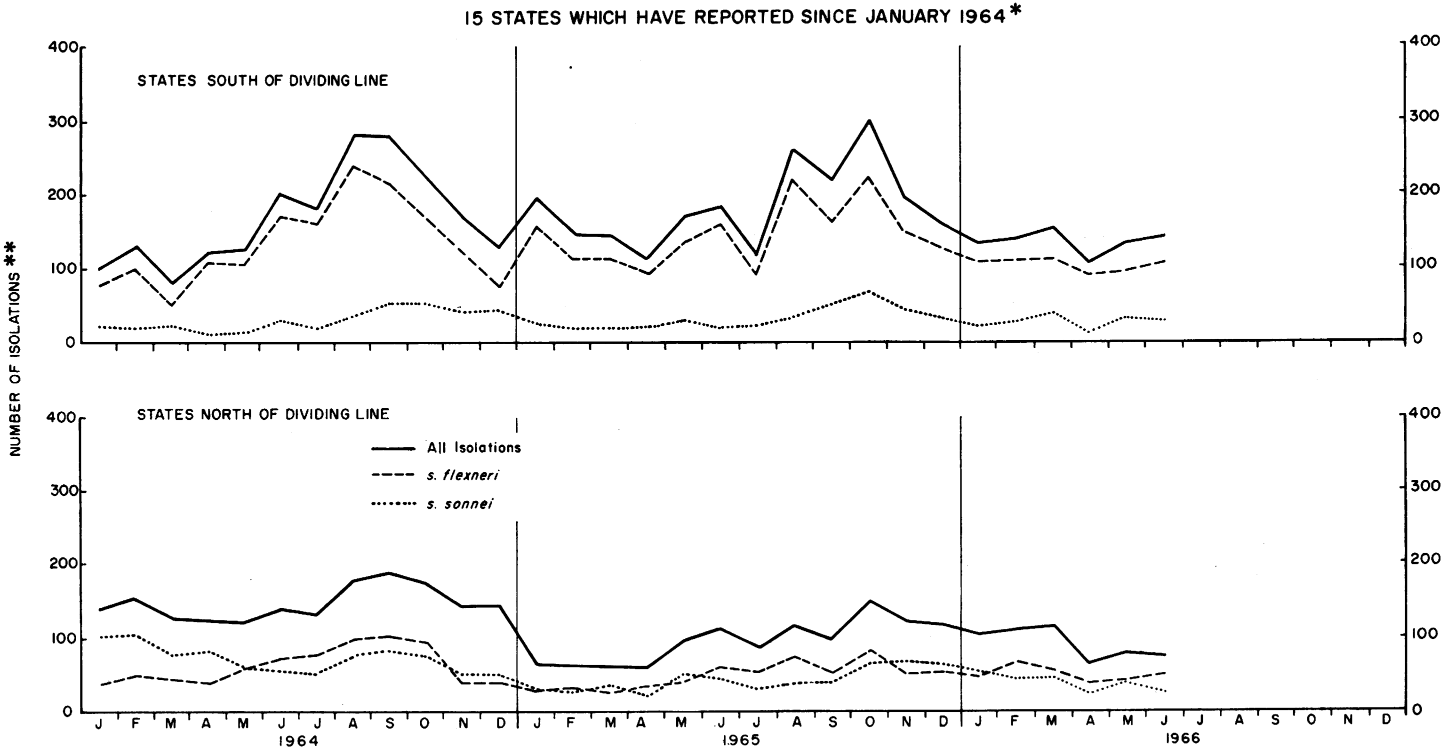


Figure 3—Seasonal distribution of Shigella isolations by serotype and region



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

Table 2—Age and sex distribution of individuals reported as harboring shigellae in the United States

A. Over-all sex distribution for the first ten quarters*

Male	% of total	Female	% of total	Total
7,857	49.4	8,060	50.6	15,917

B. Age and sex distribution for quarters 3–10 (April, 1964, through March, 1966)*

Age (yrs.)	Male	% of subtotal	Female	% of subtotal	Subtotal	% of total
Under 1	517	57.4	383	42.6	900	9.8
1–4	1,736	51.0	1,671	49.0	3,407	37.3
5–9	1,027	52.8	919	47.2	1,946	21.3
10–19	591	49.3	609	50.8	1,200	13.1
20–49	482	37.6	800	62.4	1,282	14.0
50 plus	158	38.8	249	61.2	407	4.5
Total of both sexes					9,142	

* Age and sex unknown in some cases.

Age and Sex

Two-thirds of the isolations were from children under ten, and almost 40 per cent of the isolations were from children in the one- to four-year age group (Table 2). Although no over-all sex predilection existed, there was a significant preponderance of isolations from males under one year of age as compared with females under one. The preponderance of male infants was balanced by a preponderance of females in the age group over 20. Both these differences are statistically significant ($p = < 0.0001$).

Serotypes

There are currently over 30 serotypes of Shigella. As shown in Table 3, S. sonnei accounted for 37.1 per cent and S. flexneri 2 for 25.4 per cent of the total isolates reported to the NCDC since the beginning of the Shigella Surveillance Program. Each quarter, a total of six strains accounted for over 85 per cent of all isolates (Table 3).[12]

Geographic Distribution of Shigella Isolates

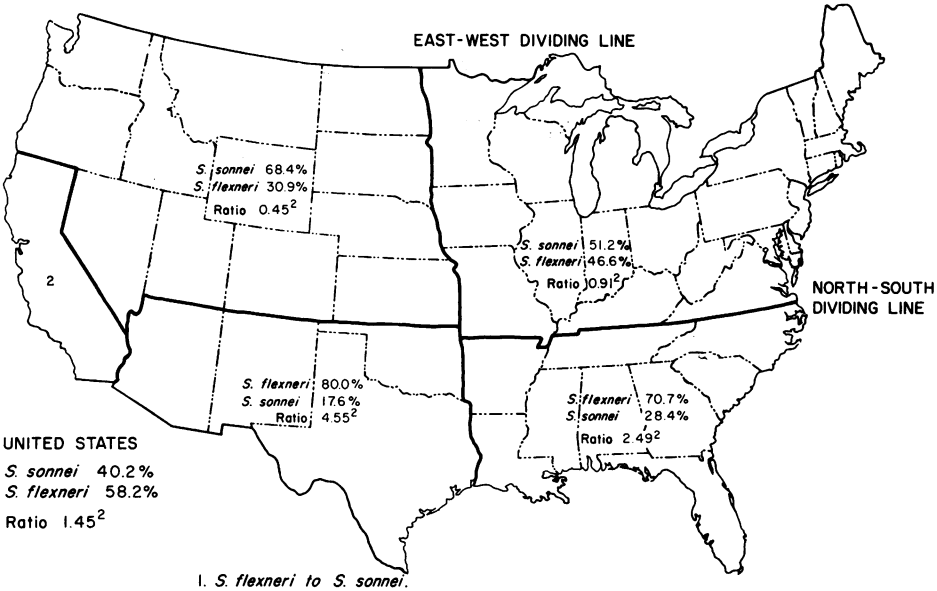
Figure 4 shows an arbitrary regional division of the United States. The ratio of S. flexneri to S. sonnei isolations varies in different parts of the country.

Table 3—Relative frequency of the strains of Shigella reported to the NCDC, fall quarter, 1963, through second quarter, 1966

Strains, listed in descending order of frequency	% of total isolations since fall, 1963
S. sonnei	37.1
S. flexneri 2	25.4
S. flexneri 1, 3, 4, and 6, in varying order from quarter to quarter	

S. flexneri 5, and all strains of S. dysenteriae and S. boydii are less commonly isolated in the United States. There have been 102 isolations of S. dysenteriae and 165 isolations of S. boydii reported to the NCDC through the second quarter, 1966.

Figure 4—Percentage S. flexneri and S. sonnei of total Shigella isolations reported from various regions of the United States—fourth quarter, 1965, through second quarter, 1966



1. S. flexneri to S. sonnei.
2. CALIFORNIA IS EXCLUDED BECAUSE IT OVERLAPS TWO REGIONS.

S. flexneri accounted for two-thirds to three-quarters of the total isolations in the South, that is, the states below the 37th parallel, but less than half the total isolations in the North. The per cent of the total isolates accounted for by S. sonnei and S. flexneri during the last three quarters is shown, along with the ratio of S. flexneri to S. sonnei for each of the four regions of the country (Figure 4). This geographic distribution will be discussed below.

Seasonal Distribution of Shigella Isolates

The greatest number of Shigella isolates reported to the NCDC occurred in the fall. A slight autumn peak is apparent for total isolations reported from the nation (Figure 2). Data based on monthly isolations from the 15 states which have reported to the NCDC since January, 1964, show this seasonal peak more clearly (Figure 3). With a delay of several weeks in the reporting system, the peak incidence of shigellosis thus occurs in late summer. This seasonal pattern has also been noted in salmonellosis.[4]

Isolations from Nonhuman Sources

Table 4 lists the isolations of Shigella from nonhuman sources. Primates accounted for more than 80 per cent of these isolations. Another interesting source has been the fluid contents of plastic ice cubes imported from the Far East. There have been a few isolations of Shigella from fowl products, including one isolation of S. sonnei from frozen egg albumin in a northwestern state and several isolations of Shigella from checked and frozen eggs in a Rocky Mountain state. No reports have been received of human shigellosis transmitted from any of these nonhuman sources, although human shigellosis has occasionally been transmitted from nonhuman primates.

Discussion

The isolations of Shigella reported to the NCDC do not coincide precisely with the amount of clinical shigellosis in the United States. These isolations represent only those cultures which have been reported, first to a state department of public health, then to the NCDC. Some of the isolations are from asymptomatic carriers. On the other hand, this system provides no estimate of the number of people with febrile diarrhea who never have their stools cultured, or the number of stool cultures yielding Shigella which are not reported to the NCDC.

It is difficult to compare incidence data when sources are different. The data compiled by the National Office of Vital Statistics and later by the Morbidity and Mortality Weekly Report (MMWR) provided the only yardstick to measure national incidence of shigellosis in the past. As noted above, the national incidence dropped by almost half after 1951, when states were encouraged to confirm culturally their reported cases of shigellosis. The data from the NCDC Shigella Surveillance Program differ from that of the MMWR surveillance in that they include only cases which have been confirmed culturally. In 1965, the last year that the MMWR compiled data on shigellosis, it reported 11,027 cases. The NCDC Shigella Surveillance Program showed only 7,964 isolations of Shigella in 1965. Since most of the states were reporting Shigella isolations to the NCDC during 1965, the difference between the two surveillance systems is largely accounted for by cases of shigellosis reported by physicians but not confirmed by culture. These cases would be included only in the MMWR data.

Estimates of the actual amount of shigellosis in the United States can reasonably be based on the NCDC data as a lower limit. Much of the shigellosis diagnosed clinically but not confirmed by culture *is* actually shigellosis; none of this would be included under the present NCDC system. Furthermore, such procedures as (1) more thorough questioning of index cases for family contacts who might be ill, (2) earlier culturing of patients with diarrhea,

Table 4—Isolations of Shigella from nonhuman sources reported to the NCDC

No.	Source	Type	Comment
103 (81.7%)	Monkeys	80% S. flexneri	Fifty isolations from one state, all S. flexneri 3
11	Laboratory stock cultures	S. flexneri	All from one state
4	Plastic ice cubes	S. sonnei (3) S. flexneri (1)	
1	Frozen egg albumin	S. sonnei	
1	Guinea pig	S. flexneri	
6	Miscellaneous (includes several isolations from fowl products in a Rocky Mountain state)		
126			

prior to antibiotic therapy, and (3) multiple stool cultures in cases of diarrhea, would all increase the reported incidence of shigellosis in the United States.

The data of Hardy and Watt,[1,2] derived largely from studies in New Mexico, Georgia, New York City, and Puerto Rico during the period 1936-1942, substantiate this claim. Most of their index cases seemed unrelated to any manifest source. In New Mexico, 56 per cent, and in Manhattan, 80 per cent of the index cases had had no known contact with shigellosis. However, when case-finding was emphasized, additional contact cases were often found. There were many "hidden sources" of shigellae for each "manifest source." Surveys showed that only two of 380 patients with shigellosis were under medical care. They also showed that repeated stool cultures increase the percentage of proved positive cases. Of diarrheal patients having only one culture, 56 per cent yielded shigellae, whereas of patients having four or more cultures, 85 per cent were shown to have shigellosis.

Although the number of discrete outbreaks of shigellosis that occur cannot always be derived from the NCDC Shigella Surveillance Data, there are several ways in which outbreaks can be detected. An increase in incidence of Shigella isolations from a particular state or region can be noted. Similarly, an unusually large number of isolations of shigellae of the same serotype can indicate an epidemic. An unusual age or sex distribution of the patients reported as harboring shigellae can be the first clue to an epidemic. Finally, family outbreaks can be detected since the patients are usually reported by name, and epidemics in hospitals, institutions, or other confined groups can be noted from the residences given on the reporting form.

The discrepancies in sex distribution of the patients harboring shigellae which appear in the NCDC surveillance data (predominance of males among the infants and females among the adults) may represent unknown bias in the reporting system rather than the disease itself. Hardy and Watt found a predominance of male infants as compared with female infants in patients presenting with diarrhea, but not in patients shown to have shigellosis.[2] However, predominance of male infants and children has been reported in other diseases, such as staphylococcal skin infections, purulent meningitis, infectious croup, neonatal sepsis, and ECHO type 9 central nervous system infections.[13-19]

Hardy and Watt also noted a predominance of females in the 15-44 age group, not only in the patients with diarrhea of undetermined cause, but in the patients with shigellosis. Speculative theories to account for the marked preponderance of isolations from females over 20 have been advanced, the most popular being that women of this age have closer contact with children, especially sick children, than do men of this age. The salmonella surveillance data from the NCDC also show a predominance of isolations from males under 20 years of age, and a predominance of isolations from females over 20.[4]

A recent study from Arizona stresses differences in age distribution of patients with shigellosis since the studies of Hardy and Watt.[3] In the Arizona study, 67 per cent of the acutely ill patients for whom treatment was sought were infants, and 40 per cent of all patients with shigellosis were infants. These data may reflect a relative endemicity of shigellosis compared with most other states, since Arizona reports a high number of Shigella isolations relative to its population. The Arizona report did note that Shigella was recovered at a slightly higher rate from Indians than would be expected if distribution of this pathogen were normal.

The age-specific attack rates for infants and children from the NCDC data compare closely with rates calculated almost three decades ago by Hardy and Watt. Approximately 10 per cent of the patients reported to the NCDC as harboring Shigella are infants (Table 2). Hardy and Watt found the same percentage of infants in their study group in Manhattan, the area with the lowest incidence of shigellosis in their studies. They found rates two to three times as high in infants in New Mexico and Georgia. The rates from NCDC data for children one to four years old and for children under ten compare closely with those of Hardy and Watt from New Mexico and Georgia.[2]

Hardy and Watt also commented on the geographic distribution of shigellosis. They were impressed with the "preponderance of Sonne and the rarity of Newcastle in New York as compared with New Mexico and Georgia." Figure 4 shows that the relative percentage of S. flexneri is greatest in the Southwest. The relative percentage of S. sonnei is greatest in the Northwest, whereas in Canada, S. flexneri has been more commonly isolated in recent years (accounting for 66 per cent, 51 per cent, and 52 per cent of total Shigella isolates during 1963-1965),[20] indicating, perhaps, that climate is not the only factor in the "regionalization" of serotypes. Another finding is that 33 (57 per cent) of the 58 isolations of S. dysenteriae 2 reported since 1963 are from one state in the Great Lakes area.

There is striking regional variation in relative frequency of Shigella strains isolated in different parts of the world. Chun showed that 91 per cent of 3,732 strains isolated in Korea in 1952-1953 were S. flexneri, and that S. sonnei represented only 2.3 per cent.[21] In Japan and Europe, S. sonnei has recently become more prominent compared with S. flexneri, which was common in the 1950's.[21] S. dysenteriae has almost disappeared in these countries. It is possible that the increasing frequency of S. sonnei in some countries reflects greater clinical awareness or better surveillance, since S. sonnei causes milder illness than the other shigellae.

The greater seasonal variation of S. flexneri as compared with S. sonnei is shown in Figure 3. Since S. flexneri is more commonly isolated in the southern United States (those states below the 37th parallel), the total isolations from the South rise to a higher peak in the fall than those from the North.[22]

Shigellosis is endemic in certain medical institutions and Indian reservations, and is also present in some lower socioeconomic communities across the nation. A recent investigation of shigellosis in a large northwestern city showed that the majority of cases in that outbreak occurred in lower socioeconomic groups and that transmission was by person-to-person contact, primarily among children.[23] Studies of the epidemiology of shigellosis in urban centers and rural areas have stressed the importance of sanitation and living conditions. Shigellosis is not equally distributed throughout a community, but occurs more commonly in those segments where indexes such as income, housing, and sanitation (including presence of water for washing) are below the community average.[24,9] The role played by these factors has also been demonstrated in studies in the military and in mental institutions. It has been shown that military units with high Shigella carrier rates display poor personal hygiene when compared with units with lower carrier rates,[2] and that Shigella can be cultured from the fingers of over 10 per cent of fecal carriers.[2]

It is difficult to improve the environmental sanitation of certain populations, such as those in institutions for the mentally retarded. Therefore in recent years there has been interest in the possible control of shigellosis in confined groups (such as those in institutions or on reservations) by immunization with a mutant or hybrid, living, attenuated, polyvalent, oral shigella vaccine, such as that being developed by Formal and colleagues at Walter Reed.[25] One such vaccine, prepared from a streptomycin-dependent S. flexneri 2a organism, has protected Yugoslavian soldiers against dysentery caused by S. flexneri 2a.[26]

To better define the scope of the shigellosis problem in confined groups, the Enteric Diseases Unit of the National Communicable Disease Center has emphasized the importance of surveillance and investigation of shigellosis in institutions for the mentally retarded. A common pattern in these institutions is that children, especially the more retarded children, have the highest incidence of shigellosis. Newly admitted children are likely to develop shigellosis within the first few months. Transmission is generally from person to person, with attack rates varying considerably from cottage to cottage, but always many times higher in those cottages with the youngest and most retarded children.[27] Despite constant efforts to improve hygiene, shigellosis frequently remains endemic. Because of major sanitation problems inherent in these groups, an effective vaccine may greatly facilitate control of institutional shigellosis, and would also be applicable to other groups living in areas of poor environmental sanitation.

Summary

The National Communicable Disease Center received reports of almost 19,000 isolations of Shigella from the inception of the Shigella Surveillance Program in the fall of 1963 to mid-1966. Two-thirds of these isolates were from children under ten. Differences have been noted in age and sex distribution of the patients from whom isolates have been obtained. There are regional differences in the prevalence of serotypes. The peak incidence of shigellosis occurred in late summer. S. sonnei and S. flexneri 2 account for more than 60 per cent of the total isolates. Nonhuman sources of shigellae include primates and fowl products. Shigellosis is endemic in certain medical institutions and Indian reservations, and is also present in some lower socioeconomic communities. An effective oral vaccine may facilitate control of shigellosis in confined groups.

REFERENCES

1. Hardy, Albert V., and Watt, James. Studies of the Acute Diarrheal Diseases. XII. Etiology. Pub. Health Rep. 60:57-66, 1945.
2. ———. Studies of the Acute Diarrheal Diseases. XVIII. Epidemiology. Ibid. 63:363-378, 1948.
3. Goodwin, M. H., Jr.; Mackel, D. C.; Ganelin, R. S.; Weaver, R. E.; and Payne, F. J. Observation on Etiology of Diarrheal Diseases in Arizona. Am. J. Trop. Med. Hyg. 9:336-342, 1960.
4. United States Department of Health, Education, and Welfare, Public Health Service, National Communicable Disease Center. Salmonella Surveillance Report. Annual Summary, 1965. Atlanta, Ga. (June), 1966.
5. Tucker, Cecil B.; Fulkerson, Glenn C.; and Neudecker, R. M. A Milkborne Outbreak of Shigellosis. Pub. Health Rep. 69:432-436, 1954.
6. Keller, Martin D., and Robbins, Malcolm L. An Outbreak of Shigella Gastroenteritis. Ibid. 71:856-862, 1956.
7. Ehrenkranz, N. Joel; Takos, Michael J.; Hoffert, Warren R.; and Riemer, Florence. An Epidemic of Shigella Sonnei Dysentery Arising in a General Hospital. New England J. Med. 259:375-377, 1958.
8. Greenberg, Jerome H.; Schmidt, Edward A.; and Bell, Fred S., Jr. A Common Source Epidemic of Shigellosis. Pub. Health Rep. 81:1019-1024, 1966.
9. Mosley, Wiley H.; Adams, Beatrice; and Lyman, Edwin. Epidemiologic and Sociologic Features of a Large Urban Outbreak of Shigellosis. J.A.M.A. 182: 1307-1311, 1962.
10. Drachman, R. H.; Payne, F. R.; Jenkins, A. A.; Mackel, D. C.; Petersen, N. J.; Boring, J. R., III; Gareau, F. E.; Fraser, R. S.; and Myers, G. G. An Outbreak of Waterborne Shigella Gastroenteritis. Am. J. Hyg. 72:321-334, 1960.
11. Sanders, Eugene; Brachman, Philip S.; Friedman, Eli A.; Goldsby, James; and McCall, Charles E. Salmonellosis in the United States. Results of Nationwide Surveillance. Am. J. Epidemiol. 81:370-384, 1965.
12. US Department of Health, Education, and Welfare, Public Health Service, National Communicable Disease Center. Shigella Surveillance Rep. No. 11, Atlanta, Ga. (Aug.), 1966.
13. Thompson, D. J.; Gezon, H. M.; Hatch, T. F.; Rycheck, R. R.; Rogers, K. M. Sex Distribution of Staphylococcus aureus Colonization and Disease in Newborn Infants. New England J. Med. 269:337-341, 1963.
14. Ravenholt, R. T. History, Epidemiology and Control of Staphylococcal Disease in Seattle. A.J.P.H. 52,10: 1796-1809, 1962.
15. Lund, E. Distribution of Age and Sex in Cases of Pneumococcal Meningitis. Acta path. et microbiol. scandinav. 61:487-490, 1964.

16. Carpenter, R. R., and Petersdorf, R. G. Clinical Spectrum of Bacterial Meningitis. Am. J. Med. 33: 262–275, 1962.
17. Berg, R. B. Weight and Sex of Children Hospitalized with Infectious Croup—Analysis of 850 Cases. Pediatrics 31:18–21, 1963.
18. Smith, R. T.; Platou, E. S.; and Good, R. A. Septicemia of Newborn: Current Status of Problem. Ibid. 17:549–575, 1956.
19. Sabin, A. B.; Krumbiegal, E. R.; and Wigand, R. ECHO Type 9 Virus Disease. A.M.A. Am. J. Dis. Child. 96:197–219, 1958.
20. Department of National Health and Welfare, Laboratory of Hygiene. Report of the National Salmonella, Shigella and Escherichia Coli Reference and Typing Center for Canada. Ottawa, Canada, 1965.
21. Chun, D. A Review of Salmonella and Shigella in Korea. Endemic Diseases Bulletin of Nagasaki University 6:125–138, 1964.
22. United States Department of Health, Education, and Welfare, Public Health Service, National Communicable Disease Center. Shigella Surveillance Rep. No. 5. Atlanta, Ga. (Mar.), 1965.
23. US Department of Health, Education, and Welfare, Public Health Service, National Communicable Disease Center. Shigella Surveillance Rep. No. 13. (To be published). Atlanta, Ga.
24. Stewart, William H.; McCabe, Leland J., Jr.; Hemphill, Emmarie C.; and DeCapito, Thelma. IV. Diarrheal Disease Control Studies: The Relationship of Certain Environmental Factors to the Prevalence of Shigella Infections. Am. J. Trop. Med. 4: 718–724, 1955.
25. Formal, S. B.; Kent, T. H.; May, H. C.; Palmer, A.; Falkow, S.; and LaBrec, E. H. Protection of Monkeys Against Experimental Shigellosis with a Living, Attenuated Oral Polyvalent Dysentery Vaccine. J. Bact. 92:17–22, 1966.
26. Mel, Col. D. M.; Terzin, A. L.; and Vuksic, Col. L. Studies on Vaccination Against S. flexneri 2a in a Field Trial. Bull. World Health Organ. 32:647–655, 1965.
27. US Department of Health, Education, and Welfare, Public Health Service, National Communicable Disease Center. Shigella Surveillance Rep. No. 7, Atlanta, Ga. (Sept.), 1965.

Dr. Eichner and Dr. Gangarosa are with the Enteric Diseases Unit, Bacterial Diseases Section, Epidemiology Program, National Communicable Disease Center, Public Health Service, U. S. Department of Health, Education, and Welfare, Atlanta, Ga. 30333. Dr. Goldsby is with the Computer Center, National Communicable Disease Center.

This paper was presented before the Epidemiology Section of the American Public Health Association at the Ninety-Fourth Annual Meeting in San Francisco, Calif., November 1, 1966.

Pesticides and Public Health

The National Communicable Disease Center announces a course in Pesticides and Public Health to be given May 13-16 in Atlanta, Ga. Course content includes discussion of the ecology of pesticides, toxicology, epidemiology of pesticide poisoning, pesticide laws, and the monitoring of pesticide residues in human beings.

Materials are designed for the use of personnel of state and local health departments, federal agencies, arthropod control districts, conservation groups, and other appropriate agencies. There is no charge for tuition or books. Further information from Chief, State Services Section, Pesticide Program, National Communicable Disease Center, Atlanta, Ga. 30333