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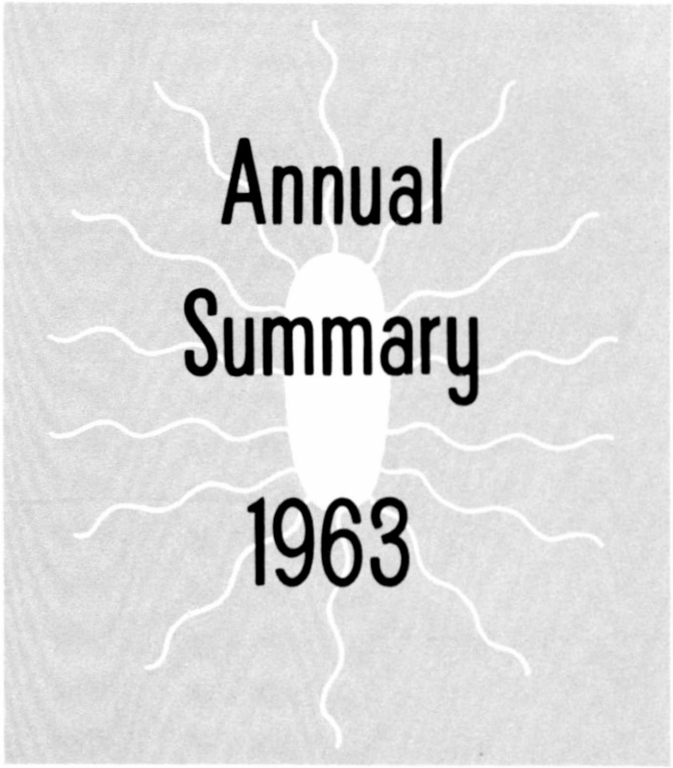
COMMUNICABLE DISEASE CENTER

SALMONELLA

SURVEILLANCE



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Salmonella Surveillance Report

Annual Summary - 1963

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Salmonella Surveillance

Annual Summary - 1963

I. INTRODUCTION

In April 1962 a program of surveillance of salmonellosis in the United States was jointly established by the Communicable Disease Center (CDC) and the Associations of State and Territorial Epidemiologists and Laboratory Directors. The surveillance activities were assigned to the Investigations and Veterinary Public Health Sections of Epidemiology Branch at CDC. The program, initially instigated on a trial basis, was formalized on January 1, 1963. At this time all 50 States, the District of Columbia, the Salmonella Reference Center at the Beth Israel Hospital, New York City, the Virgin Islands, and the National Animal Disease Laboratory, Ames, Iowa reported isolations of salmonellae from human and nonhuman sources on a weekly basis.

This report summarizes the first full year of salmonella surveillance on a nationwide basis (December 28, 1962 - December 27, 1963). The purpose of the compilation is to present the results without detailed discussion. The report will serve as a prototype for subsequent annual summary data, which will be compiled following each calendar year.

II. MATERIALS AND METHODS

The data analyzed are derived from three sources: (1) the Morbidity and Mortality Analysis Unit (1942-1962 Morbidity and Mortality Weekly Report (MMWR) Annual Supplements), (2) the Salmonella Surveillance Unit and (3) summary data submitted from other countries. The data from the first source (MMWR) include cases of salmonellosis diagnosed clinically and presumably confirmed bacteriologically. Reports are dichotomized into typhoid fever and salmonellosis exclusive of typhoid fever. Whether the cases are reported by onset of illness or date of culture is not known. The data collected by the Salmonella Surveillance Unit represent laboratory isolations of salmonellae, without distinction as to whether the isolate came from a clinical case or a carrier.

Human isolates are reported by name, age, sex, serotype, county of residence, and whether or not the case was fatal. Nonhuman isolates are reported by source, serotype, and county of origin. Approximately 60 per cent of these are reported from the National Animal Disease Laboratory, Ames, Iowa and the remainder from State Reporting centers.

Interpretations are limited by the bias inherent in the methods and materials used for analysis. For example geographical prevalences of human isolates reflect "interest factors." Nonhuman data are most difficult to interpret because isolations are obtained from both ill and asymptomatic animals, multiple isolates may be reported from the same source, denominator data are unavailable, and diagnostic procedures differ among animal species (it is

common practice to culture fowl tissue, whereas, other animals are frequently subjected to gross anatomical and histological examinations for disease).

Despite the limitations, certain observations are justified, and the data herein provide the ground work on which future collations may be made. An attempt has been made in this report to characterize the epidemiology of salmonellosis within the limits of the data obtained during the first year of operation of the Surveillance Program. The data must be confirmed, and the extent to which confirmation is afforded by surveillance in subsequent years is one measure of the success of the program.

III. SUMMARY

During 1963, 18,649 human isolations of salmonellae were reported to the Salmonella Surveillance Unit. A seasonal pattern was noted with a peak in October and a trough in January, which was not dissimilar from the seasonal index computed on the basis of the MMWR salmonellosis data. This suggests that the incidence of human salmonellosis apparently has a predictable seasonal pattern.

Of the estimated 900 known serotypes, 124 were represented among the 1963 isolates from humans. Salmonella typhi-murium and typhi-murium var. copenhagen were the most frequently recovered serotypes, followed by S. derby and S. heidelberg. Among nonhuman sources, S. typhi-murium and typhi-murium var. copenhagen were also the most prevalent, however, S. heidelberg appeared as second most common. Salmonella derby was the serotype most frequently associated with deaths, which demonstrated the effect of a large outbreak due to that organism among older people with life-threatening illnesses in hospital environs.

Seven States accounted for 53.8 per cent of all human isolations of salmonellae reported during the year. These States in order of decreasing number of isolations reported were California, New York, Pennsylvania, Massachusetts, Florida, Illinois, and Louisiana. The combined attack rate for these States was 14 per 100,000 compared with 10 per 100,000 for the entire country. Hawaii reported 484 isolations which resulted in the highest attack rate of 70 per 100,000.

Geographic concentrations of the individual serotypes were noted among the five most common serotypes isolated from humans. Additionally, a number of the less frequently reported types were broken down into regional groups (eg. Salmonella miami was recovered from human specimens 65 times, 44 of which were from Florida and 8 from Georgia).

Fifty-seven family and general outbreaks were reported as such, representing an estimated minimum of 2,800 illnesses (an average of approximately 50 per outbreak). Salmonella typhi accounted for the largest number of outbreaks (eight) but the average number of illnesses per outbreak amounted to only eight as compared to 58 and 78 for S. typhi-murium and S. heidelberg respectively.

Twenty-six States reported outbreaks with California accounting for the largest number (eight). The remaining 24 States reported none.

In 32 of the 57 outbreaks, a suspect or confirmed source of infection was determined. Thirteen were traced to human carriers, seven to eggs, four to Easter chicks and ducklings, two to unknown foods, and one each to turkey, turkey roll, beef jerkey, ice cream, pet turtles and a dead rat.

The modal age group for individuals infected with salmonellae was 1-4 years. The highest attack rate was in those under one year. There was no apparent sex predeliction.

The mortality rate for salmonellosis was estimated to be 0.34 per cent. This was lower than the mortality rate derived from MMWR data, which has been estimated to be between 0.9 and 2.6 per cent.

The family case to total case ratio for salmonellae isolated was 18.1 per cent. The proportion of this figure due to person-to-person spread is not known.

A total of 5,389 salmonella isolations from nonhuman sources were reported. Of these, 58,1 per cent were from poultry or wild fowl; 28.7 per cent, domestic and wild animals; 5.2 per cent, animal feeds; 2.8 per cent, eggs and egg products; 1.7 per cent, other human foods, and 3.5 per cent from other and unknown sources.

The greatest number of nonhuman recoveries (22.8 per cent) were reported from the East North Central Region of the country. The Pacific Region followed closely with 21.2 per cent and the West North Central Region with 19.4 per cent.

During 1963, 104 serotypes were reported from nonhuman sources. The ten most common accounted for 66.7 per cent of all isolations reported. Salmonella typhi-murium and S. typhi-murium var. copenhagen accounted for 24.6 per cent. With only minor exceptions, the lists of most common serotypes from human and nonhuman sources were similar.

Apparent host specificity was observed in certain serotypes. For example, all S. pullorum and S. gallinarum isolates were from poultry and eggs. Salmonella typhi-suis was isolated four times, all from swine, and S. dublin was isolated only from cattle.

IV. REPORTS OF ISOLATIONS FROM THE STATES

A. Human

Incidence

During 1963, a total of 18,649 human isolations of salmonellae were reported to the Salmonella Surveillance Unit. This represents an increase of 8,361

over the total for 1962 as recorded by the Morbidity and Mortality Analysis Unit for a percentage increase of 81.3. This increase, at least in part, may be explained by a difference in the two reporting mechanisms (vide supra) and an increased awareness and interest in the salmonella problem. A comparable figure for the Morbidity and Mortality Analysis Unit data is not available. The pattern in Figure I demonstrates an average annual increase in reported cases since 1950 of 9.6 per cent with a high degree of variation (from a high of 26.6 to a low of -6.5 per cent). In contrast, the incidence of typhoid fever has steadily declined such that in 1962 S. typhi accounted for approximately 6 per cent of all reported isolates of salmonella in contrast to 84 per cent in 1942.

Seasonal Prevalence

A seasonal index of salmonellosis computed on the basis of MMWR data appears in Table II. The period of below average incidence of salmonellosis is January to June with the trough occurring in February. The period above average begins in early summer and continues, with the exception of November, through December. The pattern during August to December demonstrates the degree of variation noted from one month to the next.

Figure 2 demonstrates the average number of reported isolations per week for each month during 1963. For comparison, the expected figures based on the seasonal index described above and the actual total for 1963 are depicted by the broken line. The similarities are remarkable as are the differences. For the period beginning with April and ending with August, the curves approximate congruity. The major differences in the curves occurred in September and October. The reasons for this divergence may possibly be explained by differences in reporting mechanisms used to obtain the data represented by the two curves (vide supra) and the fact that the curve represented by the broken line portrays cases only rather than cases and carriers as represented by the solid line. In any event, the similarity of the two curves is sufficient to lend credence to the belief that there is a seasonal pattern of salmonellosis in the United States and that the peak incidence occurs in late summer or early autumn.

Serotype Frequency

During 1963, 124 different serotypes isolated from humans were reported. This number accounted for approximately 14 per cent of the estimated 900 known salmonella serotypes. Ten of the 900, or 1.1 per cent, accounted for 13,750 (73.7 per cent) of the 18,649 isolations reported during 1963. Therefore, the preponderance of human salmonellosis appears to be related to a small number of serotypes. The 10 most frequently reported serotypes appear in Table IV. Salmonella typhi-murium and S. typhi-murium var. copenhagen headed the list in each month during 1963 and accounted for 30.1 per cent of all recoveries reported. Prior to an outbreak of hospital-associated illnesses due to S. derby, this second most commonly reported serotype represented about 2.0 per cent of all isolations. The outbreak, due to this serotype which began in March, 1963, was responsible for elevating S. derby to the second most commonly isolated serotype. The next three, S. heidelberg, S.

newport, and S. infantis respectively, appeared among the seven most frequently reported serotypes in all 12 months of 1963.

When the 10 most common strains among humans were compared with the 10 most common among nonhuman sources, striking similarities were noted. With the exception of S. derby, the first five on the former list also appear on the nonhuman list. In addition, two other serotypes were common to both lists (S. saint-paul and S. montevideo). These similarities, taking into consideration that the data are not wholly comparable, demonstrate the close association of human and nonhuman disease. However, the presence of serotypes such as S. typhi and S. pullorum on the lists, which are almost entirely host specific for humans and poultry respectively, reminds us that the host also probably perpetuates the infection within his own kind. Salmonella typhi is perpetuated by the human carrier and consequently makes the human its sole reservoir of infection. The case of S. pullorum and poultry is essentially analogous.

Geographic Patterns

The geographic distribution of human isolates reported during 1963 appears in Figure 3. California, with 2,646 recoveries, reported the largest number followed by New York, 2,183; Pennsylvania, 1,494; Massachusetts, 1,151; Florida, 909; Illinois, 846; and Louisiana, 812. These seven States accounted for a total of 10,041 reported isolations or 53.8 per cent of the total reported for the country while containing only 38 per cent of the country's population within their boundaries. The combined attack rate for these States was estimated to be 14/100,000 as compared to 10 for the country as a whole.

Hawaii reported the highest attack rate (70/100,000) which was almost three times higher than Louisiana's 24/100,000, the next highest. (The basis of the computed attack rate is the estimated resident population for 1963).

The geographic attack rates depicted in Figure 3 demonstrate interesting patterns. The three States exhibiting the highest attack rates, Hawaii, Louisiana and Massachusetts (70, 24 & 22/100,000 respectively), are conspicuously geographically separated from other States with high attack rates. This suggests that the high attack rates in these areas, especially Louisiana and Massachusetts, are due in large part to some factor other than that which is influencing attack rates in the surrounding States. Consequently, it is likely that the vigor with which salmonellosis is diagnosed and reported contributes to the attack rates of some States in addition to human, ecological and climatic factors.

Table IV demonstrates geographical variances among specific serotypes. New England and the Middle Atlantic States accounted for 74 per cent of all S. derby recoveries demonstrating once again the effect of the hospital associated interstate outbreak. Salmonella heidelberg was more prevalent in the Pacific States. A large outbreak due to this type in Washington in May, 1963 was probably responsible for the divergence. Salmonella newport was concentrated in the West South Central States. An apparent outbreak due

to this type occurred in Louisiana and Texas between July and October, 1963 reflecting the high percentage in that region. The East North Central Region accounted for an unusually large number of S. infantis isolations. No apparent outbreak in that region was large enough to cause such a divergence from the norm.

Other serotypes, less frequently reported than the aforementioned ones, also have definite geographical patterns. For example, of the 40 isolates of S. cubana which have been reported from humans, all except one were reported from States east of the Mississippi River. Salmonella miami was recovered from humans 65 times, 44 of which were reported from Florida, 8 from Georgia, and the remaining 13 scattered over the country. Of 168 reported isolations of S. javiana, 157 were from Southern States. Salmonella loma-linda was reported 6 times during 1963, all of which came from the Western States. Salmonella weltevreden was recovered from human specimens on 46 occasions, 44 of which were in Hawaii. One was isolated in California and traced epidemiologically to Hawaii. The remaining one was reported from Illinois.

Outbreaks

A total of 57 general and family outbreaks of illness due to salmonellae were investigated and reported in the Salmonella Surveillance Reports during 1963. An estimated minimum of 2,800 illnesses were involved for an average of approximately 50 and a range of 2 to over 1,000 per outbreak. In 13 of the epidemics the proven or suspected source of infection was a human carrier via personal contact or an infected food or infected water. Seven outbreaks were attributed to eggs, 4 to Easter chicks and ducklings, 2 to unknown foods, and 1 each to turkey, turkey roll, beef jerkey, ice cream, pet turtles, and a dead rat. There were 25 outbreaks for which the source was not clear or was unknown.

California investigated and reported 8 outbreaks of salmonellosis, Massachusetts, 6; New Jersey and New York 4 each; Pennsylvania and Texas 3 each, and Illinois, Kansas, Michigan, Nebraska, North Carolina, Virginia and Washington 2 each. Other States reporting 1 each were Alaska, Colorado, Connecticut, Georgia, Hawaii, Iowa, Kentucky, Maryland, Minnesota, Missouri, Ohio, Oregon, Vermont, and Wisconsin. The remaining 24 States including the District of Columbia, reported none. It should be emphasized that these reports do not reflect the prevalence of outbreaks in these States nor do they account but for a fraction of the whole.

The fifty-seven reported epidemics were attributed to 26 different serotypes and ranged from family outbreaks involving only 2 people to an interstate outbreak involving many people. Table V depicts the serotypes which were responsible for more than one outbreak each. With the exception of S. derby and S. oranienburg the serotypes which appeared among the ten most common strains are present in this table. Salmonella derby, which was responsible for one large interstate outbreak of hospital-associated infections, resulted in over 1,000 illnesses and countless asymptomatic excreters. Salmonella oranienburg was responsible for one reported outbreak involving 10 members of the same family. Four reported outbreaks were attributed to two serotypes each and one outbreak was found to be caused by three different serotypes.

Age & Sex Distribution

Of the 17,880 individuals for which sex was indicated, 8,854 (49.5 per cent) were males and 9,026 (50.5 per cent) were females.

Of 11,725 individuals harboring salmonellae reported by age during 1963, 7,215 or 61.5 per cent were less than 20. The age specific attack rates appear in Figure 4. The highest attack rate occurred in the less than 1 year age group (43/100,000). The drop in attack rates from the less than 1 year age group to the 10-19 year age group was precipitous. After a constant level from 10 to 50 years, the curve demonstrates a gradual rise to a much lesser second peak of an attack rate of 6.6 per 100,000 for persons 80 years and over.

Salmonella derby, the serotype implicated in the hospital-associated outbreak in the Northeastern United States, represented the only significant departure from the pattern established by all salmonellae and the five most common serotypes from humans (Figure 5). The high concentration in the 50-79 year age groups accounted for the divergence and demonstrates the effect of a large outbreak on the normal endemic pattern of an otherwise or previously infrequently isolated serotype. This variance may reflect the age specific distribution of hospitalized patients.

Mortality

During 1963, 63 deaths with which salmonellae were associated were reported. When related to the 18,649 isolations reported, the death to case ratio determined is 0.34 per cent. It is believed that this is not a true reflection of the mortality rate due to salmonellosis in this country because (1) the reporting officials do not always have access to information concerning the clinical courses of patients' illnesses and (2) it is believed that, in some cases, isolates are reported prior to death and the deaths are then not reported. Additionally, the mortality rates computed on the basis of data reported between 1951 and 1961 indicate a higher mortality rate than that computed for the 1963 data. The annual mortality rates computed on the basis of the MMWR data range from 2.9 per cent in 1951 to 0.9 per cent in 1961.

Salmonella derby appeared as the most common among deaths associated with salmonellae. However, the highest attack rate for S. derby was among older hospitalized patients, some with life-threatening illnesses. Salmonella typhi-murium and S. typhi-murium var. copenhagen were associated with 12 (19.0 per cent) of the reported deaths. Salmonella cholerae-suis and S. cholerae-suis var. kunzendorf accounted for six (9.5 per cent) of the 63 reported deaths. These two serotypes accounted for only 74 (0.4 per cent) of all isolations reported for 1963, making the death to case ratio for S. cholerae-suis 8.1 per cent. Salmonella derby followed with a ratio of 0.9 per cent.

Of the 63 deaths reported, the sex of 60 of the individuals was known. Twenty-seven (45 per cent) were males. Of the 44 for which age was known,

31 (70.5 per cent) were 40 years of age or over. Of the remaining 13, 9 were less than 5 years and 4 were in the 20 to 29 years age group.

Family Case to Total Case Ratio

Of the 18,649 cases reported during 1963, 3,369, or 18.1 per cent, represented those who had other members of their family also positive for salmonellae. With the exception of S. derby, the family case to total case ratios for the five most common serotypes isolated from humans was consistant. The marked departure of the S. derby ratio from the others shown in Table VI is another example demonstrating the effect of a large outbreak on the endemic patterns of a serotype.

Multiple Infections

During 1963, 171 human specimens were found to be simultaneously harboring more than one salmonella serotype. Of these, 162 had two different serotypes and 9 had three. Salmonella typhi-murium was isolated most frequently from a common specimen with one or more other serotypes (31 times). Salmonella heidelberg was isolated in conjunction with at least one other serotype from a human specimen on 28 occasions, S. newport, 27; S. anatum, 21; S. manhattan, 20; S. derby, 18; S. typhi, 17, and S. infantis and S. saint-paul, 16. The combination occurring most frequently was S. typhi and another unknown group D organism in an epidemic situation. Under similar circumstances S. amager and S. manhattan were isolated from 11 individuals each. Other relatively common combinations were S. heidelberg and S. newport, 9; S. anatum and S. newport, 8; S. anatum and S. heidelberg, 6; S. heidelberg and S. typhi-murium, 5, and S. saint-paul and S. typhi-murium, 5. It is not known whether the incidence of multiple infections is a function of characteristics of salmonella organisms, laboratory techniques (such as the number of colonies picked) or a combination of both factors. The data compiled during 1963 do not indicate a pattern which would suggest that one or more serotypes are dependent upon others for their pathogenicity, virility or other characteristics.

Rare Serotypes

There were 33 serotypes reported during 1963 which were classified as rare because they were reported during only one month from only one State. These 33 different serotypes accounted for (26.6 per cent) of the 124 strains reported while representing only 38 (0.2 per cent) of the 18,649 reported isolations. Data and comments concerning these serotypes appear in Table VII.

B. Nonhuman

During 1963, a total of 5,389 salmonella isolations from nonhuman sources were reported. The sources of these are depicted by number and per cent of total in Figure 6. Although these cultures were isolated from a variety of sources, 3,128 (58.1 per cent) were from poultry or wild fowl. There were 1,550 (28.7 per cent) isolations from other domestic and wild animals, 279

(5.2 per cent) from animal feeds; 152 (2.8 per cent) from eggs and egg products; 89 (1.7 per cent) from other human foods, and 191 (3.5 per cent) from other and unknown sources.

Animals

Isolations from animal sources comprise 4,678 or 86.8 per cent of the total nonhuman sources. Of this group, 4,374 isolations are from known animal sources with the distribution depicted in Table VIII.

Turkey, chicken, cattle and swine isolations total 3,995 or 91.3 per cent of the number reported from known animal species. This animal group is the most important source in the transmission cycle of disease from animal to man. Of the other animal species listed, dogs and horses had a small number reported with 72 from each. Although sheep isolations were reported only 6 times, salmonellosis is not an uncommon cause of acute dysentery in this species.

Laboratory animal outbreaks of salmonellosis can be serious problems. The isolations reported indicate that most of the common animal species used in laboratories can be infected and pose unique control problems in laboratory animal production facilities.

The wild animal category is somewhat misleading in that the animals in question are often pen raised and the circumstances of infection would be similar to domestic animals. The dearth of isolations from rodents is by no means suggestive of rare occurrence of these species but probably indicates failure to culture these animals.

Human Food

There were 241 (4.5 per cent) reported isolations from human food. One hundred and fifty-two or 63 per cent of these isolates were from eggs. Poultry meat accounted for 13 (5.4 per cent) isolates and read meat 20 (8.7 per cent). Other food products or foods of unspecified origin accounted for 56 (23.2 per cent) isolates. These frequencies, at least in part, reflect the prevalence of specific foods cultured, and do not indicate differences in levels of contamination.

The total isolations from fowl and other animal species parallels the isolations from food products derived from these species with 66.4 per cent of the total animal isolates obtained from chickens and turkeys and 68.4 per cent of the total cultures from human food being poultry meat and eggs. Of the total isolations from animals, 26.8 per cent were from cattle and swine and 8.7 per cent of total food cultures were from red meat. It is not possible to develop a predictable ratio unless one were to sample all food items proportionately to the number of animals involved or the amount of food prepared from that source. It merely points out a relationship that may be expected, namely, if one species of animal is highly infected, products from this source would probably have a greater chance of being contaminated. This does not take into consideration all the variables that

exist in producing a noncontaminated item in which attempts are made to minimize or control contamination (i.e. pasteurization of eggs, milk and cooked food products).

Animal Feed

The number of animal feed isolations reported represented 279 (5.2 per cent) of the nonhuman total. One hundred and eighty-five (66.3 per cent) of the feed isolations were of unknown origin, from complete feed rations or from ingredients not listed. Meat scraps accounted for 76 (27.2 per cent) of the total isolates from animal feed ingredients; feather meal, 9 (3.2 per cent); fish meal, 4 (1.4 per cent); grain, 3 (1.1 per cent), and vegetable protein supplement, 2 (0.7 per cent).

The ability to isolate salmonellae from a high percentage of meat scraps and feather meal samples suggests that the ingredients from which these products are derived are grossly contaminated. This may be true because the environment in which the product is handled after it is rendered may serve as an incubator in which the organism continues to grow and the product becomes more heavily contaminated. The problem of a contaminated environment is not entirely dependent upon a continuous source of contaminated raw material entering the plant but could result from a single source of exposure. It has been shown that polluted water utilized in fish meal plants could easily contaminate the raw fish and environment which in turn retains and generates the problem during processing.

Positive correlation has not been made between the frequency of isolations from various animal feed products and the frequency of isolations from the animal species from which the animal protein supplements were derived. Poultry and swine, the animal species which commonly consume the animal feed products containing the more heavily contaminated components, should have a greater likelihood of infection and thus the isolations would be expected to correlate with contaminated food as a source. This is seen in poultry but not in swine, perhaps because of factors such as the intensity with which attempts are made to isolate salmonellae from animal species and differences in reporting isolations from laboratories that specialize in poultry or large animal diagnostic service.

Fertilizer

Fertilizers are listed as a source of salmonellae. These fertilizer products are derived from the raw products similar to those used to manufacture the protein and mineral supplements for animal feeds. The number reported (24) is small and may indicate that products labeled as fertilizers are infrequently tested for salmonellae.

Miscellaneous Sources

Isolations from cold blooded vertebrates such as turtles, snakes and others totaled 35. Salmonellae are frequently isolated from these species. The infection in pet turtles has resulted in human infection, particularly among young children.

Six isolations of salmonella from flies were reported and 1 isolation from a cockroach. Flies can serve as vectors of salmonellae and effectively contaminate food products.

The 48 water isolations reported included 31 from sewage, 2 from drinking water, and 14 unspecified. Water purification and proper sewage treatment tends to minimize the danger of human infection but many rural families and small communities are still faced with the problem of polluted water which may contain salmonellae.

Geographic Distribution

The 5,389 salmonellae isolations reported during 1963 came from 48 States (Figure 7). Only 2 States, Nevada and Idaho, failed to report isolations and the following ten States accounted for 78.5 per cent: California, Indiana, Maine, Georgia, Louisiana, Missouri, Michigan, Iowa, Arkansas and Texas. The distribution of all nonhuman salmonella isolates in the United States reported during 1963 is listed by geographic region in Table X. The greatest number (22.8 per cent) was reported from the East North Central Region. The Pacific Region followed closely with 21.2 per cent and the West North Central with 19.4 per cent. The variability in reports of isolations may be explained in a large part by factors unrelated to the incidence of infection in fowl or other animals. If the true incidence in these species was the same in all regions of the United States, then the differences observed between regions would relate to population densities, number of laboratories available, or better use of existing laboratories. No doubt, the availability of adequate laboratory diagnostic service within a State is a major factor contributing to the differences. To support this opinion, the four States which reported the largest number of isolates in order of frequency are California (966), Indiana (624), Minnesota (538), and Georgia (312). These four States are in separate regions with States adjacent to them that have similar animal populations but who report considerably fewer isolates. The emphasis placed on isolating salmonellae from a certain species of animal in the various States also distorts the distribution of reported isolations.

The geographic distribution of isolations by the 4 most common animal species, chickens, turkeys, cattle and swine, is illustrated in Table XI. The South Atlantic Region reported the largest number of chicken isolations followed by East North Central and West South Central. The greatest number of isolations from chickens was reported from Georgia, the largest broiler producing State in the United States. However, California is the highest in production of laying hens. As a parallel, the largest number of isolations from turkeys is from the area that includes the leading turkey producing State, California.

Cattle isolations were highest, also, in the Pacific Region with California reporting all but 9 from this area. However, this region does not have the largest cattle population.

Swine isolations were reported more frequently from the West South Central Region where the major number of isolates were obtained by one research worker conducting a study on swine salmonellosis in Louisiana. Excluding this study, the East North Central Region would lead the list.

Serotypes

During 1963, 104 serotypes were identified among the 5,389 isolates reported from nonhuman sources.

Fifty-six types were reported 5 or more times during the year and accounted for 98.3 per cent of the total number of isolates reported in 1963. The 10 most common types are listed in Table III and comprised 66.7 per cent of the total number reported.

The 10 most common serotypes from man included 4 types not listed in the 10 most common serotypes from nonhuman sources. These are S. typhi, S. derby, S. oranienburg, and S. enteritidis. Salmonella derby is one of the top 10 from swine and cattle. This serotype represents only 2.1 per cent of the total isolations from all nonhuman sources.

The predominant salmonella serotypes isolated from animals during 3 periods from 1934 through the first half of 1961 are compared with those reported from animals during 1963 (Table XII). It may be noted that 4 serotypes were among the 10 most common serotypes observed for each of the reporting intervals. These serotypes are S. anatum, S. cholerae-suis, S. newport and S. typhi-murium. Salmonella heidelberg first appeared in this country in 1954 and by 1958 it ranked as the 7th most common serotype reported from animals; by 1961 it was the 3rd most common serotype and in 1963 it appeared as the 2nd most common type. During the past 2 years, S. heidelberg has been reported with increased frequency also from man.

(a) Animals

The 10 most common serotypes from chickens, turkeys, cattle and swine are given in Table XIII. These are the same 10 common serotypes reported from all nonhuman sources (Table II); the position of prevalence varies.

Salmonella typhi-murium was the most common type reported, this occurring more than 3 times as often as the next most common type, S. heidelberg.

There were several types that appeared predominantly from one source. For example, all S. pullorum and S. gallinarum isolates were from poultry and eggs. Salmonella typhi-suis was isolated 4 times from swine only, and S. dublin was isolated only from cattle. Salmonella cholerae-suis var. kunzendorf was recovered predominantly from swine but was also reported from laboratory rabbits, a furbearing animal, 3 times from cattle, and from feather meal. Salmonella typhi, exclusively a human pathogen, was not isolated from an animal source but single isolations were reported from drinking water, sewage and food.

(b) Human Food

Salmonella oranienburg was the most frequent type isolated from human food (39), principally from eggs. Six isolation of this serotype were reported from chickens and 14 from animal feed. Other common types in order of frequency from human foods were S. infantis (33), S. montevideo (33), S.

typhi-murium (17) and S. tennessee (16). These 4 serotypes were reported frequently from poultry and animal feed sources. There were 40 types reported from food, all of which appeared in man except 3, S. alabama, S. albuquerque and S. harburg. These 3 types were not reported from animal or fowl sources or from feeds.

(c) Animal Feed

There were 45 types identified from 279 reported isolations from animal feeds. All but 5 of these types were reported from animals. These were S. grumpensis, S. illinois, S. jaffna, S. manilla, and S. mississippi. The most frequent types isolated from feeds were S. tennessee (27), S. anatum (24), S. infantis (22), S. senftenberg (17), and S. montevideo (16). Three of these, S. anatum, S. infantis and S. montevideo, were reported frequently from fowl and other animals as well as from man.

(d) Geographic Distribution of Serotypes

The percentage distribution of the most common types is given in Table X. When the percentage distribution of all salmonellae is considered as the norm, variances in occurrence of the common types are apparent in different regions. Although S. typhi-murium and S. typhi-murium var. copenhagen were the most common serotypes reported, their distribution in the 9 regions ranged from 2.4 per cent of the total isolations in the East South Central to 23.8 per cent in the East North Central. Salmonella heidelberg was reported most often from the Pacific Region (31.2 per cent). The source was principally turkeys in which S. heidelberg accounted for 14.5 per cent of the total number of isolates from this species. Salmonella infantis was reported most frequently from the East North Central Region. In chickens 10.8 per cent of all the isolations reported from the United States were of this serotype. Salmonella anatum was reported most often from the West South Central Region (30.7 per cent). Although this type was reported the greatest number of times from turkeys (74), it was reported as the third most common serotype in swine. Salmonella montevideo was reported most often from the South Atlantic Region (53.0 per cent). It is the fourth most common type in chickens and accounts for 8.3 per cent of isolates of all serotypes reported from chickens. Salmonella saint-paul was highest in the West North Central Region (36.9 per cent) and was reported most often from turkeys. In turkeys, S. saint-paul was the third most common type with 10.3 per cent of the total isolations.

The Pacific Region reported S. newport most often with 54.2 per cent of the total isolations from the United States. This type was reported in high frequency from bovine (123), turkey (32), and swine (18). It was the second most common type in cattle with 21.0 per cent of the total number of isolates reported from this species.

Salmonella pullorum is probably the most sought out serotype of all nonhuman isolates. Millions of serological tests are run yearly on poultry breeding stock to detect infected fowl. Most of the serologically reactive birds are killed and cultured in attempts to isolate this organism. Therefore S. pullorum would be expected in the list of the most common types, when in

actuality it may be one of the rarest types from poultry sources. This search for "pullorum" disease may in part account for the greatest percentage of nonhuman isolates being reported from poultry. The reported number of isolations was highest in the East North Central Region which accounted for 22.6 per cent of the total isolations. Chickens accounted for 183 of the 195 S. pullorum cultures and it was the second most common serotype in this species with 13.2 per cent of the total number of isolations from chickens.

Salmonella schwarzengrund was reported most frequently from the Pacific Region with 67.0 per cent of the total isolations of this serotype in the United States. Turkeys were the major source from which isolations of this type were reported with 8.7 per cent of the total types reported from this species.

The East North Central Region reported S. cholerae-suis most often with 41.0 per cent of the total followed by the South Atlantic Region with 33.1 per cent. Swine are the most common source from which this type is isolated accounting for 95.7 per cent of the total reported. It was the second most common type in swine barely exceeded by the combined types of S. typhi-murium and S. typhi-murium var. copenhagen.

Peculiar distribution of salmonella is illustrated by a few infrequently reported types. Salmonella dublin was reported 42 times from bovine species in California and 3 times from Utah. Information from Utah indicates that the cattle infected may have originated from California; 2 human isolations were reported also from California.

Salmonella concord was isolated from a turkey source in Virginia early in 1963. Later in the year, 2 human isolations from separate counties in Virginia were reported. The 4 isolations of S. madelia from animals and the single isolation from man were reported from Florida. This serotype has occurred in Florida in both man and animals for more than a decade. S. decatur, isolated from homemade ice cream, was reported from Oklahoma. Two of the 3 isolations from man were reported also from Oklahoma. Other rare serotypes reported from both human and nonhuman sources in the same State included: S. alachua and S. johannesburg from California; S. irumu from Missouri; S. norwich from Indiana, and S. stanley from Illinois.

V. INTERNATIONAL

A. Summary

Data compiled in England, Wales and Germany indicate a downward trend in the incidence of salmonellosis in those countries for the years applicable. However, 1963 figures from England and Wales demonstrated an increase over 1962, and 1959 figures from Germany are the latest available. Canadian data for 1961-1963 indicate an upward trend in the incidence of salmonellosis, corresponding to the picture portrayed by data compiled in the United States.

Monthly data on human isolations of salmonellae from England, Wales and Germany tend to substantiate the hypothesis that the incidence of salmonellosis

is seasonal with a peak between mid-summer and early autumn. British data for 1963 demonstrated a peak in mid-summer, while German data for 1959 portrayed a peak in August. Data compiled during 1963 in the United States exhibited a peak incidence in October. However, MMWR data for 1961-1962 indicated that August was the peak month for salmonellosis in the United States.

Salmonella typhi-murium was the most commonly recovered serotype in Canada, England, Wales, and the United States during 1963, in the Netherlands in 1962, and in Germany during 1959. This was the only serotype among the ten most frequently reported serotypes in each of the countries. Salmonella paratyphi B was isolated with high frequency in every country except the United States. Serotypes which were unique in a particular country as one of the ten most common serotypes isolated were: S. thompson, 2nd most common in Canada; S. panama and S. bredeney, 3rd and 10th most common respectively in the Netherlands; S. manchester, S. blockley, S. bareilly, and S. anatum, 3rd, 5th, 6th, and 7th most common respectively in Germany.

Approximately half of the nonhuman isolations of salmonellae in Canada were from foods for human consumption. Canada was unique among the countries studied in this respect, which probably reflects a more concentrated effort in culturing foods in that country. The vast majority of their food isolations (80 per cent) were from eggs and egg products. Large domestic animals (cattle and swine) were the most common sources of nonhuman isolations of salmonellae in the Netherlands. This was apparently true in Germany also. In addition, a large number of isolations of salmonellae from water and sewage were reported by Germany. The predominant nonhuman sources in the United States contrasted with those in the other countries, as poultry accounted for more than half of the nonhuman isolations of salmonellae in this country. The differences observed are undoubtedly reflections of the diversity of culture efforts in the various countries and probably do not represent a true assessment of the relative importance of the various reservoirs of salmonella infections. It appears that each country's accounting of nonhuman sources complements the other to point out the variety of potential sources for human salmonellosis.

B. Canada

During 1963, 3,021 isolations of salmonellae from humans were reported by the Department of National Health and Welfare. The ten most frequently isolated serotypes from humans were:

Rank	Serotype	Number	Per Cent
1	S. typhi-murium	1,271	42.1
2	S. thompson	602	19.9
3	S. heidelberg	340	11.2
4	S. newport	192	6.4
5	S. paratyphi B	91	3.0
6	S. typhi	89	2.9
7	S. saint-paul	82	2.7
8	S. infantis	58	1.9
9	S. enteritidis	41	1.4
10	S. montevideo	40	1.3
	TOTAL	2,806	92.9
	TOTAL (all salmonellae)	18,649	

Eight of the serotypes which appeared on the above list also appeared on the list of ten most common serotypes in the United States (Table III). The exceptions were S. thompson and S. paratyphi B. S. thompson was responsible for a large outbreak, however, it dropped to second position in 1963 from the most prevalent serotype recovered in 1961 and 1962. S. paratyphi B has been consistently common in Canada, but not common in the United States.

The 3,021 human isolations reported during 1963 in Canada represented a 19.3 per cent increase over the previous year's figure of 2,532, which was a 28.0 per cent increase over 1961. These figures suggest that the over-all incidence of salmonellosis in Canada has been increasing in recent years.

During 1963, 1,145 isolations of salmonellae from nonhuman sources were reported, of which 545 (47.6 per cent) were from human foods. The vast majority of these (436) were from eggs and egg products. The most common animal recoveries were from poultry (241), hogs (111), and cattle (30).

The serotypes most frequently recovered from nonhuman specimens were S. thompson (20.2 per cent), S. typhi-murium (17.3 per cent), and S. heidelberg (11.3 per cent). S. thompson and S. heidelberg were most commonly recovered from eggs and egg products.

C. England & Wales

During 1963, 5,013 isolations of salmonellae from human specimens were made in various laboratories in England and Wales. This represented an increase of 373 (8.0 per cent) over the figure of 4,640 reported during 1962. However, the trend in incidence of salmonellosis has been generally downward over the past 10 years.

The comparison of the numbers of specific serotypes isolated in 1962 and 1963 was as follows:

Serotype	Number of Isolations 1962	1963	Per Cent Increase
S. typhi	165	276	67.3
S. paratyphi A	8	5	-37.5
S. paratyphi B	201	531	164.2
S. paratyphi C	1	1	--
S. typhi-murium	2,555	2,751	7.7
other types	1,710	1,449	-15.3
Total	4,640	5,013	8.0

Over half of the 1963 isolations reported were S. typhi-murium, which showed an increase of 7.7 per cent over 1962. The largest percentage increase was represented by isolations of S. paratyphi B. This was attributed to a large outbreak traced to a confectionary product which included frozen egg from China as one of the prime ingredients. About one third of the S. typhi isolations were from patients associated with a large outbreak in Zermatt, Switzerland, which accounted for the largest part of the 67.3 per cent increase from 1962 to 1963.

The seasonal pattern of S. typhi-murium isolations demonstrated a peak during the four-week period including the last two weeks of June and the first two weeks of July. The pattern for other salmonellae indicated that the peak incidence of salmonellosis occurred around August.

D. Germany

The latest annual summarization of salmonellosis in Germany applies to 1959. The ten most common serotypes isolated were:

Rank	Serotype	Number	Per Cent
1	S. typhi-murium	1,941	27.8
2	S. paratyphi B	1,349	19.3
3	S. manchester	920	13.2
4	S. infantis	334	4.8
5	S. blockley	306	4.4
6	S. bareilly	305	4.4
7	S. anatum	252	3.6
8	S. enteritidis	248	3.5
9	S. derby	116	1.7
10	S. stanley	112	1.6
Total		5,883	84.2
Total (all salmonellae)		6,990	

Numerous differences exist between the serotype frequency pattern for Germany and the United States, although these differences must be interpreted in light of the temporal variation. The majority of the serotypes listed above are relatively common in the United States, although they do not all appear on the list of the ten most common serotypes. Major exceptions may be observed in two serotypes. Salmonella manchester, which was third most common in Germany, is extremely rare in this country. The tenth most common in Germany, S. stanley, is also a rare cause of human illness in the United States.

The data compiled for the years 1956-1959 indicate a downward trend in salmonellosis in Germany. The total number of isolations of salmonellae for the years 1956-1959 were 9,928, 8,176, 6,758, and 6,990 respectively. The seasonal pattern demonstrated by the 1959 German data was similar to that constructed from United States data for 1963. The peak occurred earlier, however, in August rather than October.

Serotypes recovered most frequently from animal specimens were S. dublin (2,658, 50.3 per cent), S. typhi-murium (1,249, 23.7 per cent) and S. gallinarum-pullorum (756, 14.3 per cent). The data did not include the species of animals from which these isolates were most frequently recovered, however, the fact that S. dublin and S. gallinarum-pullorum are host adapted serotypes (cattle and poultry, respectively), suggests that cattle and poultry were among the most prevalent species affected.

Human and animal foods were responsible for 518 isolations. The most common serotypes recovered were: S. typhi-murium (52), S. senftenburg (51), and S. bareilly (50). There was no pronounced concentration of a specific serotype.

Water and sewage isolations totaled 952. Salmonella paratyphi B was the serotype recovered most frequently from these sources with 279 (29.3 per cent isolations). S. typhi-murium (221, 23.2 per cent) and S. muenchen (103, 10.8 per cent) were also commonly recovered from water and sewage.

E. The Netherlands

Data for 1962 from the Netherlands are unavailable at present, therefore, 1963 data are presented for comparison. The ten most frequently recovered serotypes from humans during 1962 were:

Rank	Serotype	Number	Per Cent
1	S. typhi-murium	4,359	53.3
2	S. stanley	1,316	16.1
3	S. panama	592	7.2
4	S. muenchen	339	4.1
5	S. heidelberg	231	2.8
6	S. bovis-morbificans	155	1.9
7	S. paratyphi B	124	1.5
8	S. typhi	124	1.5
9	S. newport	107	1.3
10	S. bredeney	81	1.0
	Total	7,428	90.9
	Total Salmonellae (1962)	8,175	

When compared to data compiled in the United States, many differences may be seen. For example, S. stanley is rare in the United States while it is second most common in the Netherlands. Salmonella panama and S. muenchen, although not uncommon in this country, are the second and third most frequently isolated serotypes in the European country. The other major difference in relative frequencies is exemplified by the appearance of S. bovis-morbificans in the above list. This serotype is extremely rare in the United States.

A total of 1,777 isolations of salmonellae were recovered from nonhuman sources. Four species of animals accounted for 1,463 (82.3 per cent). Cattle represented 738 (41.5 per cent) of the isolations reported, of which 591 were from calves. Other common animal sources were swine, 552 (29.4 per cent), ducks, 123 (6.9 per cent), and chickens, 80 (4.5 per cent).

TABLE I

SALMONELLA SEROTYPES ISOLATED FROM HUMANS DURING 1963

SEROTYPE	REGION AND REPORTING CENTER																	
	NEW ENGLAND							MIDDLE ATLANTIC						EAST NORTH CENTRAL				
	MAINE	NH	VT	MASS	RI	CONN	TOTAL	NY-A	NY-BI*	NY-C	NJ	PA	TOTAL	OHIO	IND	ILL	MICH	WIS	TOTAL
alachua											1		1			1			1
albany																			
amager																1			1
anatum				2		1	3	7	3	3		7	20	5	2	14	17		38
atlanta																			
bareilly				1		1	2	2	2	2		2	8	1		2	7		10
berta								2	2	2	2	3	11	1	1	6	3		11
binza									1				1	1					1
blockley				18	2	15	35	13	12	6	6	26	63	15	7	25	21	5	73
bovis-morbificans									1		1		2				1		1
braenderup				1		4	5	2	2	1	2	7	14	3	5	4	2		14
brandenburg														1	1				2
bredeney				4		1	5	3	2	1	2	13	21	3		12	5		20
california				1			1	1				1	2			1			1
cerro									1				1						
chester						6	6	7		2	6	35	50		1	22	3		26
cholerae-suis									6	3			9	2	1	1			4
cholerae-suis v. kun				7		2	9	1			4	2	7	1	5	2	5		13
colorado																			
cubana				4			4	4	1		5	2	12	4	1	1	9		15
daytona																			
decatur																			
derby	2	2	3	84	12	44	147	140	196	67	86	556	1,045	47	7	86	17	8	165
dublin																			
duesseldorf																			
enteritidis	2		1	213	6	23	245	36	61	27	25	42	191	38	3	41	34	39	155
fayed																			
gaminara									1	1			2						
georgia								1					1						
give						1	1	3	2			4	9	1	1	2	1		5
grumpensis																			
hartford								1				1	2			1	4		5
heidelberg	16			163	10	33	222	23	104	36	98	63	324	34	11	36	27	29	137
illinois																			
indiana								1				3	4			1	4	2	7
infantis	8			40	1	19	68	49	37	16	5	52	159	54	34	73	30	12	203
inverness								1					1						
irumu																			
javiana				1	1	1	3									2	4		6
johannesburg								1					1						
kentucky						1	1	1	1			11	13			3			3
lexington																1			1
lindenburg																			
litchfield			1	5			6	2	3	2			7	7	3	3	2	1	16
livingstone				1			1							1		1			2
loma-linda																			
manchester																			
manhattan	8			4	1		13	34	9	3	1	3	50	6	1	8	5	2	22
meleagridis						1	1		14		3	23	40	1		3	6		10
miami				1			1	1				3	4	1		1	1		3
minnesota									1	1			2				3	1	4
mission																			
mississippi																1			1
montevideo	1			16	2	13	32	17	25	15	15	33	105	10	2	31	14	5	62
muenchen				29	1	1	31		39	4	1	26	70	4	5	19	8	2	38
muenster																			
new-brunswick																			
newington		1		1		1	3	1	1			5	7			1		1	2
newport	1		1	34	1	11	48	26	55	27	5	48	161	24	6	45	40	14	129
norwich														1	1	2			4
oranienburg			3	34	6	14	57	12	20	5	9	27	73	17	1	23	15	7	63
orion				1			1												
oslo																			
panama				10	1	2	13	1	7	3	3	4	18	1		1	6	13	21
paratyphi A									2				2	1					1
paratyphi B v. java	2			2		6	10	14				3	17			13		14	27
paratyphi B				25	2	1	28		13		9	9	31	11	3	1	11		26
paratyphi C												1	1					1	1
pensacola																			
poona									1	1		2	4						
reading				1		1	2	3				11	14			3	1		4
richmond																			
rubislaw																			
saint-paul	6			27	1	6	40	14	42	20	6	61	143	37	3	20	27	12	99
san-diego				9			9	3	12	2		1	18	9		6	4		19
saphra																			
schwarzengrund				7			7		7	2	7	2	18	13	2	5	2		22
senftenberg			1				1		1			2	3	1	1	2			4
simsbury									1	2			3						
stanley											3		3			1			1
sundsvall																			
tallahassee																			
tennessee				18	1	2	21	8	8	2	2	14	34	2	6	6	4	6	24
thomasville																9			9
thompson				19	2	10	31	12	41	12	5	34	104	16	2	16	23	13	70
typhi	6	1	1	5		15	28	10	31		4	35	80	44	13	24	6	8	95
typhimurium	20		22	283	30	106	461	210	283	161	73	308	1,035	221	53	250	220	136	880
typhimurium v. cop	3			68			71				8	9	17	1		1	28		30
urbana				2			2	4	3		1		8	1		2	2	3	8
weltevreden																			
worthington								4	3				7	2			1	3	6
Untypable Group A		1				1	2												
Untypable Group B		22		3	5	1	31	1	1	1			3	2				3	5
Untypable Group C-1	1	3		1			5	1	4				5	2		1			3
Untypable Group C-2		3	1				4		1				1				1		1
Untypable Group D		3			1		4		1				1					3	3
Untypable Group E		2		1			3							1					1
Untypable Group J																	1		1
Untypable Group O																			
Untypable								1		3			4			1	1	1	3
Unknown		1		1			2	3		2			5	1		6	3	9	19
TOTAL	76	39	34	1,147	86	344	1,726	681	1,064	435	398	1,494	4,072	649	183	845	629	353	2,658

New York (A-Albany, BI-Beth Israel Hosp., C-City)

* The Beth-Israel Salmonella Typing Center in New York is a reference laboratory and processes many cultures from other states which are assigned to the respective states although reported by N.Y. - B.I.

TABLE I (Continued)
BY SEROTYPE AND REPORTING CENTER

REGION AND REPORTING CENTER																	
WEST NORTH CENTRAL								SOUTH ATLANTIC									
MINN	IOWA	MO	ND	SD	NEBR	KAN	TOTAL	DEL	MD	DC	VA	WV	NC	SC	GA	FLA	TOTAL	SEROTYPE
						3	3									1	1	alachua
											1					1	2	albany
																		amager
						13	13		2		4		9		3	11	29	anatum
															11		11	atlanta
															2	17	19	bareilly
									2		1				6	3	12	berta
											1					1	2	binza
4		4					8		9		1		9		18	16	53	blockley
																		bovis-morbificans
		1				5	6						1			7	8	braenderup
																		brandenburg
3	1						4		1						10	6	17	bredeney
															2	1	3	california
											1				2		3	cerro
		1					1		4	1	74		3		2	1	85	chester
			1				1			1					3	1	5	cholerae-suis
		1				1	2		5				6			7	18	cholerae-suis v. kun
																2	2	colorado
		1					1				2		1		3	1	7	cubana
																2	2	daytona
															1		1	decatur
5		6		1			12	12	25	5	2		4		9	6	63	derby
																		dublin
											1		1				2	duesseldorf
9	1	6		1		2	19	3	19	3	12		4		13	45	99	enteritidis
											2					1	3	fayed
																		gaminara
																		georgia
	2						2		1				1		1	3	6	give
																		grumpensis
															1	7	8	hartford
28		7	4	1	1	1	42	2	21	6	34		23		99	25	210	heidelberg
															7		7	illinois
															1	2	3	indiana
24	1	15	1			15	56	1	15		30	1	23		27	37	134	infantis
																2	2	inverness
		3					3						69			1	70	irumu
		1					1		1		3		2		22	38	66	javiana
																		johannesburg
									1	1					1	8	11	kentucky
																		lexington
																		lindenburg
										1	1				6	2	10	litchfield
											1				2	1	4	livingstone
																		loma-linda
											2						2	manchester
	1	3	1				5		1	1	7				1	9	19	manhattan
1						1	2		3	1					8	1	13	meleagridis
									1		1				8	44	54	miami
															4		4	minnesota
									1						1		2	mission
															13	1	14	mississippi
5	1	20					26	2	17	2	12	2	14		19	49	117	montevideo
8		2			1	3	14		4		4		3		5	29	45	muenchen
																1	1	muenster
											4						4	new-brunswick
										1							1	newington
16	2	5		2		16	41		14		7		20		61	77	179	newport
									1		1				1		3	norwich
3		6				54	63		4		13		6		14	112	149	oranienburg
		1					1									1	1	orion
																		oslo
3		2				7	12		7		2						9	panama
																		paratyphi A
1		1		1			3						6		3	8	17	paratyphi B v. java
1		1			1		3	2	7		1	3	3		1	2	19	paratyphi B
																		paratyphi C
											3				1	1	5	pensacola
															2	1	3	poona
1		2					3									1	1	reading
						4	4		1								1	richmond
																		rubislaw
23	9	3	1			3	39		13	4	8		11		12	37	85	saint-paul
1						1	2		5		2				1	5	13	san-diego
																1	1	saphra
															1	1	2	schwarzengrund
		1					1				1					2	3	senftenberg
																1	1	simsbury
																		stanley
																		sundsvall
															1	5	6	tallahassee
14			1			3	18	1	1		6		1		6	16	31	tennessee
															1	1	2	thomasville
3		7				11	21	1	9		4		4		5	5	28	thompson
1		33		1		2	37	2	20	1	24	8	58	1	3	52	169	typhi
94	63	61	21	8	29	158	434	10	98	27	101	6	75		143	182	642	typhimurium
	1		1				2								1	1	2	typhimurium v. cop
									1						1		2	urbana
																		weltevreden
1		1					2				1						1	worthington
																		Untypable Group A
	6	1		5		2	14			42	1	1		1			45	Untypable Group B
				1			1			9							9	Untypable Group C-1
									1	5				1			7	Untypable Group C-2
										24							24	Untypable Group D
																		Untypable Group E
																		Untypable Group J
						1	1											Untypable Group O
										1						1	2	Untypable
	1		1		1		3		1	11				1		1	14	Unknown
249	89	196	32	21	33	306	926	36	316	147	376	21	357	4	569	904	2,730	TOTAL

TABLE I (Continued)

SEROTYPE	REGION AND REPORTING CENTER																	
	EAST SOUTH CENTRAL					WEST SOUTH CENTRAL					MOUNTAIN							
	KY	TENN	ALA	MISS	TOTAL	ARK	LA	OKLA	TEX	TOTAL	MONT	IDA	WYO	COLO	NM	ARI	UTAH	NEV	TOTAL
alachua							1			1									
albany							37			37									
amager		1	1	1	3	1	23	1	32	57	1			1		1			3
anatum																			
atlanta																			
bareilly				1	1		3	1	5	9			1	1		1			3
berta		1			1		12			12						1			1
binza																			
blockley		3	1		4	4	48		9	61						1	2		3
bovis-morbificans							1			1									
braenderup							3		3	6									
brandenburg							2			2									
bredeney		1			1				3	3				4		2	1		7
california									2	2									
cerro							1		1	2									
chester	1	1			2		4		2	6				8					8
cholerae-suis	1				1														
cholerae-suis v. kun	1	1	1		3		1			1									
colorado																			
cubana			1		1														
daytona									1	1									
decatur								2		2									
derby		3	3		6	2	23		8	33				8		1			9
dublin																			
duesseldorf																			
enteritidis	4	7	1		12		11	1	13	25	1	2					3		6
fayed																			
gaminara							1			1									
georgia						1				1									
give							22		2	24						1			1
grumpensis																			
hartford																			
heidelberg	1	10	6		17	5	15	2	18	40	6	8		28		11	6		59
illinois																			
indiana																			
infantis	4	10	8		22	5	20	7	19	51		1		11		18	4		34
inverness			1		1														
irumu														5					5
javiana		5	1		6	6	45	2	32	85									
johannesburg																			
kentucky		1			1		13		4	17						3			3
lexington																			
lindenburg								1		1				1					1
litchfield							11		2	13				1		1			2
livingstone							6		3	9									
loma-linda																1			1
manchester																			
manhattan			1		1		17		2	19	1	1							2
meleagridis		3			3		2		1	3									
miami			1		1														
minnesota						1	1		1	3									
mission																			
mississippi						2	8		2	12									
montevideo		1	5		6		20		16	36				21		3			24
muenchen		1	4		5	1	14	2	9	26	1			1		9			11
muenster							3		1	4									
new-brunswick							1			1									
newington						1	3			4						1			1
newport		12	23		35	16	80	5	86	187		2		20	1	20			43
norwich							3			3									
oranienburg		3	5		8	4	32	2	27	65				18		8	1		27
orion																			
oslo																			
panama		1	1	1	3		3		10	13							3		3
paratyphi A																			
paratyphi B v. java			2		2		63			63	3				1				4
paratyphi B		5			5			5	15	20	3	1	3	5					12
paratyphi C												1							1
pensacola							1			1									
poona		1	1		2	1	4		6	11									
reading									1	1				1		1			2
richmond																			
rubislaw							9		2	11									
saint-paul		4	1		5	1	11		8	20	3			8	1	3	1		16
san-diego			2		2		2			2				2			1		3
saphra							3		1	4									
schwarzengrund							1			1				1			1		2
senftenberg			1		1		14			14									
simsbury							1			1									
stanley														3		2			5
sundsvall									1	1									
tallahassee																			
tennessee	1	2	2		5	1	4		3	8									
thomasville																			
thompson		2	2	1	5	2	15		7	24		1				2			3
typhi	22	30			52	32	1	8	49	90		1		9	11	1			22
typhimurium	21	53	34	6	114	21	150	29	115	315	9	30		176	1	24	20		260
typhimurium v. cop						4	30			34		6				7	1		14
urbana							4		1	5							2		2
weltevreden																			
worthington																			
Untypable Group A				1	1														
Untypable Group B	3			6	9	22		1	2	25	1	2		2	94	1	11	1	112
Untypable Group C-1	1	1		2	4	7				7					15				15
Untypable Group C-2						5				5					21				21
Untypable Group D	1				1	20	1		1	22					8				8
Untypable Group E				1	1	1				1					4				4
Untypable Group J																			
Untypable Group O																			
Untypable			1		1	2	1			3									
Unknown			7	1	8	1				1	3				7		6		16
TOTAL	61	163	117	21	362	169	805	69	526	1,569	32	56	4	335	164	124	63	1	779

TABLE I (Continued)

REGION AND REPORTING CENTER												SEROTYPE
PACIFIC						OTHER VI	TOTAL	PERCENT OF TOTAL	NON-HUMAN TOTAL	% OF NON-HUMAN TOTAL		
WASH	ORE	CAL	ALASKA	HAWAII	TOTAL							
		4			4		10		5			alachua
							3		3			albany
		1			1		39		9			amager
5	2	31		20	58		224	1.2	270	5.0		anatum
							11					atlanta
		6		1	7		59		23			bareilly
		14	1	1	16		64		7			berta
		2			2		6		27			binza
1	1	56		2	60		360	1.9	125	2.3		blockley
							4					bovis-morbificans
		3			3		56		6			braenderup
							4					brandenburg
4	1	53		17	75		153		116			bredeney
1		1			2		11		22			california
							6		25			cerro
		6			6		190		96			chester
							20					cholerae-suis
		1			1		54		139			cholerae-suis v. kun
				1	1		3					colorado
							40		28			cubana
							3					daytona
							3		1			decatur
6	1	63		60	130		1,610	8.6	114	2.1		derby
		2			2		2		45			dublin
		1			1		3					duesseldorf
5	1	37		2	45	4	801	4.3	70			enteritidis
							3					fayed
							3		2			gaminara
							2					georgia
2	1	7		7	17		65		48			give
				3	3		3		4			grumpensis
1					1		16		2			hartford
132	15	301	3	31	482		1,533	8.2	365	6.8		heidelberg
							7		2			illinois
							14		27			indiana
16	7	189	1	30	243		970	5.2	347	6.4		infantis
							4		2			inverness
							78		3			irumu
		1			1		168		5			javiana
		1			1		2		4			johannesburg
		13		1	14		63		29			kentucky
1					1		2		8			lexington
							2					lindenburg
3		10			13		67		22			litchfield
		1			1		17		45			livingstone
	1	4			5		6		1			loma-linda
							2					manchester
2	8	20		31	61		192		32			manhattan
1		7		2	10		82		18			meleagridis
1				1	2		65		15			miami
							13		9			minnesota
							2		1			mission
							27		1			mississippi
6	5	46	1	24	82		490	2.6	253	4.7		montevideo
1	1	21		2	25		265	1.4	74			muenchen
							5		1			muenster
		1			1		6		9			new-brunswick
		29			29		47		64			newington
9	7	227		14	257		1,080	5.8	203	3.8		newport
	2	1			3		13		3			norwich
1	4	23		6	34		539	2.9	99			oranienburg
							3		11			orion
				5	5		5					oslo
1		7		41	49		141		12			panama
		5			5		8					paratyphi A
1		27	4		32		175		3			paratyphi B v. java
6		3		2	11		155		4			paratyphi B
		1			1		4					paratyphi C
							6					pensacola
		27			27		47		7			poona
1	12	6			19		46		46			reading
							5					richmond
							11		8			rubislaw
7	9	111		12	139		586	3.1	206	3.8		saint-paul
9	4	38	1		52		120		69			san-diego
							5					saphra
2		92		1	95		147		191			schwarzengrund
1		4		1	6		33		39			senftenberg
1					1		6		6			simsbury
		4			4		13		5			stanley
		1			1		2		1			sundsvall
							6					tallahassee
1	1	12		9	23		164		88			tennessee
							11		5			thomasville
3	5	23	3	1	35		321	1.7	90			thompson
4	3	117	4	5	133		706	3.8	3			typhi
178	79	940	1	96	1,294		5,435	29.1	1,065	19.8		typhimurium
		1	2		3		173		260			typhimurium v. cop
		2		2	4		31		3			urbana
		1		44	45		46		1			weltevreden
		10		8	18		34		98			worthington
		1			1		4		2			Untypable Group A
	9	18	9		36		280		6			Untypable Group B
	14	3	1	1	19		68		4			Untypable Group C-1
	3		1		4		43		1			Untypable Group C-2
	8		1		9		72		2			Untypable Group D
	4	1			5		15		2			Untypable Group E
							1					Untypable Group J
		2			2		3		8			Untypable Group O
1		1			2		15		3			Untypable
1	4				5		73		4			Unknown
415	212	2641	33	484	3,785	4	18,649*		5,389			TOTAL

VI (Virgin Islands)

* Includes 38 isolations of Rare Serotypes shown in Table VII

TABLE II

Monthly Index of Salmonellosis
in The United States*

January	79.4	July	120.4
February	66.8	August	131.5
March	79.2	September	108.7
April	87.0	October	117.0
May	95.7	November	99.2
June	102.9	December	111.8

*The index is expressed as percentages of an average month and was computed on the basis of data compiled by the Morbidity and Mortality Analysis Unit at C.D.C. 1951-1962 by the ratio to moving average method. See Frederick C. Mills, Statistical Methods. 3rd. ed. (New York: Henry Holt and Co., 1955), pp. 362-71

TABLE III

The Ten Most common Salmonella Serotypes Isolated From Human & Nonhuman Specimens in the United States, 1963

Rank	Human			Nonhuman			Associated with Deaths (Human)			
	Serotype	No.	%	Serotype	No.	%	Serotype	No.		%
1	S. typhi-murium & typhi-murium var. copenhagen	5,608	30.1	typhi-murium & typhi-murium var. copenhagen	1,325	24.6	derby		15	23.8
2	S. derby	1,610	8.6	heidelberg	365	6.8	typhi-murium & typhi-murium var. copenhagen		12	19.0
3	S. heidelberg	1,533	8.2	infantis	347	6.4	cholerae-suis & cholerae-suis var. kunzendorf		6	9.5
4	S. newport	1,080	5.8	anatum	270	5.0	typhi		5	7.9
5	S. infantis	970	5.2	montevideo	243	4.7	newport		4	6.3
6	S. enteritidis	801	4.3	saint-paul	206	3.8	heidelberg & thompson	3 (each)	6	
7	S. typhi	706	3.8	newport	203	3.8	enteritidis infantis & saint-paul	2 (each)	6	
8	S. saint-paul	586	3.1	pullorum	195	3.6	anatum, berta, muenchen, oranienburg	1 (each)	9	
9	S. oranienburg	539	2.9	schwarzengrund	191	3.5	paratyphi B. var. java, pullorum, tennessee			
10	S. montevideo	490	2.6	cholerae-suis var. kunzendorf	139	2.6	untypable (group B) & unknown			
	TOTAL	13,923	74.7		3,594	66.7			63	100.0
	TOTAL (all serotypes)	18,649			5,389				63	

TABLE IV

Percentage Distribution of the Five
Most Common Serotypes from Humans
by Region of the United States, 1963

Region*	All Salmonellae	S. typhi-murium	S. derby	S. heidelberg	S. newport	S. infantis
New England	9.3	8.5	9.1	14.5	4.4	7.0
Middle Atlantic	21.9	19.0	64.9	21.1	14.9	16.4
East N. Central	14.3	16.2	10.2	8.9	11.9	20.9
West N. Central	5.0	8.0	0.7	2.7	3.8	5.8
South Atlantic	14.6	11.8	3.9	13.8	16.6	13.8
East S. Central	1.9	2.1	0.5	1.1	3.3	2.3
West S. Central	8.5	5.8	2.0	2.6	17.3	5.3
Mountain	4.2	4.8	0.6	3.9	4.0	3.5
Pacific	20.3	23.8	8.1	31.4	23.8	25.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
Number of Isolates	18,649	5,435	1,610	1,533	1,080	970

* New England: Me., N. H., Vt., Mass., R. I. & Conn. Middle Atlantic: N. Y., N. J. & Penna.
East N. Central: Ohio, Ind., Ill., Mich. & Wisc. West N. Central: Minn., Iowa, Mo., N. D., S.D., Neb. & Kans.
South Atlantic: Dela., Md., D. C., Va., W. Va., N. C., S. C., Ga. & Fla. East S. Central: Ky., Tenn., Ala. & Miss.
West Central: Ark., La., Okla. & Tex. Mountain: Mont., Ida., Wyo., Colo., N. M., Ariz., Utah & Nev.
Pacific: Wash., Ore., Calif., Alaska & Hawaii.

TABLE V

Salmonella Serotypes Responsible for Two or More Reported Outbreaks of Illness in the United States -- 1963

Serotype	Number of Outbreaks[1]			Approximate Number Ill	
	Family	General	Total	Total	Per/Outbreak
S. typhi	5	3	8	62	8
S. typhi-murium	4	3	7	403	58
S. heidelberg	1	6	7	546	78
S. chester	2	2	4	66	16
S. enteritidis	-	4	4	122	30
S. newport	2	2	4	58	14
S. muenchen	-	3	3	51	17
S. bredeney	1	1	2	13	6
S. infantis	-	2	2	34	17
S. montevideo	-	2	2	50	25
S. panama	1	1	2	4	2
S. saint-paul	1	1	2	16	8
S. schwarzengrund	1	1	2	11	6
S. thompson	1	1	2	20	10
TOTAL[2]	19	38	57	2,898	51

[1]Outbreaks: Family - involving members of only one household.
General - involving members of more than one household.

[2]Includes serotypes involved in only one reported outbreak.

TABLE VI

The Frequency of Multiple Isolations of Salmonellae Within Families in the United States, 1963

Serotype	Total No. of Isolations	Isolations from Individuals with one or more members of their family also positive	
		Number	Per Cent of Total
All Salmonellae	18,649	3,375	18.1
S. typhi-murium	5,435	1,102	20.3
S. derby	1,610	97	6.0
S. heidelberg	1,533	345	22.5
S. newport	1,080	280	19.5
S. infantis	969	162	16.7

TABLE VII

Rare Salmonella Serotypes Recovered From Humans in the United States, 1963*

Serotype	Center	Month	Number	C.D.C.**	Comment
S. abaetetuba	LA	Sep	1	2	Isolated from a carrier from Honduras who was visiting a medical clinic in New Orleans. No isolation of this type has been reported from a U. S. resident.
S. abony	NY-BI	Dec	1	2	Of two C.D.C. isolations - one from water from Colorado and one from human in Ga. First recovery made in 1940.
S. babelsberg	CALIF	Dec	1	0	Extremely rare in U.S.A. This isolate from a 3-month-old male from Los Angeles.
S. banana	LA	Aug	1	1	First isolated in 1951 from a serpant in the Belgian Congo. This isolation from a 51-year-old female's stool submitted after postoperative fever & diarrhea.
S. bonariensis	FLA	Nov	1	4	All C.D.C. isolates from humans - N.M. 2, N.Y. 1, and Texas 1.
S. cambridge	KAN	Mar	2	16	Phage carrying variant of S. meleagridis, recovered from turkeys 11 times, swine 4 times, and a human source once in C.D.C. Laboratory.
S. carno	CONN	Dec	1	0	First isolated in 1957 from meat and bone scraps during a field study in Great Britain.
S. carrau	GA	Oct	1	22	Second human isolate reported to Salmonella Surveillance Unit. First isolated 1936 from mesenteric gland of a pig.
S. clifton	LA	Sep	1	0	First isolated from a turtle in 1954.

TABLE VII (cont'd)

Serotype	Center	Month	Number	C.D.C.**	Comment
S. concord	VA	Oct	1	17	Fifteen of 17 C.D.C. isolations from humans (1 each from a chicken & a turkey). First isolated 1944 from blood of baby chicks.
S. corvallis	NY-BI	Oct	2	0	Initially discovered in pooled cecal contents of poults with enteritis (1949).
S. elizabethville	LA	Jul	1	0	Very uncommon serotype. This isolation from a 9-month-old female in La. First isolated from a person with clinical hepatitis-Belgian Congo-1949.
S. gatow	LA	Dec	1	0	Extremely rare in U.S.A. This isolate from a 3-year-old female.
S. gatuni	MINN	May	1	2	Of two C.D.C. isolates - one from Hawaii from a human and the other from an unknown source in Florida. First isolated from a waitress-Canal Zone-1945.
S. habana	TEX	Oct	1	5	Five C.D.C. isolations from humans. Rarely isolated organism. First isolated during outbreak of meningitis in a maternity hospital-Havana, Cuba-1937.
S. haifa	CALIF	Oct	1	0	Only previous isolation Nov. 1963 from a 42-year-old woman who experienced severe diarrhea and fever shortly after visiting Haifa, Israel, while on a Mediterranean cruise in 1962.
S. horsham	CALIF	May	1	1	This isolation represented only the second in C.D.C. experience. The first was isolated from a patient in California.
S. hvittingfoss	CALIF	May	1	1	Only previous isolation in C.D.C. experience originated from a human case of salmonellosis in Oklahoma.

TABLE VII (cont'd)

Serotype	Center	Month	Number	C.D.C.**	Comment
S. kottbus	MASS	Jun	4	1	First isolated in 1928. These isolates from three different families in three separate counties. No known epidemiological connection.
S. llandoff	FLA	Apr	1	0	Extremely rare serotype.
S. london	NY-A	Mar	1	2	Very old type yet almost unseen in this country. Four isolations from poultry in Virginia during same month.
S. madelia	FLA	Oct	1	44	Only third isolation in salmonella surveillance experience. First isolation from a 7-month-old infant in Ga. who experienced a mild illness.
S. maricopa	ILL	Nov	1	0	Another extremely rare type. First isolated from sewage in Arizona in 1960.
S. menston	MD	Aug	1	0	Only previous isolation known to Salmonella Surveillance Unit from Mexican itinerant laborer in Colorado, December, 1962.
S. new-haw	CALIF	Jun	1	0	This recovery from a 30-year-old male M.D. Very rare serotype.
S. pomona	LA	May	1	8	Of previous isolations in C.D.C. experience, 3 originated from humans and 5 from non-human sources (1 dog, 2 turkeys, 1 reptile & 1 water).
S. potsdam	MD	Apr	1	9	This recovery caused severe illness in a 13-month-old female infant which required hospitalization for 16 days. First isolated 1930.
S. pullorum	MINN	Oct	1	1796	Uncommon isolate from man. This recovery from the blood of 2½-year-old male upon admission to hospital and from spleen on autopsy 5 days after admission.

TABLE VII (cont'd)

Serotype	Center	Month	Number	C.D.C.**	Comment
S. tamale	FLA	Jul	1	0	First reported in world literature in 1958. Extremely uncommon serotype.
S. virchow	ORE	Jan	1	0	Reported ten times during 1962 from various parts of the country.
S. weslaco	LA	Oct	1	13	Nine of C.D.C. isolations from Texas, ten of thirteen from humans. First isolated 1947 from the rectum of a normal cat in Weslaco, Texas.
S. westerstede	TEX	Aug	1	0	Highly uncommon serotype.
S. westhampton	FLA	Oct	1	1	Extremely rare type. First isolation from an apparently normal dog in Virginia - 1953.
			38		

* Serotypes reported during only one month from only one state. Total (1963) 18,649 salmonella isolations.

** Represents approximately 28,000 isolations of salmonellae from all sources between 1947 and 1958.

TABLE VIII
SALMONELLA SEROTYPES ISOLATED FROM NON-HUMAN,

SEROTYPE	FOWL										ANIMAL																						Human Food							
	Domestic					Wild					Farm					Pet		Laboratory					Wild																		
	Chicken	Turkey	Duck	Pigeon	Other, Unknown, Or Environment	Pheasant	Quail	Other, Unknown, Or Environment	Unknown	Total	Equine	Bovine	Ovine	Porcine	Other, Unknown, Or Environment	Canine	Feline	Mouse	Rat	Guinea Pig	Rabbit	Monkey	Rat	Mouse	Fur-Bearing	Zoo	Unknown	Total	Poultry Meat Prod.	Red Meat Products	Whole Eggs	Frozen Eggs	Powdered Eggs	Other Egg Products	Other Or Unknown	Total
alabama																																							
alachua	1	4								5																														4
albany	2	1								3																														
albuquerque																																							
amager	5	2								7																			1							1				2
anatum	46	74	4		2		2			128	3	17		59	15	2	1	2	1			2				3		105	1					1	1				1
aqua																																							
arechavaleta														2	1													3											
bareilly	2	1								3		1		11														12											
berta	3	3								6																														
binza	5	16	1							22									1									1											
blockley	82	28			3					113				2		1												3	1										1
bonariensis																			1									1										
brasenderup	2									2																													
bredeney	16	78	1							95				7					1									8		5					1	6		
cairo																																							
california	2	11				1				14				2		1									1			3			1							1
carrau																									1			1										
cerro	4	1								5				1														1										
champaign																1												1										
chester	9	71			1				1	82										1		1						2	1	1	2			4	8		
cholerae-suis v. kun												3		133							1				1		138										
concord		1								1																													
cubana	2	5								7		3		1		1												5		1					1			
decatur																																					1	1	
derby	7	29	4						1	41	1	3		28	3	4						1						40	2	3				1	4	10		
dublin												45																45										
durban																										1		1										
eastbourne	1									1																													
enteritidis	14	27			2		1		6	50		5		4		3		1	1	1								15			1					1	
gallinarum	35	6			1				12	54																													
gaminara																																							
garoli											1																	1										
give	19	5			4	1	2	1		32		1		8		2									1			12										
grumpensis																																							
harburg																																							
hartford														1											1			2						1				1
heidelberg	115	212			2				1	330	2	5		8		1	1					1				1		19	1	3	1			1	3	9		
illinois																																							
indiana	11	15								26						1												1										
infantis	149	37			2		2		3	193		1		11		7	1	64	1		5					2		92			2	10	1	13	7	33		
inverness																										1		1										
irumu																															2				1		3		
jaffna																																							
javiana		1							1	2				3														3										
johannesburg	2									2																													
kentucky	4	7					2			13		1		3					1									5	1		1		1			2	
labadi																																							1
lexington		6								6						1												1										
litchfield	5	5								10	1																	1							1	1		
livingstone	8	2							3	13				11	6	1												18							1	1		
loma-linda																									1			1										
london	4	1								5																					1					1		
madella											1	2													1			4										
mampong	1									1																													
manhattan	4	23							1	28						2												2										
manila																																							
meleagridis	4	8	1		1					14						1												1										
miami												3		3		2												8							7	7		
mikawasima																																							
minnesota	4	1	1							6																													
mission	1									1																													
mississippi																																							
montevideo	115	23			33					171		1	1	11		1			1		3							17	2		11		6	12	2	33		
muenchen	6	30							2	38	2			21												2		26										
muenster											1																												
new-brunswick		7								7		1																1										
newington	11	23			1		1		7	63		2		2		1						1						6	1							1		
newport	2	32								34	7	123	2	18	1	5	2			2						1		161							4	4		
norwich	3									3																													
ohio	1									1																													
onarimon											1																	1										
oranienburg	6	4				1	2			13	1	1		8		3			2		2	3			1		21			21	2	4	12		39		
orion	1	2								3				2		2												4										
panama		2								2				4								3						7			1				2	3		
paratyphi B v. java														1														1										
paratyphi B																																							
pomona																																							
poona		2								2																													
pullorum	183	1			1				7	192																					2					2		
reading	27	18								45																													
rubislaw														6														6										
saint-paul	32	151	1						2	186	1	3		9								1						14			1					1		
salintis												1																1										
san-diego	10	53								63				1	1		1									1		4										
schwarzengrund	22	127		1					1	151		1		15		5												21				4			1	5		
senftenberg	9	2	3				2		1	17																								1				1	
simsbury	1	1								2				1														1										
singapore																																							
stanley																						5						5										
sundsvall																1												1										
tel-el-kebir																																							
tennessee	17	13	1		2		1		4	38						1		1			1							3		1		1		2	12	16		
thomasville																3												3										
thompson	56	12	2		1				1	73		1		2		1						1						5			2	4	2	1		9		
typhi																																					1	1	
typhimurium	181	201	11	14	8	9	2	9	11	446	39	342	3	105	23	12		2	2	18	2	6	1	1	16	7		579	1		8			6	2	17		
typhimurium v. cop	90	44	4	41	11		1	2	3	196	10	15		32		1	1				2				2			63			1					1		
typhi-suis														4														4										
urbana	1									1																													
virchow																																							
vleuten																									2			2		1	2			1		4		
weltevreden																																					1	1	
worthington	38	22		1					2	63		1		20		4						1						21	1				1		1	3		
Untypable		13					1			16	1	4		1	1										1			13										
Unknown	1									1						1												1		1						1		
TOTAL	1384	1464	34	57	75	12	19	16	67	3128	72	586	6	561	51	72	7	70	12	25	14	25	1	1	24	19	4	1550	13	20	60	22	15	55	56	241		

TABLE VIII (Continued)
BY SOURCE DURING 1963

Animal Feed							Fertilizer				Other																				
											Cold Blooded Vertebrates				Insect			Water													
Meat Scraps	Feather Meal	Fish Meal	Grain	Vegetable Protein Supplement	Other Or Unknown	Total	Feather Meal	Fish Meal	Other Or Unknown	Total	Turtle	Snake	Other Or Unknown	Total	Fly	Cockroach	Total	Sewage	Drinking	Other	Total	Transfusion Blood	Other	Unknown	Non Human Total	Per cent	Human Total	Per cent of Total	SEROTYPE
					1	1																			4					alabama
																									5		10			alachua
																									3					albany
																									2					albuquerque
																									9		39			amager
13	2				12	27						1		1				1		2	3			4	270	5.0	224	1.2		anatum
												1		1											1					aqua
																									3					arechavaleta
4					2	6						1		1										1	23		59			bareilly
																								1	7		64			berta
1			1		1	2									4		4	1		2	2			1	27		6			binza
				1		2															3				125	2.3	360	1.9		blockley
																									1		1			bonariensis
											2			2						1	1		1		6		56			braenderup
1	1				2	4												3			3				116	2.2	153	0.8		bredeney
																									1					cairo
5						5																			32		11			california
												1		1											2		1			carrau
3					8	11		5		5								3			3				25		6			cerro
																									1					champaign
1					1	2			1	1								1			1				96	1.8	190	1.0		chester
							1			1															139	2.6	54	0.3		cholerae-suis v. kun
																									1		2			concord
3		1			9	13												2			2				28		40			cubana
																									1		3			decatur
2					6	8												1			1		10	4	114	2.1	1,610	8.6		derby
																									45		2			dublin
																									1					durban
																									1					eastbourne
					2	2												1			1			1	70	1.3	801	4.3		enteritidis
												1	1	2										1	55					gallinarum
																									2		1			gaminara
												3		3											1					garoli
					1	1																			48		65			give
2					2	4																			4		3			grumpensis
																									1					harburg
																									7		16			hartford
					2	2					2			2				1			1			4	365	6.8	1,533	8.2		heidelberg
																									2		7			illinois
																									27		14			indiana
					22	22							1	1	1		1			1	1			5	347	6.4	970	5.2		infantis
																									2		4			inverness
					1	1																			3		78			irumu
																									1					jaffna
																									5		168			javiana
1		3			1	1												1			1				4		2			johannesburg
					5	9																			29		63			kentucky
																									1					labadi
					1	1																			8		2			lexington
					7	7												1		2	3				22		67			litchfield
8					3	12												1			1				45		17			livingstone
																									1		6			loma-linda
																									6		1			london
																									4		1			madelia
																									1					mampong
					1	1							1	1				1			1				32		192			manhattan
2					1	3																			1					manila
																									18		82			meleagridis
												1		1											15		65			miami
																									1					mikawasima
					1	1						1		1				1			1				9		13			minnesota
					1	1																			1		7			mission
					8	16			7	7								1			1		5	3	253	4.7	490	2.6		mississippi
6			2		7	7					1	1		2										1	74	1.4	265	1.4		montevideo
																														muenchen
1						1																			1		5			muenster
1	1				9	11												1			1		1	2	9		6			new-brunswick
1						1					1	1		2											64		47			newington
																		1			1				203	3.8	1,080	5.8		newport
																									3		13			norwich
					1	1																			2					ohio
6																									1					onarimon
2					8	14			5	5		2		2				1			1			4	99	1.8	539	2.9		oranienburg
						2												1		1	2				11					orion
																									12		141			panama
																		2			2				3		155			paratyphi B v. java
																				4	4				4		175			paratyphi B
												1		1											1		1			pomona
1					1	2												1			1				7		47			poona
																								1	195	3.6	1			pullorum
											1	1		2										1	46		46			reading
	2				2	4			1	1															8		11			rubislaw
													2	2											206	3.8	586	3.1		saint-paul
									1	1															3					salintis
																								1	69		120			san-diego
2					5	7									1		1	2			2		1	4	191	3.5	147	0.8		schwarzengrund
3	1				13	17			2	2														1	39		33			senftenberg
					3	3						1		1											8		6			simsbury
																									1					singapore
																									5		13			stanley
													1	1											1		2			sundsvall
2					25	27												1			1				1					tel-el-kebir
					2	2																		3	88		164			tennessee
	1				1	2																1			5		11			thomasville
																									90	1.7	321	1.7		thompson
1					1	2			1	1	1	1	1	3		1	1	2	1	1	4				2		706	3.8		typhi
																			1					12	1,065	19.8	3,435	29.1		typhimurium
																									260	4.8	173	0.9		typhimurium v. cop
					1	1														1	1				4					typhi-suis
																									3		31			urbana
																									4		1			virchow
																									2					vleuten
3	1				4	8																			1		46			weltevreden
1					1	2							1	1										3	98		34			worthington
																									32		594			Untypable
												1		1											4		72			unknown
76	9	4	3	2	185	279	1	5	18	24	8	19	8	35	6	1	7	31	2	15	48	1	18	58	5,389		18,649			TOTAL

TABLE IX

SALMONELLA SEROTYPES ISOLATED FROM NON-HUMANS DURING 1963

SEROTYPE	REGION AND REPORTING CENTER																	
	NEW ENGLAND							MIDDLE ATLANTIC						EAST NORTH CENTRAL					
	MAINE	NH	VT	MASS	RI	CONN	TOTAL	NY-A	NY-BI	NY-C	NJ	PA	TOTAL	OHIO	IND	ILL	MICH	WIS	TOTAL
alabama															4				4
alachua															2			1	3
albany																			
albuquerque																			
amager												1	1						
anatum										2		4	6	8	31	11	6	4	60
aqua																	1		1
arechavaleta																			
bareilly														4		4	1		9
berta																1			1
binza					1		1								4		1		5
blockley				3		2	5								29	5	1	1	36
bonariensis																			
braenderup												3	3		1				1
bredeney					1		1					1	1	2	7	3			12
cairo																			
california														2	1	2	1	2	8
carrau																	1		1
cerro														4			1	1	6
champaign																			
chester															4	1	6	16	27
cholerae-suis v. kun						1	1				1	2	3	2	48			7	57
concord																			
cubana															1	2			3
decatur																			
derby				4	1		5	1	4		1	11	17	3	13	10	3	1	30
dublin																			
durban																	1		1
eastbourne																			
enteritidis														3	18	1	4	2	28
gallinarum												3	3	1	1				2
gaminara																	2		2
garoli																			
give															5	5	7		17
grumpensis														1		1			2
harburg																			
hartford																			
heidelberg	1	1		3	1	6	12	1	2		3	3	9		22	4		7	33
illinois																			
indiana															16		3		19
infantis				2		5	7	62	2				64	2	82	3	5	1	93
inverness																	2		2
irumu																			
jeffna																			
javiana																	1		1
johannesburg																			
kentucky														3	1				4
labadi																			
lexington														1					1
litchfield					1		1								1				1
livingstone														3	2	7	1		13
loma-linda																			
london																			
madelia																			
mampong															1				1
manhattan	1			1			2								1		4		5
manila																			
meleagridis																1		3	4
miami																			
mikawasima																	1		1
minnesota										1			1			1	2		3
mission																			
mississippi																			
montevideo					3	1	4			1		1	2	4	3	11	16	1	31
muenchen														4	2	15	3		24
meunster																			
new-brunswick														1			7		8
newington			1		1		2					2	2	3	2	1	5	2	13
newport								1					1	1	7	3	28	1	40
norwich															3				3
ohio														1	1				2
onarimon																	1		1
oranienburg														7	3	16	3	1	30
orion															1	2	2		5
panama										2			2			3			3
paratyphi B v. java																			
paratyphi B																			
pomona																	1		1
poona															1				1
pullorum		1	1	2			4				3	7	10	1	30	1	7	5	44
reading				1			1							1	21				22
rubislaw																			
saint-paul						1	1				5	1	6	2	17	2	2	28	51
salinatis																			
san-diego														1	9		1		11
schwarzengrund											1		1		8		1	2	11
senftenberg														2	1	2	1	2	8
simsbury																			
singapore																	1		1
stanley																5			5
sundsvall																	1		1
tel-el-kebir																	1		1
tennessee										1			1	7	5	5	1	1	19
thomasville																			
thompson												3	3	2	25	2	3		32
typhi																1			1
typhimurium	1			12	2	11	26	1	2		2	8	13	31	138	6	65	28	268
typhimurium v. cop		1		15			16				9	17	26		22	4	8	14	48
typhi-suis																			
urbana															1				1
virchow																			
vleuten																	2		2
weltevreden																			
worthington														6	21			12	39
Untypable					1		1							1			2		3
Unknown																1	1		2
TOTAL	3	3	2	43	12	27	90	66	15	2	26	68	177	113	624	147	203	142	1229

New York (A-albany, BI-beth israel, C-city)

TABLE IX (Continued)
BY SEROTYPE AND STATE

REGION AND REPORTING CENTER																	
WEST NORTH CENTRAL								SOUTH ATLANTIC									
MINN	IOWA	MO	ND	SD	NEBR	KAN	TOTAL	DEL	MD	DC	VA	WV	NC	SC	GA	FLA	TOTAL	SEROTYPE
																		alabama
	1						1								1	1	2	alachua
		2					2											albany
	1						1								5		5	albuquerque
																		amager
8	6	14				7	35	1			9		4		1	12	27	anatum
																		aqua
																		arechavaleta
		1					1				1		2		1	1	5	bareilly
											2		1		3		6	berta
2		10					12		1		1					1	3	binza
1	1	7				2	11	1	8		6			1	23	1	40	blockley
																		bonariensis
															1		1	braenderup
9	3	1					13				2				4	1	7	bredeney
		1					1											cairo
3	1						4							1	3		4	california
																1	1	carrau
									1		12						13	cerro
																		champaign
21	18	9					48				8		2				10	chester
	11	1					12				10		7	21		8	46	cholerae-suis v kun
											1						1	concord
4		1					5											cubana
																		decatur
16	2	2					20				2				1	3	6	derby
																		dublin
																		durban
																		eastbourne
24	1	1					26		6						2		8	enteritidis
1	4	1					6	18	5		5		3	2	1	1	35	gallinarum
																		gaminara
1							1											garoli
	12						12					2					2	give
																		grumpensis
		1					1											harburg
											1					1	2	hartford
95	4	8				1	108		4		15	1		1	48	5	74	heidelberg
1							1		1								1	illinois
2							2						1				1	indiana
12	10	21				20	63	1			9	1	1	2	20	7	41	infantis
																		inverness
		3					3											irumu
											1						1	jaffna
																		javiana
1							1		1						1		2	johannesburg
4	2						6		1						1		2	kentucky
		1					1											labadi
																		lexington
5						8	13											litchfield
									1		2				1		4	livingstone
																		loma-linda
		1					1				5						5	london
																4	4	madelia
																		mampong
3							3				3						3	manhattan
																		manila
													1			3	4	meleagridis
						7	7									8	8	miami
																		mikawasima
1							1								1		1	minnesota
																		mission
																		mississippi
2	5	26					33	9	9		5			5	104	2	134	montevideo
20		2				7	29		1		2				1	1	5	muenchen
																1	1	muenster
1							1											new-brunswick
7	5					7	19		7			2			2	2	13	newington
15	1	2				3	21		1		2			4		5	12	newport
																		norwich
																		ohio
4	1	35				2	42		3						3	3	9	onarimon
5							5								1		1	oranienburg
		1					1											orion
																		panama
																		paratyphi B v. java
																		paratyphi B
																		pomona
1	1						2				1						1	poona
6	4	17					27	5	3		10	1	4	2	7	2	34	pullorum
1		4				1	6											reading
67	6	1				2	76		2		1			1	9		13	rubislaw
																		saint-paul
7	2						9							4		1	5	salinatis
																		san-diego
11	15	4					30		1				1		1	2	5	schwarzengrund
	1						1							1	3		4	senftenberg
																1	1	simsbury
																		singapore
																		stanley
																		sundsvall
4						28	32		1		6		3	1	4	1	16	tel-el-kebir
	2						2											tennessee
5		6				3	14	1	1				2		3	5	12	thomasville
																		thompson
134	15	29	1	4	1	2	186	2	20		18	3	14	5	24	10	96	typhi
22	20	8		1			51	3	7			2	4	3	23		42	typhimurium
																1	1	typhimurium v copenhagen
																		typhi-suis
																		urbana
		3					3											virchow
																		vleuten
12	20	2					34				2				9	1	12	weltevreden
																		worthington
																		Untypable
																		Unknown
538	175	226	1	5	1	100	1,046	41	85	0	142	12	50	54	312	96	792	TOTAL

TABLE IX (Continued)

SEROTYPE	EAST SOUTH CENTRAL					WEST SOUTH CENTRAL					MOUNTAIN								
	KY	TENN	ALA	MISS	TOTAL	ARK	LA	OKLA	TEX	TOTAL	MONT	IDA	WYO	COLO	NM	ARI	UTAH	NEV	TOTAL
alabama																			
alachua																			
albany																			
albuquerque																			
amager							1		1	2									
anatum			3	2	5	1	70		12	83					2	3	3		8
aqua																			
arechavaleta							3			3									
bareilly							6			6									
berta																			
binza						1			1	2									
blockley	3		1	4	8	6	2		2	10							1		1
bonariensis									1	1									
braenderup																			
bredeney						1	1		5	7							21		21
cairo																			
california						1				1							1		1
carrau																			
cerro						1	1		1	3									
champaign																			
chester	1		2		3		1		1	2									
cholerae-suis v. kun	3	8	1	1	13		1		5	6									
concord																			
cubana							7		3	10									
decatur								1		1									
derby				3	3	1	11		8	20						1			1
dublin																	3		3
durban																			
eastbourne																1			1
enteritidis						1				1						5	2		7
gallinarum			3	1	4	4	1			5									
gaminara																			
garoli																			
give			2		2		4		3	7									
grumpensis									2	2									
harburg																			
hartford																			
heidelberg			5		5	4			5	9						1			1
illinois																			
indiana			1		1														
infantis	1		4	3	8	5	3		6	14							8		8
inverness																			
irumu																			
jaffna																			
javiana		3			3				1	1									
johannesburg																			
kentucky							6	1	3	10						1			1
labadi																			
lexington																	6		6
litchfield						4				4									
livingstone			2		2		17		2	19									
loma-linda																1			1
london																			
madelia																			
mampong																			
manhattan			1	1	2		1			1									
manila									1	1									
meleagridis									2	2									
miami																			
mikawasima																			
minnesota			2		2	1				1									
mission																			
mississippi							1			1									
montevideo			8	1	9	4	2		11	17				3			2		5
muenchen			1		1	1	1		4	6						1	6		7
muenster																			
new-brunswick																			
newington				1	1	2	1		1	4							2		2
newport							2		2	4			2	5		8			15
norwich																			
ohio																			
onarimon																			
oranienburg	1				1	3	1		5	9							1		1
orion																			
panama							3		3	6									
paratyphi B v. java							2		1	3									
paratyphi B																			
pomona																			
poona							1			1									
pullorum		5	10	7	22	38			1	39	12								12
reading						8				8							1		1
rubislaw							6			6									
saint-paul						3	7		8	18							5		5
salinatis																			
san-diego						3	1		14	18							4		4
schwarzengrund			1		1	5			2	7							8		8
senftenberg						3	1		19	23									
simsbury							4			4									
singapore																			
stanley																			
sundsvall																			
tel-el-kebir																			
tennessee		1			1	3	6		2	11	2						1		3
thomasville																			
thompson			6		6	11		1	1	13									
typhi									1	1									
typhimurium	5	3	4	1	13	25	74	1	15	115	8		1	17		1	18		45
typhimurium v. cop	1	3	9	6	19	30	7		1	38	4				4		1		9
typhi-suis																			
urbana																			
virchow														1					1
vleuten																			
weltevreden																			
worthington			3		3				7	7									
Untypable								1	1	2									
Unknown						1				1									
TOTAL	15	23	69	31	138	171	256	5	164	596	26	0	3	26	6	23	94	0	178

TABLE IX (Continued)

REGION AND REPORTING CENTER												
PACIFIC						OTHER VI	NON HUMAN TOTAL	PERCENT OF TOTAL	HUMAN TOTAL	PERCENT OF TOTAL		SEROTYPE
WASH	ORE	CAL	ALASKA	HAWAII	TOTAL							
							4					alabama
		2			2		5		10			alachua
							3					albany
							2					albuquerque
							9		39			amager
		46			46		270	5.0	224	1.2		anatum
							1					aqua
							3					arechavaleta
		2			2		23		59			bareilly
							7		64			berta
		4			4		27		6			binza
		14			14		125	2.3	360	1.9		blockley
							1		1			bonariensis
1					1		6		56			braenderup
	5	49			54		116	2.2	153	0.8		bredeney
							1					cairo
		4			4		22		11			california
							2		1			carrau
3					3		25		6			cerro
			1		1		1					champaign
		6			6		96		190	1.0		chester
		1			1		139	2.6	54	0.3		cholerae-suis v. kun
							1		2			concord
		9	1		10		28		40			cubana
							1		3			decatur
		11	1		12		114	2.1	1610	8.6		derby
		42			42		45		2			dublin
							1					durban
							1					eastbourne
							70		801	4.3		enteritidis
							55					gallinarum
							2		3			gaminara
							1					garoli
		8			8		48		65			give
							4		3			grumpensis
							1					harburg
							2		16			hartford
5	9	100			114		365	6.8	1533	8.2		heidelberg
							2		7			illinois
		4			4		27		14			indiana
14		34	1		49		347	6.4	970	5.2		infantis
							2		4			inverness
							3		78			irumu
							1					jaffna
							5		168			javiana
		1			1		4		2			johannesburg
		6			6		29		63			kentucky
							1					labadi
			1		1		8		2			lexington
2		1			3		22		67			litchfield
		7			7		45		17			livingstone
							1		6			loma-linda
							6		1			london
							4		1			madelia
							1					mampong
2	5	9			16		32		192			manhattan
							1					manila
		7	1		8		18		82			meleagridis
							15		65			miami
							1					mikawasima
							9		13			minnesota
		1			1		1		2			mission
							1		27			mississippi
5		11			16		253	4.7	490	2.6		montevideo
		2			2		74		265	1.4		muenchen
							1		5			muenster
							9		6			new-brunswick
1		7			8		64		47			newington
1		109			110		203	3.8	1080	5.8		newport
							3		13			norwich
							2					ohio
							1					onarimon
2		5			7		99		539	2.9		oranienburg
							11					orion
							12		141			panama
							3		155			paratyphi B v. java
4					4		4		175			paratyphi B
							1		1			pomona
		2			2		7		47			poona
		3			3		195	3.6	1			pullorum
4	3	1			8		46		46			reading
1	1	1			2		8		11			rubislaw
2	25	9			36		206	3.8	586	3.1		saint-paul
		3			3		3					salinatis
2	11	9			22		69		120			san-diego
5	3	120			128		191	3.5	147	0.8		schwarzengrund
1		2			3		39		33			senftenberg
		1			1		6		6			simsbury
							1					singapore
							5		13			stanley
							1		2			sundsvall
							1					tel-el-kebir
	1	4			5		88		164			tennessee
			3		3		5		11			thomasville
5		5			10		90		321	1.7		thompson
					1		2		706	3.8		typhi
9	17	276		1	303		1065	19.8	5435	29.1		typhimurium
4	7				11		260	4.8	173	0.9		typhimurium v. copenhagen
		4			3		4					typhi-suis
1					1		3		31			urbana
							4		1			virchow
							2					vleuten
				1	1		1		46			weltevreden
		3			3		98		34			worthington
	1	21	4		26		32		500			Untypable
			1		1		4		72			Unknown
74	87	966	14	2	1143	- 0 -	5389		18,649			TOTAL

(VI - Virgin Islands)

TABLE X

PERCENTAGE DISTRIBUTION OF THE 10 MOST COMMON SALMONELLA SEROTYPES ISOLATED FROM NON-HUMAN SOURCES BY REGIONS OF THE UNITED STATES 1963

REGION*	ALL SALMONELLAE	S. typhi-murium & S. typhi-murium var. copenhagen	S. heidelberg	S. infantis	S. anatum	S. montevideo	S. saint-paul	S. newport	S. pullorum	S. schwarzengrund	S. cholerae-suis
NEW ENGLAND	1.7	3.2	3.3	2.0	---	1.6	0.5	---	2.0	---	0.7
MIDDLE ATLANTIC	3.3	2.9	2.5	18.5	2.2	1.6	2.9	0.5	5.1	0.5	2.2
EAST N. CENTRAL	22.8	23.8	9.0	26.8	22.2	12.3	24.8	19.7	22.6	5.8	41.0
WEST N. CENTRAL	19.4	17.9	29.6	18.2	13.0	13.0	36.9	10.3	13.8	15.7	8.6
SOUTH ATLANTIC	14.7	10.4	20.3	11.8	10.0	53.0	6.3	5.9	17.4	2.6	33.1
EAST S. CENTRAL	2.6	2.4	3.6	2.3	1.9	3.6	---	---	11.3	0.5	9.3
WEST S. CENTRAL	11.0	11.5	2.5	4.0	30.7	6.7	8.7	2.0	20.0	3.7	4.3
MOUNTAIN	3.3	4.1	0.3	2.3	3.0	2.0	2.4	7.4	6.2	4.2	---
PACIFIC	21.2	23.7	31.2	14.1	17.0	6.3	17.5	54.2	1.5	67.0	0.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
NUMBER OF ISOLATES	5,389	1,325	365	347	270	253	206	203	195	191	139

*See Table IV.

TABLE XI

ISOLATIONS OF SALMONELLA FROM CHICKENS, TURKEYS, CATTLE AND SWINE BY REGIONS IN U.S. 1963

REGION*	CHICKENS		TURKEYS		CATTLE		SWINE	
	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT
NEW ENGLAND	40	2.9	11	.75	3	.51	1	.17
MIDDLE ATLANTIC	31	2.2	9	.61			6	1.06
E. NO. CENTRAL	421	30.4	216	14.8	97	16.6	159	28.3
W. NO. CENTRAL	88	6.3	454	31.0	74	12.6	98	17.4
SO. ATLANTIC	433	31.3	95	6.5	31	5.2	75	13.3
E. SO. CENTRAL	86	6.2	6	.40	8	1.4	20	3.6
W. SO. CENTRAL	151	11.0	85	5.8	17	2.9	183	32.7
MOUNTAIN	22	1.6	69	4.7	38	23.2	2	.35
PACIFIC	112	8.1	519	35.4	318	54.3	17	3.0
TOTAL	1384	100.0	1464	100.0	586	100.0	561	100.0

*See Table IV.

TABLE XII

Predominant Salmonella Serotypes Isolated from Animals in the United States at Various Intervals during 28 Years

	1934 - 1947		1947 - 1958		1957 - 1961		1963	
	Type	No.	Type	No.	Type	No.	Type	No.
1.	S. typhi-murium	2715	S. typhi-murium	2390	S. typhi-murium	1385	S. typhi-murium	1174
2.	S. cholerae-suis	968	S. anatum	653	S. cholerae-suis	378	S. heidelberg	344
3.	S. derby	384	S. newport	363	S. heidelberg	294	S. anatum	220
4.	S. oranienburg	336	S. cholerae-suis	358	S. anatum	291	S. infantis	200
5.	S. anatum	329	S. enteritidis	343	S. enteritidis	259	S. saint-paul	197
6.	S. bredeney	297	S. derby	308	S. newport	255	S. pullorum	185
7.	S. bareilly	287	S. heidelberg	263	S. san-diego	229	S. newport	185
8.	S. newport	273	S. san-diego	214	S. infantis	186	S. montevideo	184
9.	S. muenchen	269	S. muenchen	174	S. chester	164	S. schwarzengrund	166
10.	S. meleagridis	182	S. montevideo	147	S. saint-paul	136	S. cholerae-suis	136
	Total	6040		5213		3575		2991
	Other types	2963		4199		1631		1687
	Grand Total	9003		9412		5206		4678

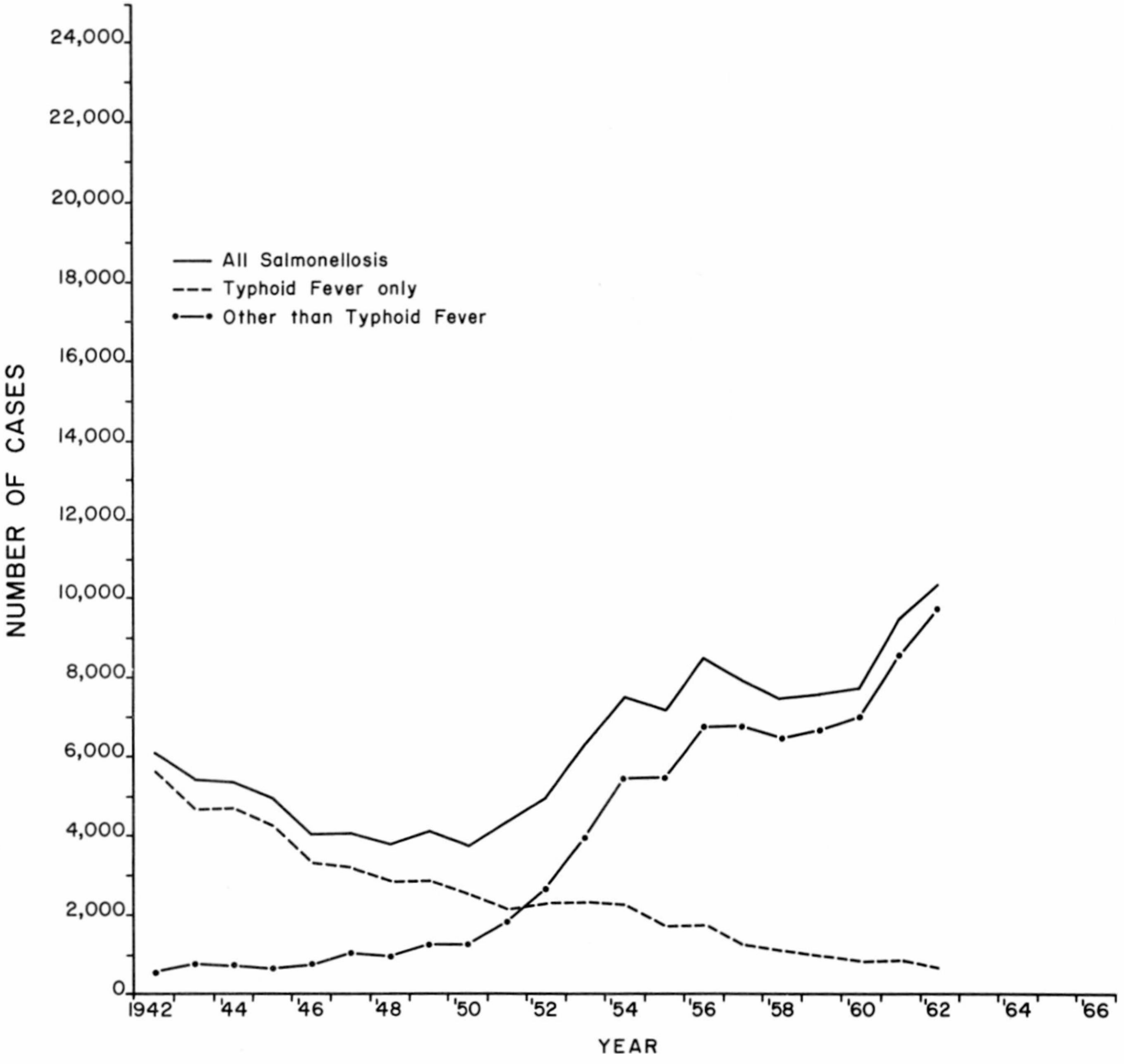
TABLE XIII

THE TEN MOST COMMON SALMONELLA SEROTYPES ISOLATED FROM ALL DOMESTIC FOWL & FARM ANIMALS, CHICKENS, TURKEYS, SWINE AND CATTLE IN THE UNITED STATES, 1963

TOTAL DOMESTIC FOWL & FARM ANIMALS		CHICKENS		TURKEYS		SWINE		CATTLE	
S. typhi-murium & S. typhi-murium var. copenhagen	1174	S. typhi-murium & S. typhi-murium var. copenhagen	271	S. typhi-murium & S. typhi-murium var. copenhagen	245	S. typhi-murium & S. typhi-murium var. copenhagen	137	S. typhi-murium & S. typhi-murium var. copenhagen	357
S. heidelberg	344	S. pullorum	183	S. heidelberg	212	S. cholerae-suis	133	S. newport	123
S. anatum	220	S. infantis	149	S. saint-paul	151	S. anatum	59	S. dublin	45
S. infantis	200	S. montevideo	115	S. schwarzengrund	127	S. derby	28	S. anatum	17
S. saint-paul	197	S. heidelberg	115	S. bredeney	78	S. muenchen	21	S. heidelberg	5
S. pullorum	185	S. blockley	82	S. anatum	74	S. worthington	20	S. enteritidis	5
S. newport	185	S. thompson	56	S. chester	71	S. newport	18	S. cubana	3
S. montevideo	184	S. anatum	46	S. san-diego	53	S. schwarzengrund	15	S. saint-paul	3
S. schwarzengrund	166	S. worthington	38	S. infantis	37	S. bareilly	11	S. miami	3
S. cholerae-suis	136	S. gallinarum	35	S. newport	32	S. montevideo, S. infantis & S. livingstone	11	S. derby S. cholerae-suis	3
TOTAL	2991		1090		1080		453		564
Total (all serotypes)	4290		1384		1464		561		586

Figure 1

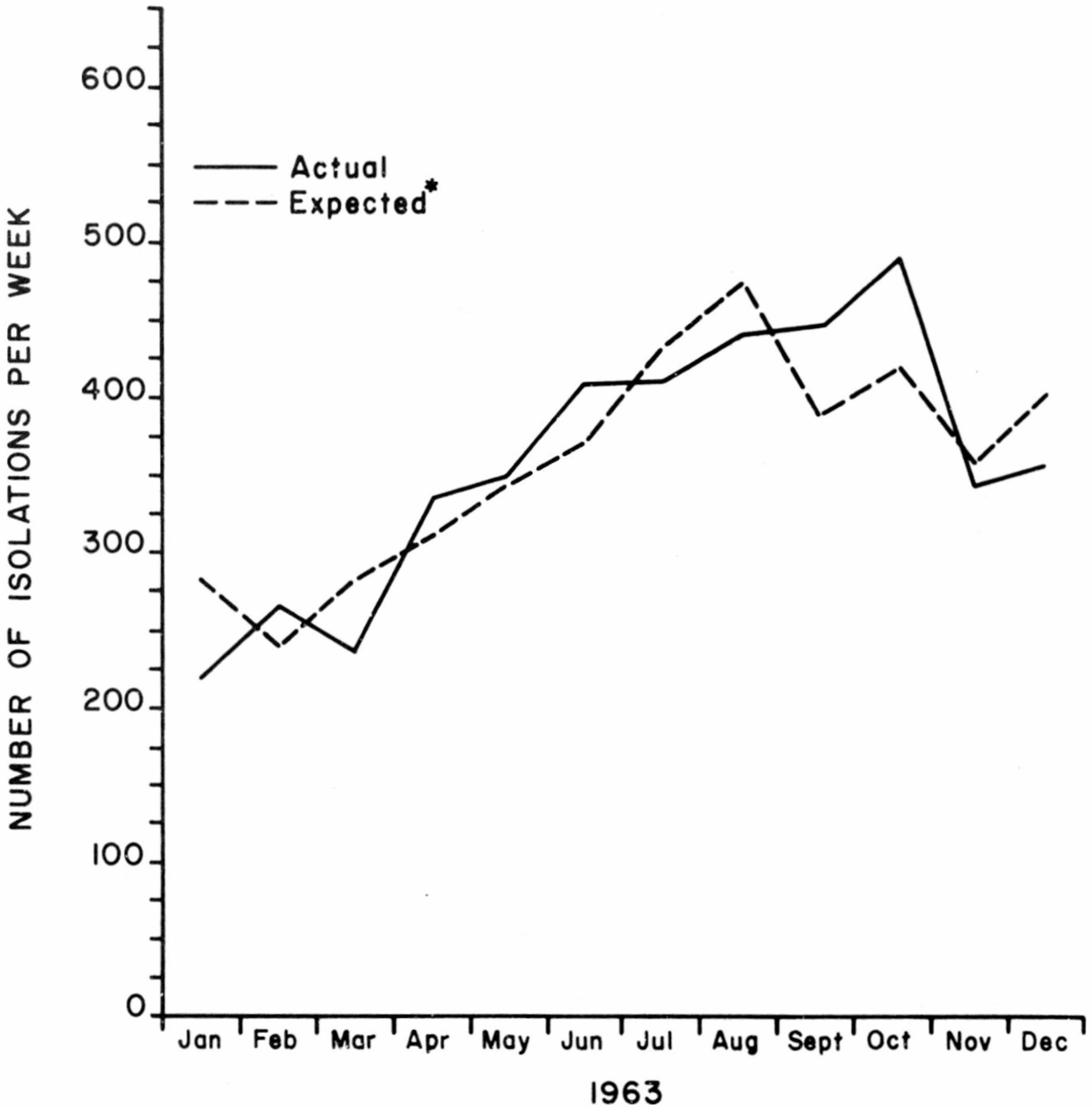
REPORTED INCIDENCE OF HUMAN SALMONELLOSIS
UNITED STATES, 1942-1962



Source: Data for 1942-1962 - MMWR Annual Supplements, 1955, 1963

Figure 2

REPORTED HUMAN ISOLATIONS OF SALMONELLAE IN THE UNITED STATES

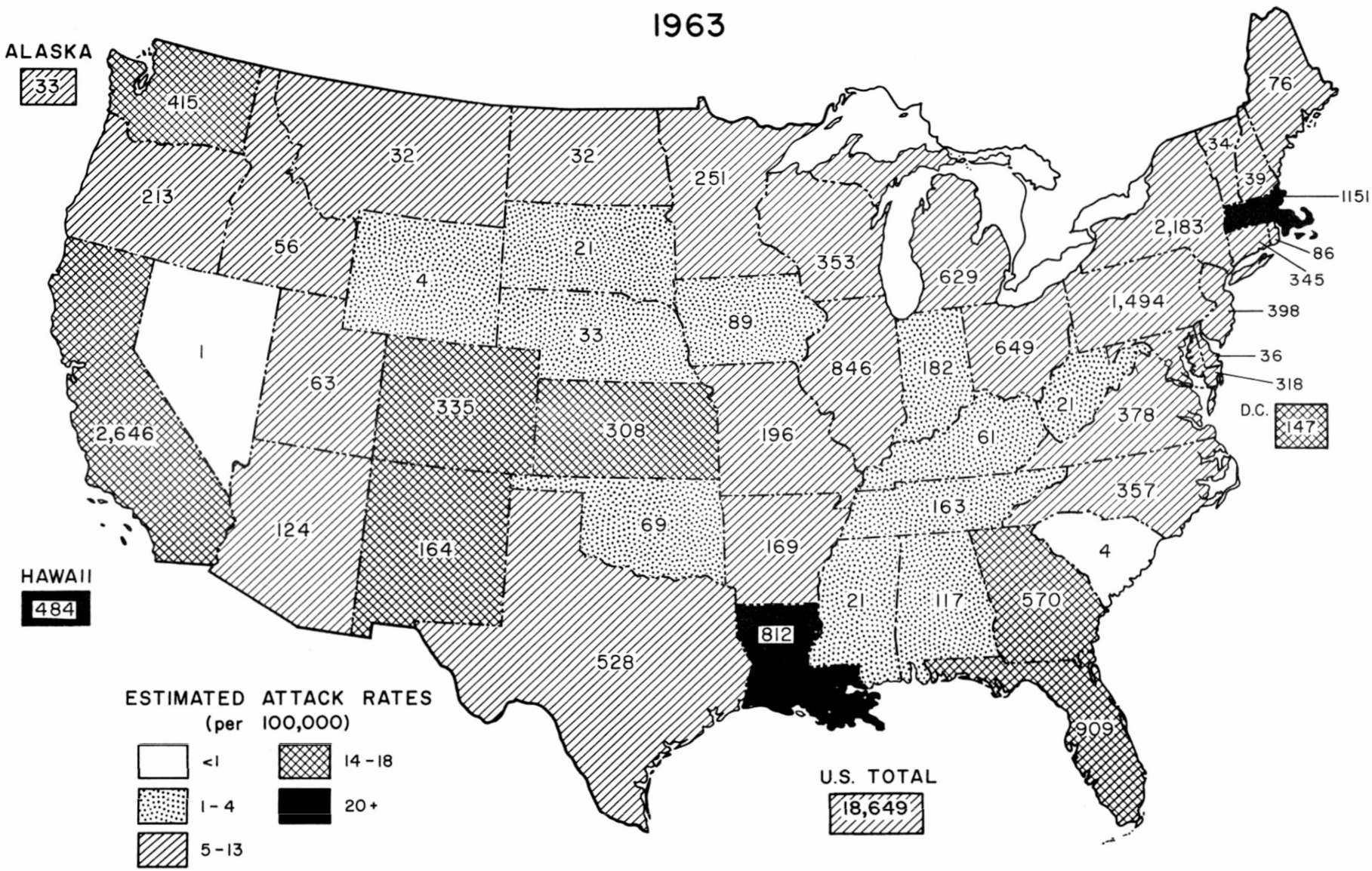


*Derived by application of a seasonal index for each month to the average month for 1963. The index was computed from monthly reports of salmonellosis cases in the United States compiled by the Morbidity and Mortality Analysis Unit, C. D. C. 1951-1962 by the ratio to moving average method. See Frederick C. Mills, Statistical Methods, 3rd. Ed. (New York: Henry Holt & Co., 1955), pp. 362-371.

Figure 3

REPORTED HUMAN ISOLATIONS OF SALMONELLAE IN THE UNITED STATES

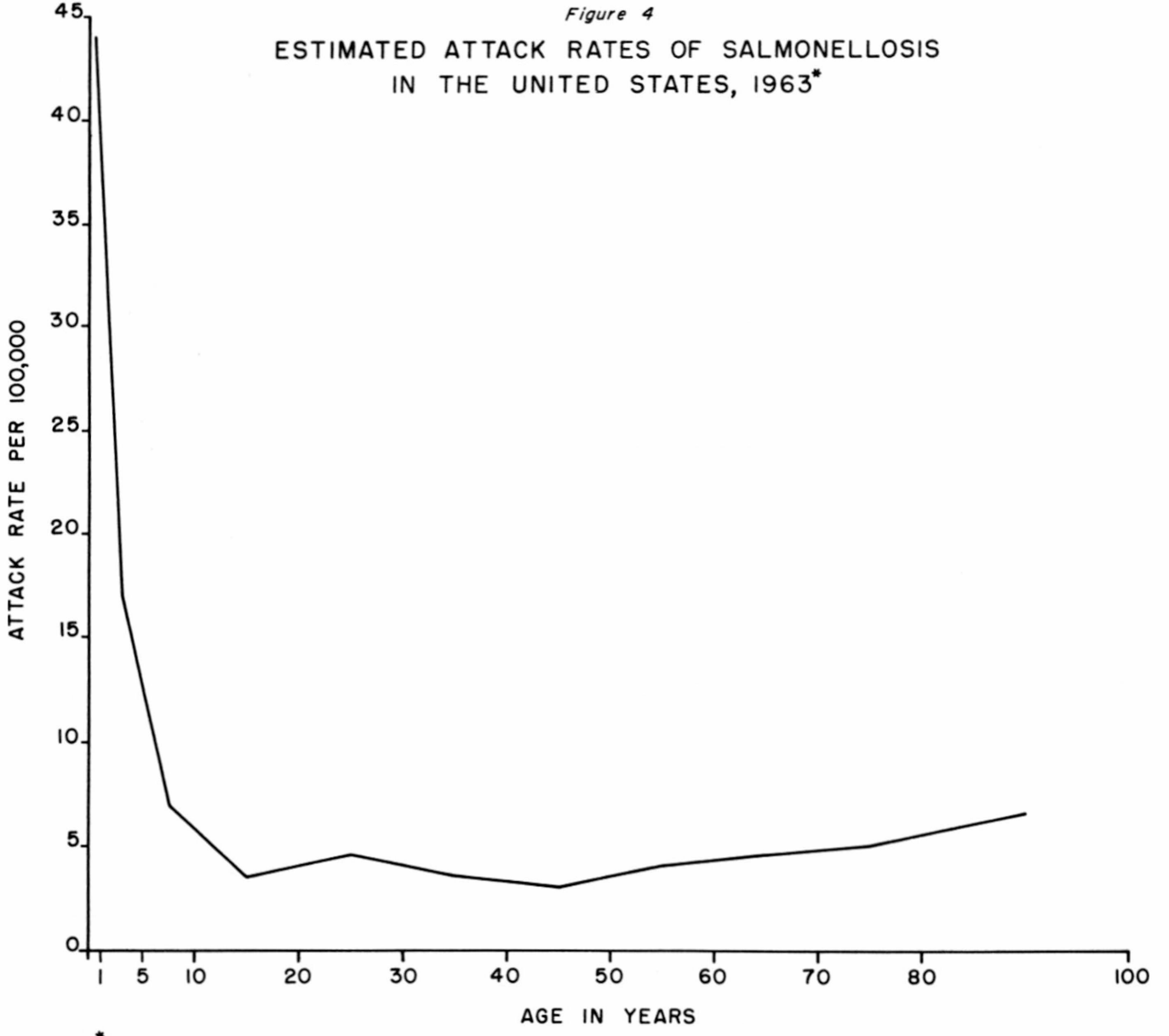
1963



NUMBERS REPRESENT TOTAL ISOLATIONS WITHIN RESPECTIVE STATES

Figure 4

ESTIMATED ATTACK RATES OF SALMONELLOSIS
IN THE UNITED STATES, 1963*



*Number of human isolations of Salmonellae, 1963 per 100,000 estimated U.S. population - July 1, 1962.

Figure 5

REPORTED HUMAN ISOLATIONS OF *Salmonella derby* AND ALL SALMONELLAE IN THE UNITED STATES, 1963

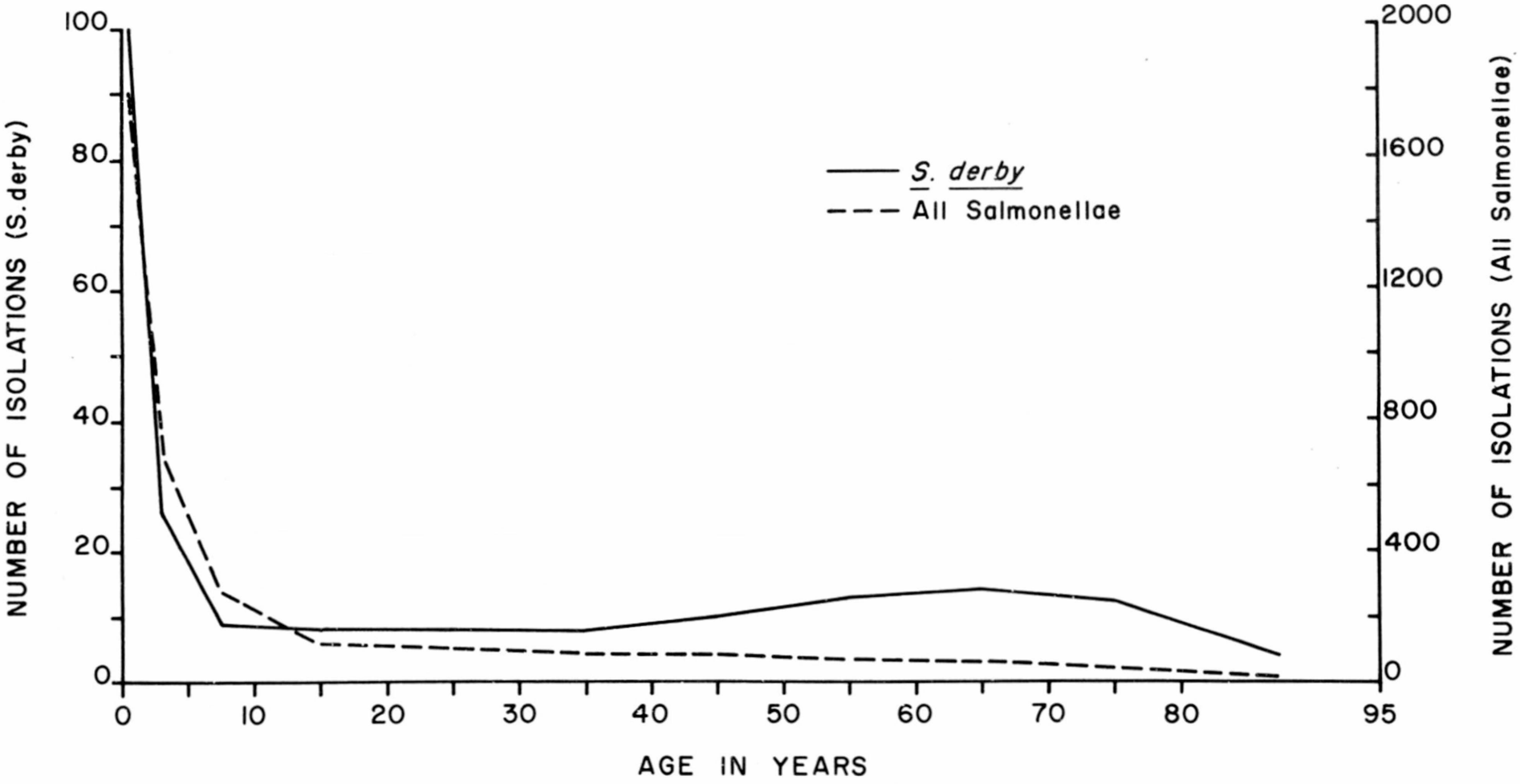
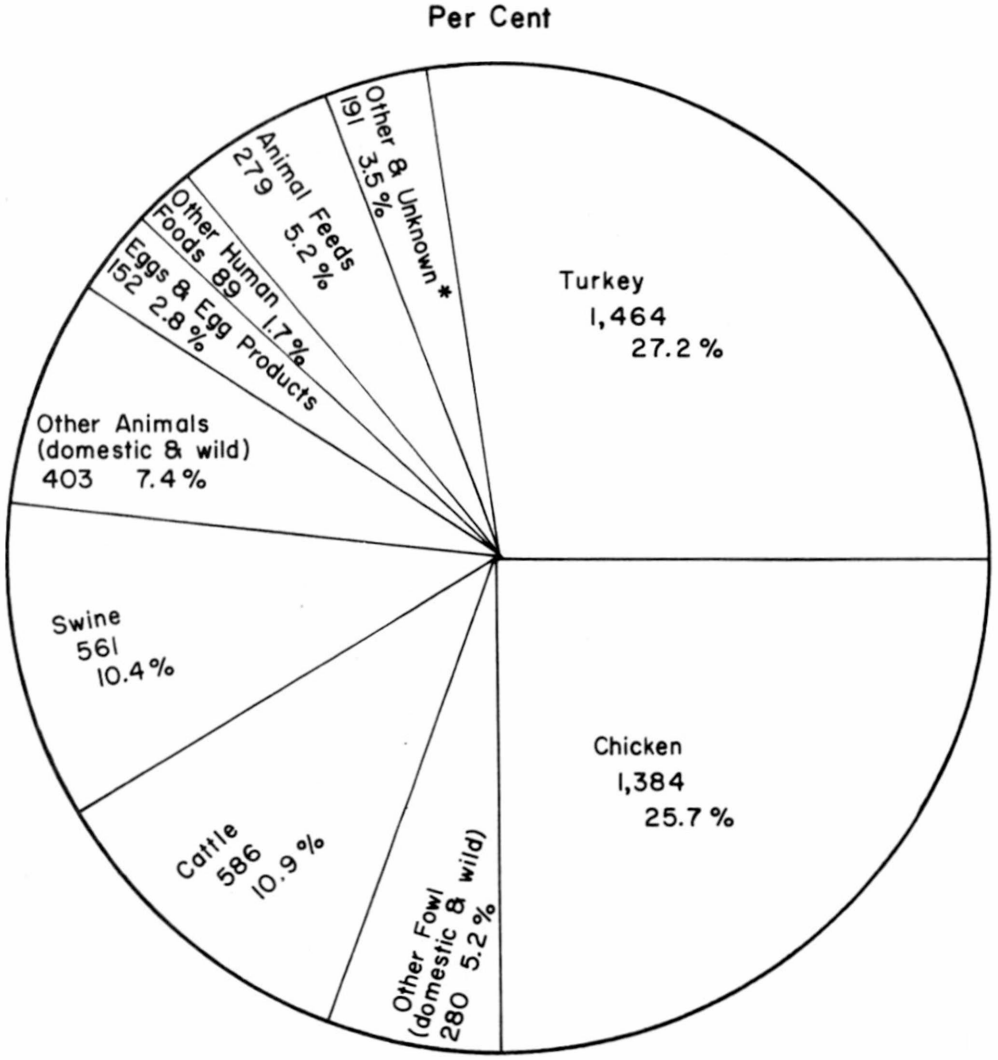


FIGURE 6

NUMBER AND PERCENT OF NON-HUMAN SALMONELLA ISOLATIONS

FROM THE INDICATED SOURCES IN THE UNITED STATES-1963



	no.	%
SALMONELLA ISOLATES FROM NON-HUMAN SPECIMENS (1963)	5,389	22.4
" " " HUMAN " "	18,649	77.6
" " " ALL " "	24,038	

* Including reptiles, insects and water

Figure 7

REPORTED ISOLATIONS OF SALMONELLAE FROM NONHUMAN SOURCES IN THE UNITED STATES

1963