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# SALMONELLA

## SURVEILLANCE

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For the Month of April, 1965

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# PREFACE

Summarized in this report is information received from State and City Health Departments, university and hospital laboratories, the National Animal Disease Laboratory (USDA, ARS), Ames, Iowa, and other pertinent sources, domestic and foreign. Much of the information is preliminary. It is intended primarily for the use of those with responsibility for disease control activities. Anyone desiring to quote this report should contact the original investigator for confirmation and interpretation.

Contributions to the Surveillance Report are most welcome. Please address to: Chief, Salmonella Surveillance Unit, Communicable Disease Center, Atlanta, Georgia, 30333.

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### SPECIAL ANNOUNCEMENT

THE PROCEEDINGS OF THE NATIONAL CONFERENCE ON SALMONELLOSIS held from March 11 - 13, 1964 are now available. All people who attended the Conference should have already received a copy as indicated at the Conference. If you have not received your copy as yet, please let us know. Anyone else who would like to obtain a copy should order it from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402, for \$1.50. The Public Health Service publishing number is 1262.

## I. SUMMARY

During April a total of 1,274 isolations of salmonellae from human sources were reported to the Salmonella Surveillance Unit for an average weekly total of 318. This represented a slight increase of 15 recoveries per week over March 1965 and a decrease of 57 isolations per week over April 1964. The trend observed in the first quarter of 1965 is continuing with total isolations running approximately 2 per cent fewer than the human recoveries during the same period last year.

Outbreaks of infection due to Salmonella heidelberg continue to be a problem, primarily in the states west of the continental divide. A report is included in this issue of an outbreak of gastroenteritis due to S. heidelberg in Hawaii. At the time this issue goes to press, reports have been received of a common source outbreak due to S. heidelberg in the State of Oregon. Preliminary information indicates that the source in this outbreak may be eggs and egg products contaminated with S. heidelberg. Previous outbreaks of S. heidelberg infection have been noted in the states of Washington, Utah, and California.

Salmonella enteritidis is being reported with increasing frequency from states in the Middle and South Atlantic Regions. A hospital-associated outbreak of infection due to S. enteritidis is currently under investigation in Richmond, Virginia. Increased activity of S. enteritidis is also noted in reports from Maryland and Pennsylvania. The possibility that a product involved in interstate commerce in this area is the common source accounting for the increased activity is being considered.

A comprehensive review of the status of salmonellosis in the State of Hawaii is included under Special Reports in this issue. Further studies on the frozen turkeys implicated in the large outbreak of gastroenteritis in Boulder County, Colorado (SSR No. 35) are included under Food & Feed Surveillance.

## II. REPORTS OF ISOLATIONS FROM THE STATES

### A. Human

The seven most commonly reported serotypes from human sources during April were:

<u>Rank</u>	<u>Serotype</u>	<u>Number</u>	<u>Per Cent</u>	<u>Rank Last Month</u>
1	<u>S. typhi-murium</u> & <u>S. typhi-murium</u> <u>var. copenhagen</u>	384	30.1	1
2	<u>S. heidelberg</u>	115	9.0	2
3	<u>S. derby</u>	67	5.3	3
4	<u>S. infantis</u>	65	5.1	4
5	<u>S. newport</u>	62	4.9	6
6	<u>S. enteritidis</u>	59	4.6	8
7	<u>S. typhi</u>	49	3.8	5
Total		801	62.8	

Total salmonellae isolated (April) 1,274

The rise in the position of S. enteritidis is explained by the increased activity in the Middle and South Atlantic states (See above). As in previous months, the serotypes listed above accounted for almost two-thirds of all isolations reported. The sex and age distribution is consistent with past experience (Table IV).

## B. Nonhuman

There were 415 isolations of salmonellae from nonhuman sources reported in April from 36 states. This is a decrease of 109 from the previous month. There were 53 serotypes identified.

The seven most common types reported for April were as follows:

<u>Rank</u>	<u>Serotype</u>	<u>Number</u>	<u>Per Cent</u>	<u>Rank Last Month</u>
1	<u>S. typhi-murium</u> & <u>S. typhi-murium</u> <u>var. copenhagen</u>	70	16.9	1
2	<u>S. heidelberg</u>	37	9.0	2
3	<u>S. give</u>	32	8.1	Not Listed
4	<u>S. infantis</u>	21	5.1	Not Listed
5	<u>S. montevideo</u>	20	4.8	Not Listed
6	<u>S. anatum</u>	19	4.6	6
7	<u>S. chester</u>	17	4.1	Not Listed
	<u>S. tennessee</u>	17	4.1	Not Listed
		<u>233</u>	<u>56.7</u>	

These types accounted for 56.7 per cent of the total.

The four species from which most of the isolations were obtained in order of frequency are: turkeys, 130(31.3 per cent); chickens, 80 (19.6 per cent); cattle, 26 (6.3 per cent); and swine, 21 (5.0 per cent).

During the month, 44 (10.6 per cent) of the reported isolations were obtained from stuffed Easter chicks and ducks (See Current Investigations). Four serotypes accounted for the recoveries: S. give, 28; S. bareilly, 6; S. livingstone, 2; and S. thompson, 2.

A rare type, S. wassenaar, recovered once from turtles during 1964, was reported from a monkey in Illinois. Salmonella oslo was also isolated from the same group of monkeys. Another rare type, S. ruiro, recovered from poultry by-products in Maryland, has not been reported in the United States previously.

## III. CURRENT INVESTIGATIONS

### Contamination of Easter Novelty Items with Salmonella Organisms.

Contamination of an Easter novelty item known as natural ducks with salmonella organisms was described in Salmonella Surveillance Report No. 36. This item is imported from Japan and consists of prepared duck skins which are then stuffed for display in Easter baskets. The presence of salmonella organisms in this novelty item has now been confirmed by 14 states. The states reporting positive isolations and the serotypes involved are shown in the accompanying table.

Recovery of Salmonella Organisms  
From Natural Ducks in State Laboratories

<u>S. give</u>	<u>S. livingstone</u>	<u>S. thompson</u>	<u>S. bareilly</u>	<u>S. enteritidis</u>
ARIZ	CONN	ILL	FLA	CONN
CONN	ILL		ILL	
FLA	ORE		ORE	
ILL	RI		CONN	
MASS	UTAH			
MICH				
MD				
NY				
PA				
RI				
TENN				
VT				

With the exception of S. enteritidis and S. thompson, all other serotypes isolated are relatively rare and should prove to be good markers in tracing possible cases related to exposure to this item. To date, no cases of human infection epidemiologically linked to this item have been reported to the Salmonella Surveillance Unit. Such reports would indeed be welcome as would any reports of additional isolations made in State Laboratories from the novelty ducks.

IV. REPORTS FROM THE STATES

A. Hawaii

Outbreak of Gastroenteritis Due to Salmonella heidelberg. Reported by W. F. Lyons, M.D., Chief, Epidemiology Branch, and Harold T. Matsuura, Communicable Disease Investigator, State of Hawaii Department of Health.

Five related families totaling 20 persons attended a family gathering at a restaurant in Hawaii on April 4, 1965. Eleven persons attending this dinner became ill on the day following the dinner with symptoms of nausea, abdominal pain, fever, and diarrhea. The incubation period was from 12 to 15 hours. Cases occurred in four of the five families attending the dinner; ages among cases ranged from 6 to 58 years. The illness was in general quite mild, and only 2 persons required medical assistance. Stool specimens were obtained from 10 of the 11 ill persons; 8 stool cultures were positive for S. heidelberg. No stool specimens were obtained from those not ill. A specific food item could not be incriminated in this outbreak. Persons who became ill and persons who did not become ill had eaten the same foods. Foods common to both groups were scallop soup, roast duck, fish fillet, lobster, abalone with mushrooms, beef and cabbage, roast chicken and seaweed soup.

Environmental swabs were taken from the kitchen of the restaurant involved five days after the outbreak. Salmonella derby was isolated from swabs taken from working tables and wash sinks. No recoveries of S. heidelberg were made from environmental cultures taken in the kitchen. Two consecutive stool specimens 24 hours apart were requested from 13 cooks and kitchen helpers in the restaurant. Stool cultures were positive for S. heidelberg in two of these individuals. Both persons had participated in production of the meal in question, and both had experienced symptoms of gastrointestinal illness two to four weeks before the family dinner was served.

Editor's Comment: Salmonella heidelberg has been an extremely frequent serotype in the last two years in the regions of the Pacific Coastal states and the Mountain states. Several large outbreaks of human disease due to S. heidelberg have been reported from California, Washington, and Utah. In several of these, the epidemiological evidence pointed to the use of frozen eggs which were contaminated with this organism. In 1964, 483 isolations of S. heidelberg were made in the United States from nonhuman sources. Over 90 per cent of these came from fowl, eggs, and egg products.

B. Kansas

Report of Discovery of Three Typhoid Carriers in a Single Family. Reported by Rosemary B. Harvey, M.D., Director, Division of Preventive Medicine, Wichita-Sedgwick County Health Department, Kansas.

Recently the Wichita-Sedgwick County Health Department received an interstate reciprocal notification from the Arkansas State Health Department that a 25-year-old male, a diagnosed typhoid carrier, was moving to Sedgwick County. According to the notification, the patient had been diagnosed as a carrier two years previously in California following a cholecystectomy. The Wichita-Sedgwick County Health Department contacted the parents of the carrier who had also recently moved to Sedgwick County. They had no knowledge of their son's being a typhoid carrier prior to this visit. Both the father, age 65, and the mother, age 63, were found to be asymptomatic typhoid carriers. Stool surveys of siblings of these three individuals are in progress but no new cases or carriers have been found. All three carriers showed cultures positive for S. typhi, degraded Vi.

C. Massachusetts

Recovery of Salmonellae From Feral Blackbirds. Reported by G. H. Snoeyenbos, D.V.M., Professor of Veterinary Science, and E. D. Morin, University of Massachusetts, Department of Veterinary and Animal Sciences.

A winter roost of blackbirds estimated to contain several hundred thousand cowbirds, and smaller numbers of starlings and grackles, suffered considerable mortality early in February 1965, following several days of extremely cold and wet weather. Most of the specimens submitted to the Department of Veterinary Science were in good condition and were considered to have died as a result of exposure. With the improvement of the weather, a marked decrease of mortality was noted.

One out of ten grackles cultured was positive for Salmonella typhi-murium; 8 out of 35 cowbirds cultured were also positive for S. typhi-murium. Additional shotgun collections were made to confirm this observation during February and early March. Salmonella organisms were isolated from 1 out of 24 starlings obtained, and 3 out of 161 cowbirds. All salmonellae in this latter collection were group B except for a single group C-1 isolation from a starling.

The apparent higher incidence of infection in the dead birds suggests that the infected birds may have been relatively more susceptible to adverse weather than unaffected birds. Difficulties arise, however, in view of the fact that large roosting flocks are apparently composed of many sub-flocks which make it very difficult to collect truly representative samples.

The migratory characteristics of these species of birds and particularly the parasitic nature of cowbirds appears to offer very interesting possibilities for transmission of infection to other wild birds.

## V. SPECIAL REPORTS

An Analysis of Salmonella Surveillance Data from the State of Hawaii.  
Compiled by Arnold F. Kaufmann, D.V.M., Salmonella Surveillance Unit, CDC,  
from data supplied by W. F. Lyons, M.D., Chief, Epidemiology Branch, State  
Department of Health, Honolulu, Hawaii.

In the delineation of the epidemiology of salmonellosis, the study of surveillance data from isolated areas presents a method of obtaining clear-cut patterns involved in this complex disease. The following compilation of data from the State of Hawaii is the first step in analysis of an isolated area.

Hawaii, the fiftieth State is comprised of an island chain stretched out over more than a thousand miles. It is a tropical area in the same latitude as Mexico City. The estimated population of the State for 1964 was 701,000 people of widely varying racial, ethnic and cultural origins. This population is disproportionately spread from over 500,000 people on Oahu to just a few on the more isolated islands. The State, while deriving much of its income from pineapple, sugar, military installations, and tourist attractions, does have a fairly sizeable animal industry. During 1963, the islands produced<sup>(1)</sup> 41 per cent of the pork consumed locally, 50 per cent of the beef, 41 per cent of the poultry meat, and 92 per cent of the shell eggs consumed. In addition, 7,000 gallons of liquid and frozen liquid eggs were produced locally. With the exception of beef, the locally produced meat and eggs are supplemented primarily by importation from the mainland. Twenty-five per cent of the beef needs are met by imports from Australia and New Zealand. A substantial portion of the feed stuffs for the locally produced animals is imported from the mainland.

The political subdivisions of the states roughly parallel the geographic island units. For reporting purposes, there are four counties: Hawaii, Honolulu, Kauai, and Maui. Due to the geographic characteristics of the State, freedom of movement is not as free between these subdivisions as they would be on the mainland. The climate is expressed as being like spring or early fall with frequent but short showers. A tabulation of climatic conditions by month in Honolulu is as follows:

### MONTHS

<u>Temp.</u>	<u>J</u>	<u>F</u>	<u>M</u>	<u>A</u>	<u>M</u>	<u>J</u>	<u>J</u>	<u>A</u>	<u>S</u>	<u>C</u>	<u>N</u>	<u>D</u>
low	66	66	66	68	69	72	73	73	73	72	70	68
high	76	76	77	78	80	82	83	84	83	82	80	78
mean	71	71	72	73	75	77	78	79	78	77	75	73
days of rain	14	10	13	12	11	11	13	13	13	13	14	15

Rainfall in Hawaii is highly variable, being greatly influenced by geography and season. Coastal leeward areas are quite arid, while windward and mountainous areas may receive well over 100 inches of rainfall a year. The greatest amount of precipitation usually occurs in the winter months.

In 1963, there were 484 salmonella isolations of human origin in Hawaii. The number of isolates increased in 1964 to 516. This represents a 6.6 per cent increase during the 2 years compared to a 13.3 per cent increase in the United States as a whole over the same period.

Many of the reported human cases are not clinical and represent asymptomatic shedders uncovered during epidemiologic investigations of clinical cases or on routine stool cultures. It has been stated that one to two per cent of routine stool cultures in Hawaii are positive for salmonella. Many of these people report no history of recent

intestinal disorder. Positive laboratory findings on these routine cultures are included in State statistical records as cases. Factors such as Hawaii's tropical climate, the presence of a good State Salmonella Typing Laboratory, and the diligence of the State Health Officials in tracing salmonellae for the past 10 years within the State undoubtedly contribute to the high reported incidence of salmonellosis.

During 1963 and 1964, three sizeable outbreaks of salmonellosis were recognized and reported. An outbreak due to Salmonella weltevreden was traced to salmon contaminated by a food handler carrying this organism (SSR No. 18). A hospital-associated outbreak due to S. montevideo (SSR No. 19) was identified as was an outbreak of S. meleagridis gastroenteritis among two groups of hospital employees attending separate banquets (SSR No. 28). In the latter report, roast duck was implicated as the vehicle of infection. Small family incidents due to various serotypes were noted including such rare serotypes as S. oslo and S. coquilhatville.

Figure 2 demonstrates the number of isolations by age within the State. The curve is identical with the rest of the country in having by far the greatest number of reported isolates originating in the 1 year and under group.

The breakdown of isolates for which sex was specified is as follows:

	<u>Male</u>	<u>Female</u>
1963	264	239
1964	<u>247</u>	<u>214</u>
Total	511	453
	(53%)	(47%)

Nonhuman isolations for 1963-1964 are shown below.

SALMONELLA ISOLATIONS - NONHUMAN SOURCES\*

<u>Year</u>	<u>County</u>	<u>Serotype</u>	<u>Source</u>
1963	Honolulu	<u>S. typhi-murium</u>	Porcine stool
	Kauai	<u>S. dublin</u>	Bovine lung
1964	Honolulu	<u>S. anatum</u>	Duckling liver
	Honolulu	<u>S. typhi-murium</u>	Duckling
	Honolulu	<u>S. typhi-murium</u>	Duckling
	Honolulu	<u>S. typhi-murium</u>	Duckling
	Honolulu	<u>S. typhi-murium</u>	Pigeon liver
	Honolulu	<u>S. typhi-murium</u>	Pigeon spleen
	Honolulu	<u>S. typhi-murium</u>	Pigeon heart
	Honolulu	<u>S. typhi-murium</u>	Pigeon lung
	Honolulu	<u>S. typhi-murium</u>	Pigeon intestine
	Honolulu	<u>S. infantis</u>	Chicken liver
	Honolulu	<u>S. infantis</u>	Chicken yolk

\*Department of Agriculture, State of Hawaii

Nonhuman isolates are few in number for this period. This puts Hawaii in the unique position of having the highest reported incidence of human salmonellosis and one of the lowest reported incidences of nonhuman salmonellosis. The true status of non-human salmonellosis in Hawaii as of the United States as a whole has not been fully delineated.

A study by local workers found that four serotypes (S. anatum, S. manhattan, S. derby, and S. weltevreden) were most commonly found in live hogs and slaughtered hogs and

their viscera. The use of hog viscera as a food item, restricted largely to older members of certain ethnic groups, has led to a hypothesis that humans infected by these "hog-associated" serotypes would have a different age, racial and residence distribution than do the other serotypes. It is hoped that convincing epidemiological association of "hog-associated" serotypes with human cases may enable meat inspection authorities to revise local slaughterhouse practices and decrease or eliminate the hazard presented by the distribution of infected hog viscera. (1)

The relative frequency of the serotypes is demonstrated in Tables number VIII, IX, and X to be quite different from the United States as a whole. The low incidence of S. typhi infection should be noted as well as the relatively high frequency of such serotypes as S. weltevreden, S. panama, S. manhattan, and S. meleagridis. The low incidence of typhoid fever may in part be due to mandatory TAB vaccination at the age of 3 years for the State's population. Levine (2) states: "The effect of this immunization program on the incidence of typhoid cases and deaths has been striking and gratifying. For example, in the 10 years prior to TAB vaccination, 678 typhoid fever cases and 97 deaths were reported compared with only 31 cases and 5 deaths during the decade following vaccinating reductions of 95 per cent in cases and 83 per cent in deaths." The high position of S. meleagridis is to be explained by the outbreak in 1964 alluded to earlier. Otherwise, the relative frequency of the serotypes has remained stable. Salmonella weltevreden, while quite common in Hawaii, is virtually nonexistent on the mainland.

The seasonal incidence of isolations of salmonellae (Figure 3) presents a bi-modal curve which is relatively consistent for both years. This is quite different from the curve presented for the United States as a whole. It may represent an artifact due to the small numbers of isolations in any one month. However, the influence of weather, tourism patterns, etc. on this pattern is unknown.

With this limited data, definite patterns have already begun to become apparent. Some of these are unique when compared to the United States as a whole such as the difference in prevalence of the various serotypes, differences in seasonal distribution and the relatively high incidence of human salmonellosis. Reasons for these differences as well as more comprehensive knowledge of the patterns of salmonellosis in the animal population will hopefully become more apparent in years to come.

## VI. INTERNATIONAL

- A. Hong Kong: Report of Two Fatal Cases of Salmonella blegdam Meningitis. Abstracted from an article by Teoh-Chan Ching Haan, Department of Pathology and Bacteriology, University of Hong Kong, appearing in The Journal of Pathology and Bacteriology, Vol. 88, No. 2, pages 587-589, 1964.

Two fatal cases of Salmonella blegdam meningitis in newborn infants occurred recently representing the first instances of such infection in Hong Kong.

Case No. 1: A Chinese female baby was delivered by forceps in a maternity hospital. In the hospital she developed fever associated with greenish, watery stools when she was 18 days old. The fever was continuous and convulsions occurred before death. Physical examination revealed bulging of the anterior fontanelle and slight rigidity of the neck. Total blood leucocyte count was 22,000; the Widal test was negative.

(1) Gooch, J. M., Public Health Veterinarian, Department of Health, State of Hawaii: Personal Communication.

(2) Levine, M., Enright, J. R., and Ching, G. Salmonellosis in TAB Vaccinated Population Island of Oahu, Hawaii: Public Health Reports, 77:293-300 (1962).

The cerebrospinal fluid was purulent. Salmonella blegdam was isolated from the blood and cerebrospinal fluid but not from a stool specimen. The patient was treated with chloramphenicol, but died six days after the onset of the illness.

Case No. 2: A Chinese female baby was delivered spontaneously one day after the birth of case 1 in the same maternity hospital. When she was 10 days old, she developed fever accompanied by convulsions. Physical examination revealed similar findings to those in case 1. Leucocyte count was 20,000. Cultures of blood and cerebrospinal fluid yielded pure growth of S. blegdam. No salmonella organism was recovered from the stool. The patient was treated with penicillin, sulphadiazine, and streptomycin but died 15 days after the onset of symptoms.

Pathology: Naked-eye examination in both cases showed only the features of purulent meningitis. The pus was pale greenish-yellow and covered the whole surface of the brain. At necropsy, pus from the brain, bile from the gall-bladder, and tissue from the mesenteric lymph nodes from both cases were cultured and all specimens yielded pure growth of S. blegdam.

Discussion: Salmonella blegdam was first isolated in 1929 at the State Institute, Copenhagen, Denmark; it was cultured from the blood of a patient with pneumonia at the Blegdam Hospital. Many of the case reports of infection with S. blegdam in the literature have described a rather severe illness with frequent septicemia and an enteric-like fever clinical picture. A mild gastroenteritis due to S. blegdam has rarely been described. The source of infection in the present two cases was not determined. Stool cultures were negative for those in close contact with the babies. It is of interest to know that the twin sister of case 2 was not infected and remained healthy.

Editor's Comment: Information on the first isolation of S. blegdam in the United States was supplied by Mr. Ben E. Diamond, Director of State Laboratories, Pierre, South Dakota. During the period November 1964 to January 1965, three cases of severe gastrointestinal illness occurred in a family in South Dakota. Two of the three cases required prolonged hospitalization. Salmonella blegdam was isolated from the two hospital patients but not from the nonhospitalized family member who also had gastrointestinal illness. Other family members were negative on stool surveys for salmonellae. Epidemiologic investigation revealed that all members of the family who acquired illness had had contact with an opossum, which had wandered onto their farm prior to the onset of the first illness. The opossum was ill upon capture and died a week before the first case of gastroenteritis occurred. The carcass of the opossum had disappeared before investigations were started and no cultures were obtained. It is speculated, however, that the opossum may have been the means by which S. blegdam infection was introduced into the family and the South Dakota community.

- B. Report from the Salmonella Reference Laboratory, Adelaide, Australia for the First Quarter of 1965. Reported by Kevin Anderson, M.D., M.R.A.C.P., M.C.P.A., Senior Medical Bacteriologist, The Institute of Medical and Veterinary Science, Adelaide, Australia.

During the first quarter of 1965, 363 isolations of salmonellae were typed. Of these, 57 were from human sources and 304 from nonhuman sources. In order of frequency the commonest human isolates were S. typhi-murium, S. derby, and S. bovis-morbificans. The commonest animal isolates were S. saint-paul, S. san diego, S. muenchen, and S. adelaide. The number of strains referred for identification has been unusually low during the first quarter, but a substantial increase has been noted during the first weeks of the second quarter.

Recently a project has been undertaken in an attempt to locate typhoid carriers in a number of aboriginal communities in Darwin, Australia by placement of sewer swabs in the area involved. The first five swabs formed the basis of an extensive experiment to determine the most satisfactory techniques for isolation of gastrointestinal pathogens.

Swabs were received in buffered glycerol-saline, and after shaking, the turbid fluid was diluted tenfold in saline to  $10^{-8}$ . Direct platings were made of these dilutions using S.S. medium (Difco) and bismuth sulphite agar, but no pathogens were detected by these methods. One milliliter aliquots of the dilutions were then added to mannitol selenite broth (0.4 per cent selenite), Rappaport's medium and mannitol broth containing 0.8 per cent sodium acid selenite. After incubation, subcultures were made onto S.S. medium and bismuth sulphite agar. Of the five swabs examined, four yielded salmonellae, but none of these were S. typhi. The findings of the initial swab survey are shown in the following table.

Results of Sewer Swab Survey

Swab	Dilution	Liquid Selective Medium	Subculture Medium	Isolate
B	Undiluted	Rappaport	S.S.	<u>S. saint-paul</u>
B	$10^{-1}$	"	"	"
C	$10^{-1}$	"	"	"
D	Undiluted	"	Bismuth sulphite agar	<u>S. muenchen</u>
D	Undiluted	Mannitol selenite broth(0.4%)	" " "	"
D	$10^{-3}$	" " "	" " "	"
D	$10^{-4}$	" " "	" " "	"
D	Undiluted	" " "	S.S.	"
D	Undiluted	Rappaport	"	"
E	Undiluted	Mannitol selenite broth(0.4%)	Bismuth sulphite agar	<u>S. saint-paul</u>
E	Undiluted	Rappaport	S.S.	"
E	$10^{-2}$	"	Bismuth sulphite agar	"

The material obtained from the swabs appeared to require less dilution than is commonly recommended in the literature. The author suggested that the superiority of Rappaport's medium for the isolation of salmonellae other than S. typhi is well demonstrated in this experiment and confirms the experiences of many other workers. Additional swabs from other areas will be examined and the results reported at a later date.

#### VII. FOOD AND FEED SURVEILLANCE

##### Examination of Frozen Turkeys Implicated in an Outbreak of Salmonellosis in Colorado (Salmonella Surveillance Report No. 35, March 1965).

Following the incrimination of roast turkey as the source of an outbreak due to Salmonella san diego involving nearly 850 persons in Colorado 1965, the Veterinary Public Health Laboratory received 4 frozen turkeys from the same lot as those served to the victims. Three of these birds, weighing 28-29 pounds each, were examined to determine the anatomical sites most heavily contaminated with salmonellae, the effects of insufficient cooking on these sites, and the degree of dissemination of organisms during cooking.

In studying the first turkey, the method used to cook the 12 turkeys in Colorado was followed. These turkeys were removed from the freezer and placed under running water

to thaw. The following morning they were removed from the plastic packages, at which time the interiors of the birds were still frozen. They were wrapped in heavy foil, then cooked for 7 to 8 hours, the first hour at 375°F, and the remaining period at 350°F. After cooking, the birds remained at room temperature until they were served the following evening. For the second and third turkeys this method was modified. They were thawed for 24 hours at room temperature instead of in water and the period of cooking was reduced from 7 or 8 hours to 5 hours for Number 2 and 3 hours for Number 3. The morning after the birds were thawed, swabs for culture were taken from the skin surfaces and from the cavity of each turkey. In addition, samples of skin and other tissues were removed, minced and cultured. While baking meat, thermometers were placed deep into the thickest portion of the turkeys and temperature readings were recorded at hourly intervals. The cooked birds were then allowed to remain at room temperature for 24 hours, after which samples for culture were collected from the same areas as those cultured from the raw birds. Tetrathionate broth was used as enrichment broth for both swabs and tissue cultures. After 24 and 48 hours incubation, the enrichment broths were streaked to brilliant green agar plates.

### Results

Salmonella san diego was isolated from surface swabs taken from two turkeys prior to cooking. It was also isolated from the abdominal cavity of one turkey (Table 1). Salmonella cerro contamination was found in all 3 birds. In no instance were salmonellae recovered from deep core samples of breast meat cultured. Table 1 lists the results of all cultures obtained from the three turkeys prior to cooking.

Salmonellae were not isolated from swab samples and tissue samples taken after cooking the 3 birds for the various periods described (Table 2). These studies demonstrated that the salmonellae on external and body cavity surfaces of the birds were killed by roasting at temperature time relationships inferior to those used by most restaurants. The fact that these birds were not stuffed with dressing and were wrapped in foil may account for the apparent effectiveness of the cooking procedure. However, the widespread distribution of salmonellae on the raw birds could provide an excellent source for contamination of the kitchen knives, cutting blocks, etc., which would then be a source of recontamination of the cooked birds.

Notification: Proceedings of National Conference on Salmonellosis.

We have been informed that a number of participants in the National Conference on Salmonellosis which was held March 11-13, 1964, have not received a copy of the proceedings of the conference. Those to whom this applies should so inform the Salmonella Surveillance Unit. Others interested in obtaining a copy of these proceedings may purchase the monograph for \$1.50 through the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The request should be made for PHS publication No. 1262.

Table 1

RESULTS OF EXAMINATION OF TURKEYS  
PRIOR TO COOKING FOR SALMONELLAE

Turkey Number	Type Sample	Number Taken	Number Positive	Serotypes
1	External Surface Swabs	10	8	<u>S. cerro</u> (6) <u>S. san diego</u> (3)
	Internal surface swabs (abdominal cavity)	4	4	<u>S. cerro</u> (2) <u>S. san diego</u> (2)
	Water in which wrapped turkey was thawed	1	0	
	Water within plastic wrapping	1	1	<u>S. san diego</u>
	Skin from breast area	1	1	<u>S. san diego</u>
	Meat from wing	1	0	
	Deep core of breast meat	1	0	
	Internal organs	3	2	<u>S. cerro</u> (1) <u>S. san diego</u> (1)
2	External surface swabs	9	8	<u>S. cerro</u> (8)
	Internal surface swabs (abdominal cavity)	5	3	<u>S. cerro</u> (2) <u>S. san diego</u> (1)
	Swab of thigh muscle next to bone	1	0	
	Water within wrapping	1	0	
	Skin portion of leg and wing	2	2	<u>S. cerro</u>
	Superficial leg muscle	1	0	
	Deep leg muscle	1	0	
	Deep core of breast meat	1	0	
	Internal organs	2	0	
3	External surface swabs	8	8	<u>S. cerro</u> (8) <u>S. san diego</u> (1)
	Internal surface swabs (abdominal cavity)	6	6	<u>S. san diego</u>
	Swab of thigh muscle next to bone	1	0	
	Bloody water within wrapping	1	0	
	Skin portions of leg and wing	2	2	<u>S. cerro</u> (1) <u>S. san diego</u> (2)
	Superficial leg muscle	1	0	
	Deep leg muscle	1	0	
	Deep core of breast meat	1	0	
	Internal organs	2	0	
	Total		68	45

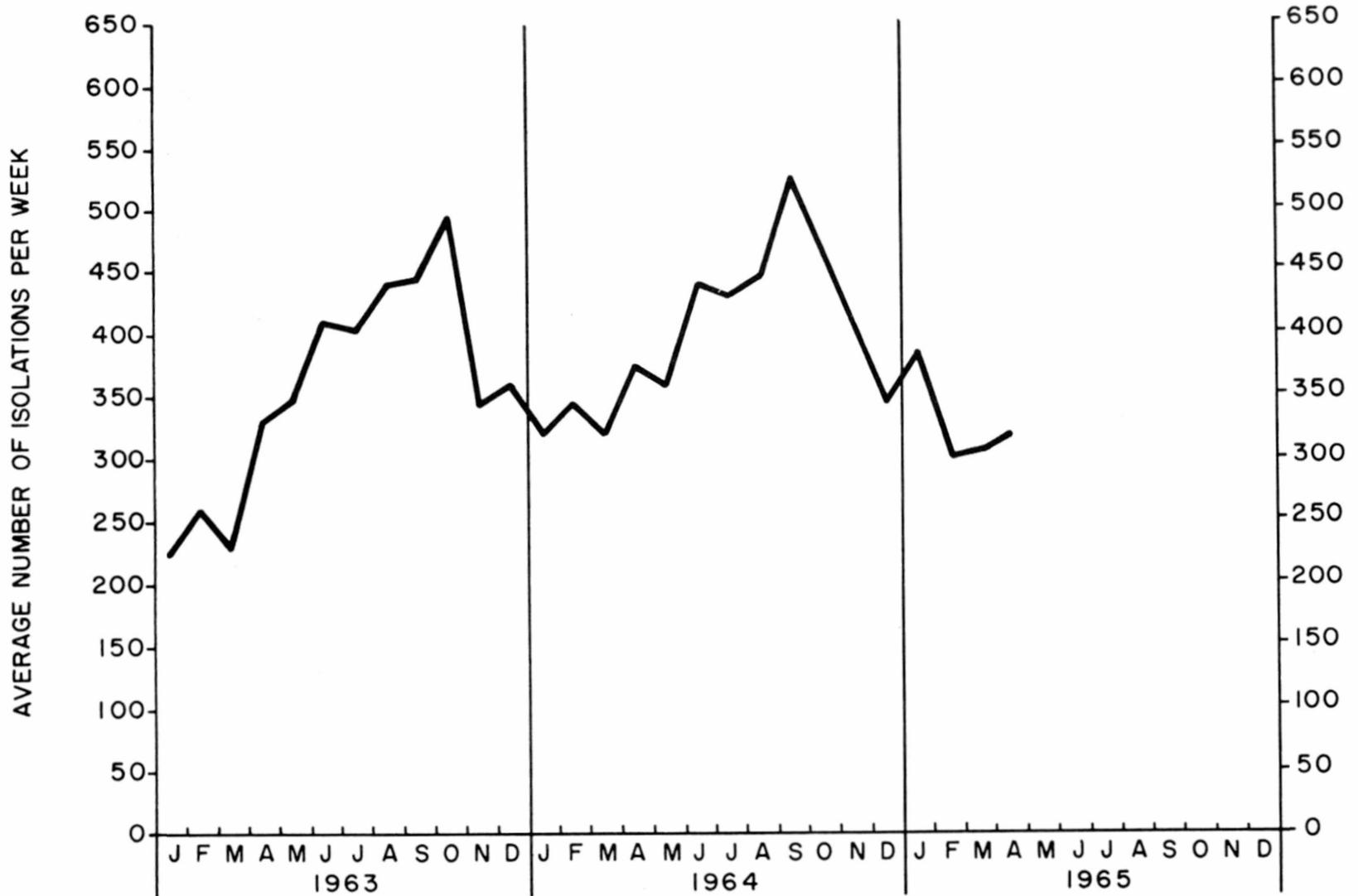
Table 2

COOKING PROCEDURE AND RESULTS OF EXAMINATION  
OF TURKEYS FOR SALMONELLAE AFTER COOKING

Turkey Number	Time and temp. setting of oven	Highest temp. re- corded by meat thermometers	Type Sample	Number Taken	Number Positive
1	1 hr. at 375F 6 hrs. at 350F	170F at 7th hr.	Superficial and deep muscle	9	0
			Outside surface of skin	2	0
			Juices in pan	2	0
			Surface of meat inside cavity	1	0
2	1 hr. at 375F 4 hrs. at 350F	180F at 5th hr.	External surface swabs	3	0
			Internal surface swabs of cavity	2	0
			Liquid in foil	1	0
			Swab of deep muscle next to bone	4	0
			Skin of wing and breast	2	0
			Superficial thigh muscle	1	0
			Deep muscle	7	0
3	1 hr. at 375F 2 hrs. at 350F	180F at 3rd hr.	External surface swabs	3	0
			Internal surface swabs of cavity	2	0
			Liquid in foil	1	0
			Swab of deep muscle next to bone	4	0
			Skin of wing and breast	2	0
			Superficial thigh muscle	1	0
			Deep muscle	7	0
Total				54	0

Figure 1.

REPORTED HUMAN ISOLATIONS OF SALMONELLAE  
IN THE UNITED STATES



*Figure 2*

REPORTED HUMAN ISOLATIONS OF SALMONELLAE  
BY AGE, HAWAII - 1963 AND 1964

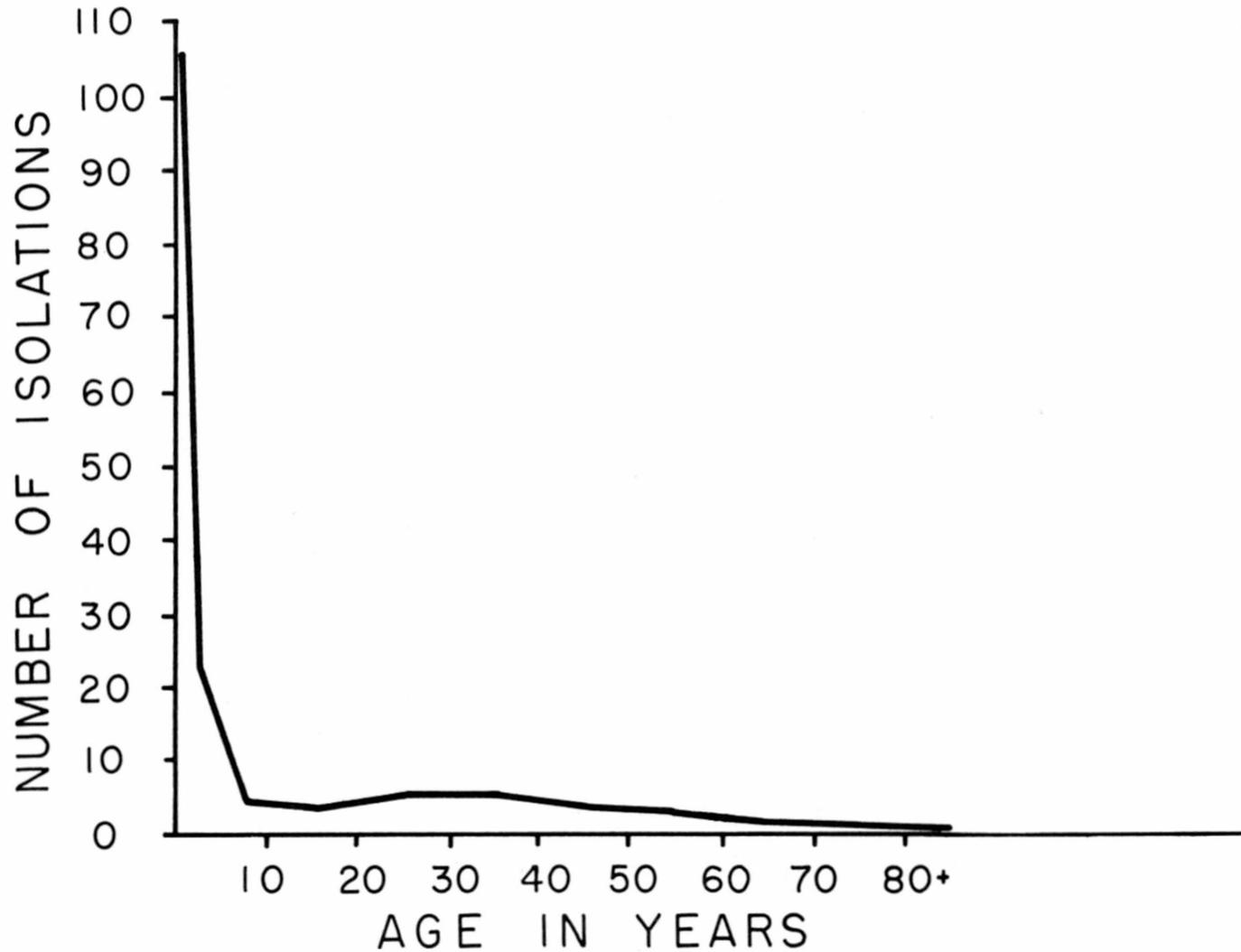


Figure 3

SALMONELLA ISOLATIONS BY MONTH  
HAWAII, 1963-64

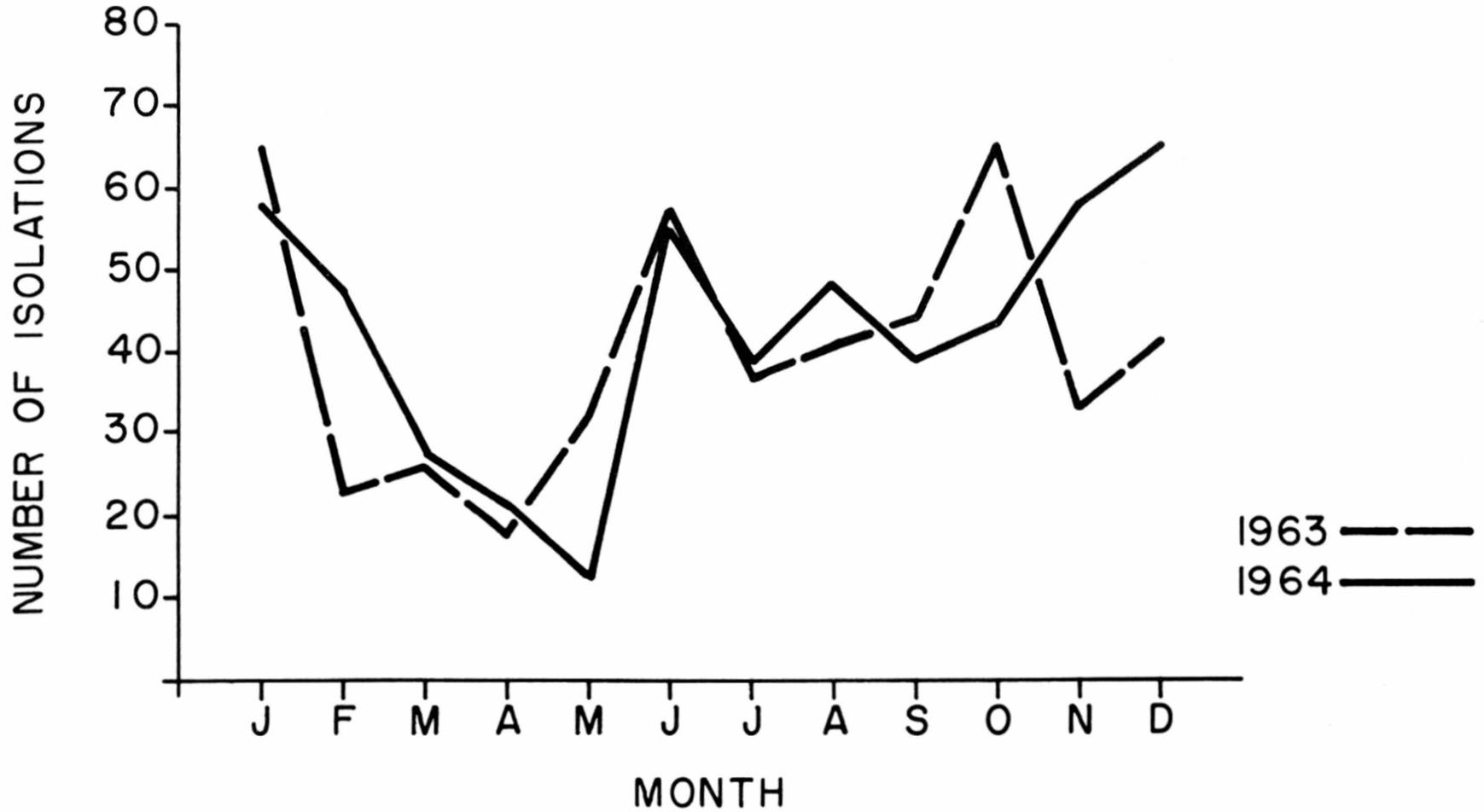


TABLE I  
SALMONELLA SEROTYPES ISOLATED FROM HUMANS DURING \*\*APRIL, 1965

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	
anatum								3	1									1	1	4
azteca																				
bareilly																				
berta																	1			1
bilthoven																				
blockley							4	1	1	2		3	7		1	2			3	6
bovis-morbificans																				
braenderup								1					1	1						1
bredeney							1							1		1	2			4
california																				
chester												9	9				2			2
cholerae-suis							1							1						1
cholerae-suis v kun																	1			1
cubana							2	1				1	2	2		6	1		9	9
derby							7	1				26	35	3		2	3		8	8
dublin																				
duesseldorf																				
enteritidis							4	2	2	2	1	11	18	1		6	1	1	9	9
gaminara													1							1
give															1					1
hartford																				
heidelberg							7	11	4		4	2	2	2		13	10		25	25
indiana													2			1			1	1
infantis							3		2			5	12	8	2	2	1	7	20	20
java							3									4			4	4
javiana																				
kentucky												1	1			2			2	2
litchfield																1			1	1
livingstone										1			1			1			1	1
manhattan								1					1			1		1	2	2
meleagridis																				
miami																1			1	1
minnesota															1				1	1
mission																				
montevideo							1	1				6	7			2	2	1	5	5
muenchen												2	2							
new-brunswick																				
newington																1			1	1
newport							4				2	2	5	8		6	1	7	22	22
oranienburg								1		1	1	1	3	2		3	1	1	7	7
oslo																				
panama									1				1			1		1	1	1
paratyphi B							2			1	1	3	5	2			2		4	4
pomona																				
poona											1		1							
saint-paul							2		2	1		4	7				5		5	5
san-diego												1	1	3					3	3
schwarzengrund										1			1	1		1			2	2
senftenberg																				
siegburg										1			1			1			1	1
stanley																				
tennessee																1			1	1
thompson							3				2	3	7		1		3		4	4
typhi	2								2	1	1	4	8		5	1	2	1	9	9
typhi-murium							2	1	3	1	2	7	3	6	4			13	13	
typhi-murium							50	17	6	32	23	16	94	14	1	17	12	7	51	51
typhi-murium v cop																				
urbana							5					1	1							
worthington																				
untypable group B							1									1	1		2	2
untypable group C-1																				
untypable group C-2																				
untypable group D																				
untypable group E																				
untypable group G																				
untypable																				
unknown																			1	1
TOTAL	2	2	3	81	21	20	129	37	32	53	48	94	264	54	18	84	50	33	239	239

New York (A-Albany, BI-Beth Israel Hospital, 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. Beth-Israel reported a total of 109 isolations for the month of April.

\*\* Includes March late reports.

TABLE I (Continued)  
BY SEROTYPE AND REPORTING CENTER

REGION AND REPORTING CENTER																TOTAL	S E R O T Y P E
WEST NORTH CENTRAL							SOUTH ATLANTIC										
MINN	IOWA	MO	ND	SD	NEBR	KAN	DEL	MD	DC	VA	WV	NC	SC	GA	FLA	TOTAL	
								1	1	2		2		1		6	anatum
												1				1	azteca
												1				1	bareilly
																	berta
																	bilthoven
3	1													1	1	2	blockley
																	bovis-morbificans
																	braenderup
																	bredeney
																	california
6														1		1	chester
																	cholerae-suis
						1								1	1	2	cholerae-suis v kun
							1							1	1	3	cubana
																	derby
1		5					3	2	2	2	1			3		6	dublin
																	duesseldorf
																	enteritidis
																	gaminara
																	give
2		1												1	1	2	hartford
		1												1	12	15	heidelberg
5						3		3			1	2				6	indiana
								2						1	2	5	infantis
																	java
3		1													4	4	javana
																	kentucky
																	litchfield
																	livingstone
																	manhattan
														1	3	4	meleagridis
																	miami
														1	1	1	minnesota
														1	1	2	mission
																	montevideo
						1				1				2	1	4	muenchen
						1								1		1	new-brunswick
						1								2	5	9	newington
		3				1		2						7	6	13	newport
		2															oranieburg
									1								oslo
																	panama
																	paratyphi B
															1	1	pomona
																	poona
3	1					2		1	6	1		1		6	5	20	saint-paul
						1								1		1	san-diego
																	schwarzengrund
										1						1	senftenberg
																	siegburg
						1		1		1						2	stanley
		1				7	1			2				2	1	6	tennessee
																	thompson
3	2	5		1		8	1	7	1	21	1	4		7	14	70	typhi
																	typhi-murium
	3						1										typhi-murium v cop
																	urbana
						1			12							12	worthington
									1							1	untypable group B
																	untypable group C-1
						1											untypable group C-2
																	untypable group D
																	untypable group E
																	untypable group G
																	untypable
	2								2							2	unknown
26	9	19	-0-	1	-0-	28	7	20	25	31	3	30	-0-	41	61	218	TOTAL

TABLE I (Continued)

S E R O T Y P E	R E G I O N A N D R E P O R T I N G C E N T E R																		
	E A S T S O U T H C E N T R A L					W E S T S O U T H C E N T R A L					M O U N T A I N								
	KY	TENN	ALA	MISS	TOTAL	ARK	LA	OKLA	TEX	TOTAL	MONT	IDA	WYO	COLO	NM	ARI	UTAH	NEV	TOTAL
anatum																	1		1
azteca																			
bareilly																			
berta																			
bilthoven																			
blockley		1			1		3		2	5									
bovis-morbificans																			
braenderup							2			2									
bredeney									2	2									
california																			
chester																			
cholerae-suis																			
cholerae-suis v kun																			
cubana								1	1	1									
derby																			
dublin																			
duesseldorf																			
enteritidis		1			1		1			1									
gaminara																			
give							3			3									
hartford																			
heidelberg							1			1									
indiana							1			1						3	3	6	
infantis			1		1		1		1	2						1		3	
java																			
javana																			
kentucky																			
litchfield			1		1		1			1									
livingstone																			
manhattan							2			2									
meleagridis																			
miami																			
minnesota																			
mission																			
montevideo		2			2				1	1									
muenchen									1	1									
new-brunswick																			
newington																			
newport		1			1		3		1	4									
oranienburg							2		1	3					2			3	
oslo																			
panama									1	1									
paratyphi B																			
pomona																			
poona																			
saint-paul													1						1
san-diego																			
schwarzengrund																			
senftenberg									1	1									
siegburg																			
stanley																			
tennessee								1		1									
thompson										1									1
typhi		3			3	2	1	1	4	8									2
typhi-murium		2			2	3	8	5	12	28				5	1	1	2	1	9
typhi-murium v cop								2		2									1
urbana																			
worthington																			
untypable group B														3					3
untypable group C-1									1	1				3					3
untypable group C-2																			
untypable group D														5					5
untypable group E														1					1
untypable group G														1					1
untypable														2					2
unknown																			
TOTAL	-0-	10	2	-0-	12	5	34	7	31	77	3	-0-	-0-	6	16	5	8	4	42

TABLE I

REGION AND REPORTING CENTER						OTHER VI	TOTAL	PERCENT OF TOTAL	FOUR MONTH TOTAL	% FOUR MONTH TOTAL	1964 4 MO. TOTAL	% 1964 4 MO. TOTAL	S E R O T Y P E
P A C I F I C													
WASH	ORE	CAL	ALASKA	HAWAII	TOTAL								
1		1		1	3		19	1.5	86	1.6	66	1.6	anatum azteca bareilly berta bilthoven
							1		1				
							1		19		26		
							1		10		20		
		1			1		1		1				
							29	2.3	106	1.9	137	2.2	blockley bovis-morbificans braenderup bredeny california
		3		3	3		3		4				
							7		23		23		
3		6		2	11		18		44		90		
1					1		1		7		7		
							19		52		25		chester cholerae-suis cholerae-suis v kun cubana derby
							1		2		8		
							1		12		11		
							17		59		22		
	1	2		3	6		67	5.3	242	4.4	1,203	19.4	
							1		3				dublin duesseldorf enteritidis gaminara give
		1			1		1		2				
		4			4		59	4.6	291	5.3	210	3.4	
							1		3				
		2			2		6		31		19		
							4		9		6		hartford heidelberg indiana infantis java
6		13		12	31		115	9.0	440	8.0	421	6.8	
							3		15		9		
1		2		4	8		65	5.1	322	5.8	287	4.6	
	1	1			1		13		49		80		
							7		37		44		javana kentucky litchfield livingstone manhattan
							1		4		8		
							7		34		19		
							4		13		1		
		3			3		6		35		60		
							1		5		7		meleagridis miami minnesota mission montevideo
							4		23		13		
							2		2				
							1		4				
		1		1	2		20	1.6	148	2.7	140	2.3	
							12	0.9	52	0.9	74	1.2	muenchen new-brunswick newington newport oranienburg
		4			4		1		1		2		
							4		16		14		
1		10		1	11		62	4.9	254	4.6	213	3.4	
		5			6		35	2.7	185	3.3	191	3.1	
							1		3				oslo panama paratyphi B pomona poona
		1		2	3		7		38		58		
		2			2		14		54		60		
							1		1		1		
							1		14		11		
							43	3.4	207	3.8	120	1.9	saint-paul san-diego schwarzengrund senftenberg siegburg
		4		1	5		11		112		50		
		5			5		13		50		28		
		3			6		2		20		18		
							1		2				
							1		2				stanley tennessee thompson typhi typhi-murium
1		2		1	3		23	1.8	70	1.3	159	2.6	
1		5			7		39	3.1	127	2.3	110	1.8	
	2	7			9		49	3.8	263	4.8	196	3.2	
13	4	27		17	61		384	30.1	1,591	28.8	1,617	26.1	
							13		64		55		typhi-murium v cop urbana worthington untypable group B untypable group C-1
							2		3		7		
							1		15		24		
							3		71		84		
							5		25		21		
							2		22		7		untypable group C-2 untypable group D untypable group E untypable group G untypable
							5		8		7		
							1		2		2		
							1		2				
							2		2				
	1				1		9		34		22		unknown
31	12	118	-0-	49	210		1,274		5,525		6,204		TOTAL

(VI - Virgin Islands)

TABLE II  
REPORTED ISOLATIONS OF S. TYPHI. BY PATIENT STATUS - APRIL 1965

STATE	REPORTED TO SALMONELLA SURVEILLANCE UNIT						CLINICAL CASES REPORTED IN MMWR			
	Cases		Carriers		Unknown		Total			
	Apr. 1965	Cuml.	Apr. 1965	Cuml.	Apr. 1965	Cuml.	Apr. 1965	Cuml.		
<b>UNITED STATES</b>	12	50	14	94	23	119	49	266	26	105
<b>NEW ENGLAND</b>	-	-	-	-	2	5	2	5	-	1
Maine	-	-	-	-	2	2	2	2	-	-
New Hampshire	-	-	-	-	-	-	-	-	-	-
Vermont	-	-	-	-	-	-	-	-	-	-
Massachusetts	-	-	-	-	-	1	-	1	-	1
Rhode Island	-	-	-	-	-	2	-	2	-	-
Connecticut	-	-	-	-	-	-	-	-	-	-
<b>MIDDLE ATLANTIC</b>	2	9	2	11	3	10	7	30	6	17
New York	2	9	-	5	3	6	5	20	4	13
New Jersey	-	-	-	-	-	4	-	4	1	2
Pennsylvania	-	-	2	6	-	-	2	6	1	2
<b>EAST NORTH CENTRAL</b>	-	3	7	21	6	11	13	35	3	15
Ohio	-	1	3	13	-	1	3	15	-	3
Indiana	-	-	4	7	2	4	6	11	-	4
Illinois	-	-	-	-	4	6	4	6	2	3
Michigan	-	2	-	1	-	-	-	3	-	3
Wisconsin	-	-	-	-	-	-	-	-	1	2
<b>WEST NORTH CENTRAL</b>	-	1	-	8	-	10	-	16	-	3
Minnesota	-	-	-	1	-	-	-	1	-	-
Iowa	-	-	-	-	-	-	-	-	-	-
Missouri	-	1	-	7	-	6	-	11	-	3
North Dakota	-	-	-	-	-	-	-	-	-	-
South Dakota	-	-	-	-	-	-	-	-	-	-
Nebraska	-	-	-	-	-	-	-	-	-	-
Kansas	-	-	-	-	-	4	-	4	-	-
<b>SOUTH ATLANTIC</b>	4	14	1	18	-	8	5	40	4	26
Delaware	-	-	-	-	-	-	-	-	1	3
Maryland	-	2	-	2	-	5	-	9	-	8
District of Columbia	-	-	-	-	-	-	-	-	-	-
Virginia	-	1	-	2	-	-	-	3	-	2
West Virginia	-	2	-	3	-	-	-	5	-	1
North Carolina	4	8	-	4	-	1	4	13	-	7
South Carolina	-	-	-	-	-	-	-	-	1	3
Georgia	-	-	-	1	-	1	-	2	1	1
Florida	-	1	1	6	-	1	1	8	1	1
<b>EAST SOUTH CENTRAL</b>	1	2	2	10	-	13	3	25	-	12
Kentucky	-	-	-	1	-	2	-	3	-	5
Tennessee	1	2	2	3	-	1	3	6	-	3
Alabama	-	-	-	-	-	-	-	-	-	2
Mississippi	-	-	-	6	-	10	-	16	-	2
<b>WEST SOUTH CENTRAL</b>	4	18	2	22	2	6	8	46	1	14
Arkansas	1	4	-	6	1	2	2	12	1	6
Louisiana	-	5	-	11	1	2	1	18	-	2
Oklahoma	-	1	1	1	-	1	1	3	-	1
Texas	3	8	1	4	-	1	4	13	-	5
<b>MOUNTAIN</b>	1	3	-	3	1	18	2	24	-	11
Montana	-	-	-	-	-	1	-	1	-	-
Idaho	-	-	-	-	-	-	-	-	-	-
Wyoming	-	-	-	-	-	-	-	-	-	1
Colorado	-	-	-	-	-	-	-	-	-	-
New Mexico	1	3	-	3	-	16	1	22	-	7
Arizona	-	-	-	-	1	1	1	1	-	3
Utah	-	-	-	-	-	-	-	-	-	-
Nevada	-	-	-	-	-	-	-	-	-	-
<b>PACIFIC</b>	-	-	-	1	9	41	9	42	1	6
Washington	-	-	-	-	-	1	-	1	-	1
Oregon	-	-	-	1	2	4	2	5	1	1
California	-	-	-	-	7	35	7	35	-	3
Alaska	-	-	-	-	-	-	-	-	-	-
Hawaii	-	-	-	-	-	1	-	1	-	1
Virgin Islands	-	-	-	-	-	-	-	-	*	*

\* Does not report.

TABLE III  
Infrequent Serotypes

<u>Serotype</u>	<u>Center</u>	<u>April</u>	<u>1965*</u>	<u>Total 1963 &amp; 1964**</u>	<u>Comment</u>
<u>S. bilthoven</u>	CALIF	1	1	0	First reported isolation to this unit.
<u>S. bovis- morbificans</u>	HAW	3	4	11	A relatively common serotype in Europe.
<u>S. dublin</u>	CALIF	1	3	5	Reported as a cause of abortion in Ewes in IDA.
<u>S. duesseldorf</u>	LA	1	2	7	Isolated from tankage in IND during 1964.
<u>S. gaminara</u>	NY-C	1	3	6	Comprised 2 of 393 isolates from tortoises in Israel 1953-1962.
<u>S. mission</u>	FLA	1	4	4	All 1965 isolates thus far from FLA.
<u>S. new-brunswick</u>	GA	1	1	10	First isolated from baby chicks in NJ 1936.
<u>S. oslo</u>	WISC	1	3	14	Reported from marmoset monkeys in Ill this year.
<u>S. pomona</u>	FLA	1	1	1	All 4 nonhuman sources during 1963-64 were zoo animals in MICH including 2 snakes.
<u>S. siegburg</u>	NY-C	1	2	2	First reported from Germany in 1953.
<u>S. stanley</u>	ILL	1	2	22	Monkeys and turkeys most common non-human sources in U.S.

\* Represents 5,525 human isolations of salmonellae during the first 4 months of 1965.

\*\* Represents 39,762 human isolations of salmonellae during 1963 and 1964.

TABLE IV

Age and Sex Distribution of 1,250 Isolations of Salmonellae  
Reported for April 1965

<u>Age</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>%</u>	<u>Cumulative %</u>
Under 1	70	55	125	10.0	10.0
1-4 yrs.	123	94	217	17.4	27.4
5-9 yrs.	50	42	92	7.4	34.8
10-19 yrs.	30	28	58	4.6	39.4
20-29 yrs.	22	36	58	4.6	44.0
30-39 yrs.	21	30	51	4.1	48.1
40-49 yrs.	21	33	54	4.3	52.4
50-59 yrs.	23	25	48	3.8	56.2
60-69 yrs.	16	22	38	3.0	59.2
70-79 yrs.	8	20	28	2.2	61.4
80+	3	13	16	1.3	62.7
Unknown	<u>224</u>	<u>241</u>	<u>465</u>	<u>37.2</u>	<u>99.9</u>
Total	611	639	1,250		
% of Total	48.9	51.1			



REPORTED NONHUMAN ISOLATES BY SROTYPE AND STATE APRIL, 1965

TABLE VI

S R O T Y P E	Ala	Ark	Ariz	Ark Calif	Calif	Colo	Conn	Del	Fla	Ga	Ill	Ind	Ky	Md	Mass	Mich	Minn	Miss	Mo	Mont	N.J.	N.Y.-R.I.	N.C.	Ohio	Ore	Pa	R.I.	S.C.	Tenn	Tex	Utah	Va	Wash	Wisc	Wyo	Total				S R O T Y P E
																																				4 mos	1965	1964	1963	
alachu					1																															1	11	alachu		
anatum					8																																8	61	anatum	
bareilly					1																																1	12	bareilly	
biza					2																															2	14	biza		
blockley										3	1																									2	62	blockley		
brandenburg																																				1	4	brandenburg		
bredeley	1																																			5	23	bredeley		
california					1																															7	22	california		
cambridge																																				1	1	cambridge		
cerro					1																														6	29	cerro			
chester																																				17	58	chester		
cholerae-salis v kun	3																																		10	31	cholerae-salis v kun			
cubana																																				3	9	cubana		
deery	2																																			7	26	deery		
doblin																																				1	19	doblin		
dusseldorf																																				1	1	dusseldorf		
enterididis																																				2	12	enterididis		
gallinarum																																				32	42	gallinarum		
give																																				32	42	give		
hartford																																				1	1	hartford		
heidelsberg																																				37	235	heidelsberg		
indiana																																				3	12	indiana		
infantis	1																																			21	116	infantis		
new																																			4	12	new			
kentucky																																				2	12	kentucky		
livingstone																																				4	36	livingstone		
sambutan																																				1	20	sambutan		
sanita																																				2	12	sanita		
enterididis																																				1	1	enterididis		
stam																																				1	1	stam		
minnesota																																				1	11	minnesota		
montevideo																																				20	65	montevideo		
munchen																																				6	12	munchen		
newington																																				1	12	newington		
newport																																				11	32	newport		
orientenburg																																				5	22	orientenburg		
oslo																																				2	1	oslo		
politorium																																				1	7	politorium		
reading																																				6	20	reading		
rubislav																																					1	1	rubislav	
salor-paul																																					15	71	salor-paul	
san-diego																																				4	38	san-diego		
schwarzengrund																																				6	23	schwarzengrund		
sentfener	1																																			5	24	sentfener		
thomsonville																																					4	5	thomsonville	
thompson																																				10	58	thompson		
typhl-martum																																				44	252	typhl-martum		
typhl-martum v cop																																				1	86	typhl-martum v cop		
worthington																																				3	23	worthington		
untypable group-B																																				1	5	untypable group-B		
untypable group-C-1																																				5	5	untypable group-C-1		
untypable group-B																																				1	1	untypable group-B		
untypable group-H																																				1	1	untypable group-H		
unknown																																				1	2	unknown		
TOTAL	8	8	9	1	86	1	4	1	8	21	24	22	14	34	19	6	43	4	24	4																				

TABLE VI-A  
 SEROTYPES REPORTED FROM NONHUMAN SOURCES  
 PREVIOUSLY DURING 1965 BUT NOT IN APRIL

Serotype	Month(s)	Reporting Center(s)	Number of Isolations
albany	Feb	Tex(1)	
	Mar	Ind(1)	2
berta	Feb	Fla	1
brandenburg	Jan	NC	1
florida	Jan	Ill	1
illinois	Mar	Minn	1
javiana	Jan	Fla(1)	
	Mar	Calif(1)	2
johannesburg	Mar	Utah	1
lexington	Jan	Tenn	1
menston	Mar	Va	1
mikawashima	Mar	Ind	1
mission	Jan	Ark(1)	
	Jan	SC(1)	2
norwich	Feb	NC	1
orion	Jan	Miss(1)	
	Jan	Mont(1)	
	Mar	Minn(2)	4
panama	Feb-Mar	Ohio(2)	
	Mar	Tex(1)	3
paratyphi-B	Mar	Tex	1
poona	Jan	Tenn(1)	
	Mar	Calif(3)	
	Mar	Mass(3)	7
tallahassee	Jan	Fla	1
typhi-suis	Feb	Calif	1
urbana	Mar	Fla	2
westerstede	Jan	Miss	2
westhampton	Feb	Mass	1
Total			37

TABLE VII

Salmonella derby Isolations and Total Salmonella Isolations  
Reported by Month\*

	<u>Total Salmonella Isolations</u>	<u>S. derby Isolations</u>	<u>Per Cent of Total</u>
1962 November	922	18	2.0
December	794	16	2.0
1963 January	1,111	30	2.7
February	1,059	22	2.1
March	931	28	3.0
April	1,330	61	4.6
May	1,738	139	8.0
June	1,640	203	12.4
July	2,133	303	14.2
August	1,770	155	8.8
September	1,786	164	9.2
October	2,462	228	9.3
November	1,381	127	9.2
December	1,439	175	12.2
1964 January	1,601	213	13.3
February	1,442	301	20.9
March	1,279	290	22.7
April	1,882	399	21.2
May	1,545	277	18.0
June	1,758	195	11.1
July	2,159	217	10.1
August	1,777	151	8.5
September	2,624	109	4.2
October	1,848	85	4.6
November	1,595	69	4.3
December	1,719	76	4.4
1965 January	1,538	58	3.8
February	1,198	39	3.3
March	1,515	78	5.1
April	1,274	67	5.3

\* As reported to the Salmonella Surveillance Unit from 50 States and the District of Columbia.

TABLE VIII  
SALMONELLA SEROTYPES ISOLATED IN HAWAII - 1963

Serotype	County										Total	Percent 1963 Total <sup>2</sup>	Percent 1963- 1964 Total <sup>2</sup>
	Unknown	Percent <sup>1</sup>	Honolulu	Percent <sup>1</sup>	Hawaii	Percent <sup>1</sup>	Kauai	Percent <sup>1</sup>	Maui	Percent <sup>1</sup>			
<i>anatum</i>	1	50.0	19	4.5	-	-	-	-	-	-	20	4.1	3.6
<i>bareilly</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	0.2
<i>berta</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	0.2
<i>blockley</i>	-	-	2	0.4	-	-	-	-	-	-	2	0.4	0.6
<i>bredeney</i>	-	-	17	4.0	-	-	-	-	-	-	17	3.5	3.7
<i>colorado</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	0.3
<i>derby</i>	-	-	57	13.5	1	4.5	-	-	2	9.0	60	12.3	10.7
<i>enteritidis</i>	-	-	2	0.4	-	-	-	-	-	-	2	0.4	(0.2)
<i>give</i>	-	-	7	1.7	-	-	-	-	-	-	7	1.4	1.8
<i>grumpensis</i>	-	-	-	-	-	-	-	3	13.5	-	3	0.6	0.9
<i>heidelberg</i>	-	-	25	5.9	5	22.5	1	7.1	-	-	31	6.4	5.8
<i>heilbron</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>infantis</i>	-	-	28	6.6	-	-	-	-	1	4.5	29	6.0	8.3
<i>kentucky</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	0.3
<i>manhattan</i>	1	50.0	30	7.1	-	-	-	-	-	-	31	6.4	10.1
<i>meleagridis</i>	-	-	-	-	1	4.5	-	-	1	4.5	2	0.4	2.7
<i>miami</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>montevideo</i>	-	-	24	5.7	-	-	-	-	-	-	24	5.0	3.8
<i>muenchen</i>	-	-	2	0.4	-	-	-	-	-	-	2	0.4	(0.2)
<i>newport</i>	-	-	13	3.1	-	-	1	7.1	-	-	14	2.9	2.6
<i>oranienburg</i>	-	-	6	1.4	-	-	-	-	-	-	6	1.2	1.1
<i>oslo</i>	-	-	3	0.6	-	-	-	-	2	9.0	5	1.0	1.0
<i>panama</i>	-	-	35	8.3	-	-	-	-	6	27.0	41	8.5	7.5
<i>paratyphi B</i>	-	-	1	0.2	1	4.5	-	-	-	-	2	0.4	(0.2)
<i>saint-paul</i>	-	-	10	2.4	-	-	-	-	2	9.0	12	2.5	1.8
<i>schwarzengrund</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	1.0
<i>senftenberg</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	0.4
<i>tennessee</i>	-	-	6	1.4	2	9.0	1	7.1	-	-	9	1.9	1.2
<i>thompson</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	0.4
<i>typhi</i>	-	-	3	0.6	-	-	1	7.1	-	-	4	0.8	(0.4)
<i>typhimurium</i>	-	-	86	20.4	5	22.5	1	7.1	4	18.0	96	19.8	18.5
<i>urbana</i>	-	-	2	0.4	-	-	-	-	-	-	2	0.4	(0.2)
<i>welikada</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>weltevreden</i>	-	-	25	5.9	8	36.0	9	64.3	1	4.5	43	8.9	6.4
<i>worthington</i>	-	-	7	1.7	-	-	-	-	1	4.5	8	1.7	1.8
<i>typhi phage type W</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>untypable C<sub>1</sub></i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
TOTALS	2	0.4*	422	87.2*	23	4.8*	14	2.9*	23	4.8*	484		

<sup>1</sup>Percent of isolates within county

<sup>2</sup>Percent of total isolates within state

( ) - isolated one year only

\* - Percent of total for state for the year

TABLE IX  
SALMONELLA SEROTYPES ISOLATED IN HAWAII - 1964

Serotype	County										Total	Percent 1964 Total <sup>2</sup>	Percent 1963- 1964 Total <sup>2</sup>
	Unknown	Percent <sup>1</sup>	Honolulu	Percent <sup>1</sup>	Hawaii	Percent <sup>1</sup>	Kauai	Percent <sup>1</sup>	Mau	Percent <sup>1</sup>			
<i>anatum</i>	-	-	16	3.6	-	-	-	-	-	-	16	3.1	3.6
<i>bareilly</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	0.2
<i>berta</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	0.2
<i>birkenhead</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>blockley</i>	-	-	4	0.9	-	-	-	-	-	-	4	0.8	0.6
<i>bovis-morbificans</i>	-	-	2	0.4	-	-	-	-	-	-	2	0.4	(0.2)
<i>braenderup</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>bredeney</i>	-	-	20	4.4	-	-	-	-	-	-	20	3.9	3.7
<i>california</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>cerro</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>colorado</i>	-	-	2	0.4	-	-	-	-	-	-	2	0.4	0.3
<i>coquilhatville</i>	-	-	3	0.6	-	-	-	-	-	-	3	0.6	(0.3)
<i>derby</i>	-	-	47	10.4	-	-	-	-	-	-	47	9.1	10.7
<i>give</i>	-	-	6	1.3	4	7.4	1	14.0	-	-	11	2.1	1.8
<i>grumpensis</i>	-	-	3	0.6	1	1.9	-	-	2	40.0	6	1.2	0.9
<i>heidelberg</i>	-	-	27	6.0	-	-	-	-	-	-	27	5.2	5.8
<i>infantis</i>	-	-	31	6.9	22	40.7	-	-	1	20.0	54	10.5	8.3
<i>java</i>	-	-	3	0.6	-	-	-	-	-	-	3	0.6	(0.3)
<i>kentucky</i>	-	-	2	0.4	-	-	-	-	-	-	2	0.4	0.3
<i>livingstone</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>manhattan</i>	-	-	62	13.8	8	14.8	-	-	-	-	70	13.6	10.1
<i>meleagridis</i>	-	-	25	5.6	-	-	-	-	-	-	25	4.8	2.7
<i>montevideo</i>	-	-	12	2.7	-	-	2	29.0	-	-	14	2.9	3.8
<i>newington</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>newport</i>	-	-	12	2.7	-	-	-	-	-	-	12	2.3	2.6
<i>oranienburg</i>	-	-	5	1.1	-	-	-	-	-	-	5	1.0	1.1
<i>oslo</i>	-	-	4	0.9	1	1.9	-	-	-	-	5	1.0	1.0
<i>panama</i>	-	-	26	5.8	8	14.8	-	-	-	-	34	6.6	7.5
<i>saint-paul</i>	-	-	6	1.3	-	-	-	-	-	-	6	1.2	1.8
<i>san-diego</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>schwarzengrund</i>	-	-	9	2.0	-	-	-	-	-	-	9	1.7	1.0
<i>senftenberg</i>	-	-	3	0.6	-	-	-	-	-	-	3	0.6	0.4
<i>tennessee</i>	-	-	3	0.6	-	-	-	-	-	-	3	0.6	1.2
<i>thompson</i>	-	-	3	0.6	-	-	-	-	-	-	3	0.6	0.4
<i>typhimurium</i>	-	-	75	16.7	10	18.0	2	29.0	2	40.0	89	17.3	18.5
<i>weltevreden</i>	-	-	19	4.2	-	-	2	29.0	-	-	21	4.1	6.4
<i>westhampton</i>	-	-	1	0.2	-	-	-	-	-	-	1	0.2	(0.1)
<i>worthington</i>	-	-	10	2.2	-	-	-	-	-	-	10	1.9	1.8
TOTALS	-	-	450	87.2*	54	10.5*	7	1.4*	5	1.0*	516		

<sup>1</sup>Percent of isolates within county  
<sup>2</sup>Percent of total isolates within state

( ) - isolated one year only  
\* - Percent of total for state for the year

TABLE X  
MOST COMMON SALMONELLA SEROTYPES

Entire U.S. 1963		Entire U.S. 1964 (provisional)		Pacific Region 1963 (ALAS, CALIF, HAI, OREG, WASH)	
Serotype	Percent of All Isolates	Serotype	Percent of All Isolates	Serotype	Percent of All Isolates
1. <i>typhi-murium</i>	30.1	1. <i>typhi-murium</i>	27.7	1. <i>typhi-murium</i>	34.3
2. <i>derby</i>	8.6	2. <i>derby</i>	11.2	2. <i>heidelberg</i>	12.7
3. <i>heidelberg</i>	8.2	3. <i>heidelberg</i>	8.1	3. <i>newport</i>	6.8
4. <i>newport</i>	5.8	4. <i>infantis</i>	7.2	4. <i>infantis</i>	6.4
5. <i>infantis</i>	5.2	5. <i>newport</i>	4.9	5. <i>saint-paul</i>	3.7
6. <i>enteritidis</i>	4.3	6. <i>enteritidis</i>	3.8	6. <i>derby</i>	3.4
7. <i>typhi</i>	3.8	7. <i>typhi</i>	3.3		
8. <i>saint-paul</i>	3.1	8. <i>saint-paul</i>	3.0		
9. <i>oranienburg</i>	2.9	9. <i>oranienburg</i>	2.6		
10. <i>montevideo</i>	2.6	10. <i>montevideo</i>	2.5		

MOST COMMON SALMONELLA SEROTYPES IN HAWAII

1963		1964 (provisional)		1963-1964 (provisional)	
Serotype	Percent of All 1963 Isolates	Serotype	Percent of All 1964 Isolates	Serotype	Percent of All 1963 and 1964 Isolates
1. <i>typhi-murium</i>	19.8	1. <i>typhi-murium</i>	17.3	1. <i>typhi-murium</i>	18.5
2. <i>derby</i>	12.3	2. <i>manhattan</i>	13.6	2. <i>derby</i>	10.7
3. <i>weltevreden</i>	8.9	3. <i>infantis</i>	10.5	3. <i>manhattan</i>	10.1
4. <i>panama</i>	8.5	4. <i>derby</i>	9.1	4. <i>infantis</i>	8.3
5. <i>heidelberg</i>	6.4	5. <i>panama</i>	6.6	5. <i>panama</i>	7.5
6. <i>manhattan</i>	6.4	6. <i>heidelberg</i>	5.2	6. <i>weltevreden</i>	6.4
7. <i>infantis</i>	6.0	7. <i>meleagridis</i>	4.8	7. <i>heidelberg</i>	5.8
8. <i>montevideo</i>	5.0	8. <i>weltevreden</i>	4.1	8. <i>montevideo</i>	3.8
9. <i>anatum</i>	4.1	9. <i>bredeney</i>	3.9	9. <i>bredeney</i>	3.7
10. <i>bredeney</i>	3.5	10. <i>anatum</i>	3.1	10. <i>anatum</i>	3.6

INCIDENCE SALMONELLOSIS per 100,000 POPULATION

Political Subdivision	1963		1964		1963-1964	
	based on 1960 census	based on 1964 est. census	based on 1960 census	based on 1964 est. census	based on 1960 census	based on 1964 est. census
Hawaii	37.5	—	88.0	—	125.5	—
Honolulu	84.3	—	89.9	—	174.3	—
Kauai	49.7	—	24.8	—	74.5	—
Maui*	53.7	—	11.7	—	65.3	—
State	76.5	69.0	81.5	73.6	158.0	142.7

\* Includes Kalawao