

A 1966-68 study of 5,000 human diaphragms indicates nearly a 75 percent reduction in the prevalence of trichiniasis in the United States during the past three decades.

The Changing Status of Trichiniasis in the U.S. Population

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EVEN THOUGH authorities in other parts of the world have long considered the United States an area of hyperendemic trichiniasis, little attention has been given to this disease in the United States. With few exceptions, health workers, regulatory officials, and swine producers either have failed to recognize the extent of trichiniasis or have considered it too insignificant a disease to justify formulation of a control program. At present, however, more attention is being given to trichiniasis, and prospects are better that an eradication program may soon be formulated.

Studies of human cadavers in the United States during the 1930's and early 1940's indicated that about one of every six of the deceased had been infected with *Trichinella spiralis* sometime during his life. In an extensive study throughout the country by the National Institutes of Health (NIH), Public Health Service, during 1936-41, an overall prevalence of 16.1 percent was obtained from 5,313 human diaphragms examined (1, 2). The diaphragms

came from hospitals in 37 States and the District of Columbia. The prevalence of trichiniasis varied by geographic area from 18.5 to 10.0 percent, a range indicating that the disease was widespread in the human population throughout the United States.

In addition to the study by the National Institutes of Health, numerous local or State studies during the same period confirmed an overall prevalence rate of about 16 percent (3, 4), with variations from 36.0 percent in Cleveland during 1938 (5) to 3.0 percent in North Carolina during 1939 (6). Other representative results include: Minneapolis, 1934-17.1 percent (7); San Francisco, 1936-24.0 percent (8); New Orleans, 1936-3.5 percent (9); New York City, 1941-22 percent (10); and Michigan, 1942-23.3 percent (11).

The few studies that have been carried out on trichiniasis in recent years have been limited in scope, but their results indicate a marked decrease in the prevalence of the disease in human beings. Beard (12), in 1950, obtained a prevalence of 8.0 percent from San Francisco, and Wallace and Sanders (13) reported 1 percent from Minneapolis during 1952-54. A prevalence of only 3.5 percent from New York City during 1959-61 was reported by Most (4)—a notable decline from the 22.0 percent obtained in a similar study during 1941. Zimmermann (14) reported a prevalence of 2.8 percent from Iowa during 1961-65, whereas Moldow (15) reported 5 percent from Pittsburgh in 1963.

Related to the reduction of the disease noted in post mortem observations is the decrease in

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the number of cases of clinical trichiniasis reported yearly. During 1944-48, a yearly average of 400 such cases was recorded (16), but the average for 1957-66 was only 196 (17). During 1966, the number of reported cases declined to 115, while only 67 cases were reported during 1967 (18).

The reduction in the incidence of the infection in human beings correlates with a similar reduction in United States swine. The decrease is especially notable for garbage-fed swine. Schwartz (19) reported a prevalence of 11.0 percent in 1950 among swine that had been fed raw garbage. During 1954-59, after garbage cooking regulations were instituted, Schwartz found that the prevalence had decreased to 2.2 percent. Jefferies and associates (20), in a statistically designed national study during 1964-66, showed that the prevalence of *T. spiralis* in garbage-fed swine in that period was 0.5 percent.

A less spectacular, though equally important, decline has been noted for trichiniasis in farm-raised (primarily grain-fed) swine. Schwartz (21) found a prevalence of 0.95 percent during the 1930's. This prevalence declined to 0.63 percent during the 1948-52 period (19). A study by Zimmermann and Brandly (22) during 1961-65 indicated that the prevalence had declined still further to 0.12 percent. A study in progress in which we are participating suggests that the prevalence in farm-raised swine is still declining.

Since there were indications of a pronounced decrease in the prevalence of trichiniasis in both human beings and swine of the United States, the authors initiated a statistically designed study in February 1966 to determine the present rate of infection in the U.S. population. Approximately 10,000 human diaphragms from all 50 States and the District of Columbia will be examined. This preliminary report covers the first 5,000 samples, which were examined between February 1966 and May 1968.

Statistical Design of Study

Norman V. Strand, professor of statistics, statistical laboratory, Iowa State University, Ames, prepared the statistical design for this study. The diaphragm specimens were obtained

from deceased persons 1 year old and over on whose bodies autopsies had been performed in general hospitals having residencies in pathology—as listed for 1963 by the American Medical Association (23). Exceptions were made only for a limited number of States having no residencies in pathology or for those States where generally cadavers were embalmed before autopsy. Specialty hospitals, such as veterans' and children's, were excluded from the study to reduce age bias.

A total of 10,000 diaphragms were desired for the sample. Since the number of autopsies that would eventually be performed in the hospitals in question could not be determined in advance, sampling rates had to be established on the basis of other information, and these rates then had to be applied to the autopsies as they were performed. Data were available by State for 1963 on the number of deaths of persons 1 year old and over and on the total number of autopsies performed in the eligible hospitals. We believed that the States should be represented in the sample in accordance with the number of deaths rather than the number of autopsies; consequently the tentative sample of 10,000 diaphragms was allocated to the States in proportion to the number of 1963 deaths. For each State, a sampling rate to be applied to the autopsies which were carried out during the study was computed by dividing the tentative sample's allocation of diaphragms by the number of autopsies performed in that State in 1963. Within each State, one of every four eligible hospitals was selected at random for the sample. The sampling rate for each State was increased proportionally by a factor equivalent to the total eligible hospitals divided by the number of selected hospitals. This rate was then applied to the listed 1963 autopsies for each hospital to determine the desired quota of consecutive autopsy samples for each hospital within the State.

In the limited number of States where there were no hospitals with residencies in pathology, the representative hospitals were selected by the respective State departments of health, the State's quota being determined by the proportion of the 1963 deaths which had occurred in the State. These States were Alaska, Idaho, Montana, Nevada, North Dakota, and Wyoming.

All contacts with hospitals to seek their participation were made through the respective State or city department of health. Alternate hospitals were provided when the selected hospitals were unable to participate or when the predominance of embalmed cadavers in a selected hospital precluded its participation.

Collection and Examination of Samples

The cooperating pathologists were requested to provide a 50–100 gm. portion of diaphragm whenever possible, but smaller samples were occasionally submitted. Diaphragms from embalmed cadavers were excluded from the study because embalming hinders examination of the sample when the method of artificial digestion is used. The diaphragm samples were placed in coded plastic bags, which contained boric acid powder to deter spoilage, and sent directly to the Veterinary Medical Research Institute (VMRI) of Iowa State University for examination.

A questionnaire for each sample requested the following information about the deceased if it was readily available: hospital case number, age, sex, race, national extraction, religion, residence, major occupation, economic status, whether the patient was hospitalized, whether the patient had a chronic heart or neurological condition, and the cause of death.

Two basic methods of examination of the samples—with a trichinoscope and by the artificial digestion-Baermann technique—were used in this study. Both were similar to those used in the earlier NIH study. In the trichinoscopic or direct microscopic examination, a 1 gm. portion of the diaphragm was cut with scissors into pieces, which were then compressed between two heavy glass plates and examined with a trichinoscope at 50× magnification.

The artificial digestion-Baermann procedure used was a slightly modified version of the one described by Kerr and co-workers (24). In this version the washed and trimmed diaphragm sample is ground fine in a food chopper, weighed, and placed in a 3-liter beaker, to which approximately 2,700 ml. of a prewarmed solution of 0.5 percent pepsin and 0.7 percent hydrochloric acid are added. The beaker is placed in an incubator at 37° C., and the solution is constantly agitated for about 17½ hours.

The contents of the beaker are then allowed to settle for 1 hour, after which two-thirds of the supernatant fluid is siphoned off. The remaining fluid and sediment is poured through a 20-mesh screen fitted into the mouth of a 250 mm. Baermann funnel; the funnel is closed at the bottom with rubber tubing, which is clamped off. The beaker is next rinsed with water at incubator temperature, and this water is added to the funnel to cover the screen. After a 1-hour settling period, a 150 mm. funnel, similarly clamped off, is filled from the bottom of the large funnel. The large funnel is then refilled with warm water and its contents allowed to settle an hour. A second 150-mm. funnel is filled from the 250-mm. funnel. After an additional hour, a ruled Syracuse watch glass is filled from each 150 mm. funnel, and these sediments are examined under a dissecting microscope at 27× magnification. Examinations are continued until two dishes are obtained containing no larvae or cysts.

The primary difference in methodology between the artificial digestion-Baermann technique used in this study and that used in the earlier NIH study is the use of a 20-mesh Baermann screen instead of an 80-mesh screen. Gould (3) gave the average size of calcified cysts in man as 0.4 mm. in length and 0.25 mm. in diameter. Since a 20-mesh screen has sieve openings of 0.841 mm., as contrasted to only 0.177 for an 80-mesh screen, a 20-mesh screen allows passage of calcified cysts that have withstood digestion, while an 80-mesh screen does not.

Results

Prevalence of infection. Five thousand human diaphragm samples were examined between February 1, 1966, and May 20, 1968. The results of the examinations are shown in table 1. The samples were obtained from 130 hospitals in 37 States and the District of Columbia. Eighty-five of the 130 hospitals have completed their sample allotments. Results of the earlier National Institutes of Health study are included in the table for comparison. Only 210 (4.2 percent) of the 5,000 diaphragm samples examined were found to contain trichina larvae, cysts, or both.

Infections caused by trichinae have been detected from the District of Columbia and 33 of the 37 States in which sampling has been initi-

Table 1. Prevalence of *Trichinella spiralis* infections in the U.S. population, 1966-68 and 1936-41, by geographic area and State

Area and State	Veterinary Medical Research Institute study 1966-68					National Institutes of Health study 1936-41		
	Dia- phragm sample quota	Percent of examina- tions com- pleted	Samples exam- ined	Number posi- tive	Percent posi- tive	Samples exam- ined	Number posi- tive	Percent posi- tive
New England			531	28	5.3	286	50	17.5
Maine.....	75	35	26	2	7.7			
New Hampshire ¹	37	100	37	2	5.4	118	18	15.3
Vermont.....						10	4	40.0
Massachusetts ¹	309	97	301	15	5.0	130	21	16.2
Rhode Island.....						10	3	30.0
Connecticut ¹	170	98	167	9	5.4	18	4	22.2
Middle Atlantic			1,082	59	5.4	809	104	12.9
New York (upstate) ¹	517	93	482	22	4.6			
New York City.....	602	30	178	10	5.6	456	41	9.0
New Jersey ¹	284	100	284	22	7.7	45	9	20.0
Pennsylvania.....	626	22	138	5	3.6	308	54	17.5
East North Central			1,202	45	3.7	355	63	17.7
Ohio.....	457	43	198	5	2.5	87	16	18.4
Indiana.....	322	14	45	1	2.2	52	13	25.0
Illinois ¹	581	92	533	22	4.1	117	19	16.2
Michigan.....	429	63	270	10	3.7	77	10	13.0
Wisconsin.....	210	74	156	7	4.5	22	5	22.7
West North Central			334	12	3.6	198	35	17.7
Minnesota.....	151	83	126	3	2.4	50	9	18.0
Iowa.....	71	82	58	2	3.4	37	6	16.2
Missouri.....	194	67	129	6	4.7	60	11	18.3
North Dakota.....								
South Dakota.....						1	1	100.0
Nebraska.....						39	7	18.0
Kansas.....	150	14	21	1	4.8	11	1	9.1
South Atlantic			957	28	2.9	3,028	493	16.3
Delaware ¹	23	100	23	1	4.4	1	0	0
Maryland ¹	185	100	184	4	2.2	387	86	22.2
District of Columbia.....	62	86	53	2	3.8	2,525	394	15.6
Virginia ¹	88	100	88	2	2.4	33	5	15.2
West Virginia.....	72	13	9	1	11.1	1	0	0
North Carolina.....						18	3	16.6
South Carolina.....	82	21	17	1	5.9	15	1	6.7
Georgia.....	305	66	200	7	3.5	33	2	6.1
Florida.....	528	73	383	10	2.6	15	2	13.3

ated. For the 14 States in which sampling has ended, the prevalence rates in human beings were as follows:

State	Percent of prevalence
Oregon.....	8.3
New Jersey.....	7.7
Kentucky.....	5.9
Connecticut.....	5.4
New Hampshire.....	5.4
Massachusetts.....	5.0
Delaware.....	4.4
Illinois.....	4.1
Idaho.....	3.1
Virginia.....	2.4
New Mexico.....	2.4
Maryland.....	2.2
Louisiana.....	0
Alaska.....	0

Incomplete results for the other States limit the conclusions that can be drawn. However, a reduction in prevalence rates of 50 percent or more from the rates that were obtained in the earlier NIH study is evident for nearly all States in both the completed and incompleting groups.

A comparison of the results obtained in our study with those in the earlier NIH study indicates a marked decline in the prevalence of trichiniasis in all nine geographic regions of the United States. The Pacific area, with diaphragm samples primarily from Oregon and Washington, currently has the high prevalence rate. The rates for the Middle Atlantic and New England areas are also somewhat higher than

Table 1. Prevalence of *Trichinella spiralis* infections in U.S. population, 1966-68 and 1936-41, by geographic area and State—Continued

Area and State	Veterinary Medical Research Institute study 1966-68			National Institutes of Health study 1936-41				
	Diaphragm sample quota	Percent of examina- tions com- pleted	Samples exam- ined	Number posi- tive	Percent posi- tive	Samples exam- ined	Number posi- tive	Percent posi- tive
East South Central			449	17	3.8	85	15	17.6
Kentucky ¹	241	98	237	14	5.9			
Tennessee.....	191	13	24	0	0	41	8	19.5
Alabama.....	230	82	188	3	1.6	34	6	17.6
Mississippi.....						10	1	10.0
West South Central			110	2	1.8	110	20	18.2
Arkansas.....						2	0	0
Louisiana ¹	74	100	74	0	0			
Oklahoma.....	114	32	36	2	5.6	87	17	19.6
Texas.....						21	3	14.3
Mountain			210	7	3.3	80	8	10.0
Montana.....	36	17	6	0	0			
Idaho ¹	32	100	32	1	3.1			
Wyoming.....						2	0	0
Colorado.....	107	55	59	3	5.1	30	3	10.0
New Mexico ¹	42	100	42	1	2.4	1	0	0
Arizona.....	69	45	31	1	3.2	43	3	7.0
Utah.....	54	74	40	1	2.5			
Nevada.....						4	2	50.0
Pacific			125	12	9.6	362	67	18.5
Washington.....	174	34	59	7	11.9	200	40	20.0
Oregon ¹	60	100	60	5	8.3	33	4	12.1
California.....						129	23	17.8
Alaska ¹	6	100	6	0	0			
Hawaii.....								
United States			5,000	210	4.2	5,313	855	16.1

¹ Sampling has been terminated.

² In the NIH study, New York State and New York

City were treated as a unit.

(-----)—No samples obtained.

the current national rate. The lowest regional prevalence rate, 1.8 percent, has been obtained from the West South Central Region. More complete sampling in all areas may change some of these comparisons.

Efficacy of methods of detection. The samples with trichina larvae, cysts, or both, detected in these studies were classified as containing living larvae, dead larvae, or mixed (table 2). Only dead larvae were recovered from 183 (87.1 percent) of the 210 positive samples. Calcification was observed in all but six of the 183 positive samples in this group. The various stages observed included polar calcification, bipolar calcification, and complete or nearly complete calcification of the cyst. Occasionally only the trichina larvae showed calcification. Most larvae, observed in calcified cysts showed some degree of disintegration or calcification. Complete or partially resorbed cysts devoid of larvae

were occasionally detected. From six of the infected diaphragms, only dead larvae (that is, dead but noncalcified specimens) were obtained by the method of artificial digestion. Twenty-two (10.5 percent) of the infected diaphragms contained only living trichina larvae, and five (2.4 percent) contained a mixture of living and dead larvae. In only one diaphragm sample, was an apparently living trichina observed in a calcified cyst.

The method of artificial digestion was the most efficient of the two techniques used to examine the diaphragm samples. In 40 percent of the positive samples, the infections were detected only by digestion, while in about 20 percent they were detected only by the trichinoscopic method. In about 40 percent of the positive samples, the infection was detectable by both methods. The method of digestion was clearly more effective for detection of living

larvae and was also better for the detection of dead larvae, including calcified cysts; the success of the method with calcified cysts was due primarily to the use of a 20-mesh screen. Use of a larger diaphragm sample than the standard 1 gm. portion would undoubtedly have increased the number of infections detected by trichinoscope, but many of these infections would have been found anyway by use of the larger mesh screen in the artificial digestion method.

Intensity of infections. Of the 210 positive samples, 80 (38.1 percent) contained less than one larva or cyst per gram (table 3). This category represents all but four of the 84 infections detected by the artificial digestion method only. One hundred ten of the positive samples contained 1-10 larvae per gram. Only four of the positive samples contained more than 50 larvae or cysts per gram. All four showed varying degrees of calcification. Most of the positive samples with live larvae had less than one trichina per gram; calcification predominated in the samples representing the heavier infections.

Epidemiologic considerations. The completed questionnaires which accompanied each diaphragm sample contained valuable epidemiologic information. This preliminary report deals primarily with the relationship of age to prevalence; other information will be analyzed in detail when the study is completed.

Table 4 shows the prevalence rates by age obtained in this study and in the earlier National Institutes of Health study. In our study, only 13 infections were detected in the age group 44 years and under. Eight of these 13 were in persons in the 35-44 year age range; the other five occurred in persons 16, 19, 21, 21, and 31

years old. The infection rate for the group 44 years old and under was 1.6 percent, markedly below the 12.6 percent for the same age group in the earlier NIH study.

The overall prevalence for the age group 45 and over was 4.7 percent. The earlier NIH study showed a prevalence of 18.3 percent for this age group. The prevalence rate for trichiniasis tends to increase with age, as would be expected because of the increased probability of a person's having consumed infectious trichinae as the years pass. Changes in the prevalence of the disease in swine have also influenced the human age-prevalence relationships.

Although not included with the listing of samples examined, 53 diaphragms from children under 1 year of age and two from stillborn infants have been examined thus far in the study. All were negative for *T. spiralis*.

Partial evaluation of the relationship of trichiniasis to nationality indicates that persons of German, Italian, and Polish extraction—who have an affinity for uncooked pork products—are more frequently infected than those of other nationalities.

Discussion

The prevalence of 4.2 percent for trichiniasis obtained from the 5,000 human diaphragms examined to date in our study, when compared with the 16.1 percent prevalence obtained in similar studies three decades ago, indicates a notable reduction of the disease in the human population of the United States. The results of other recent studies in various areas of the United States, along with the reduction in reported clinical cases, corroborate this assumption.

Table 2. Condition of the trichinae and efficacy of methods of detection

Condition of trichinae	Positive samples		Digestion only		Trichinoscope only		Both methods	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Live.....	22	10.5	18	81.8	4	22.4	4	18.2
Dead.....	183	87.1	65	35.6	41	22.4	77	42.0
Mixed.....	5	2.4	1	20.0	4	80.0	4	80.0
Total.....	210	100.0	84	40.0	41	19.5	85	40.5

Table 3. Intensity of infection

Larvae per gram	Positive samples		Number of samples with larvae—		
	Number	Percent of total	Live	Dead	Mixed
Less than 1	80	38.1	15	64	1
1-10	110	52.4	7	100	3
11-50	16	7.6	-----	15	1
51-100	2	.95	-----	2	-----
101-500	2	.95	-----	2	-----
Total	210	100.0	22	183	5

Table 4. Prevalence by age for *Trichinella spiralis* in 1966-68 Veterinary Medical Research Institute study and in 1936-41 National Institutes of Health study

Age group (years)	VMRI study 1966-68			Percent of samples positive in NIH study 1936-41
	Number examined	Number positive	Percent positive	
1-4	38	-----	-----	1.2
5-14	94	-----	-----	9.4
15-24	165	4	2.4	8.8
25-34	176	1	.6	11.3
35-44	338	8	2.1	14.9
45-54	694	19	2.7	18.1
55-64	1,083	46	4.2	18.0
65-74	1,159	52	4.5	19.1
75-84	778	53	6.8	17.5
85 and over	209	15	7.2	
Unknown	266	12	4.5	9.5
Total	5,000	210	4.2	16.1
44 and under	811	13	1.6	12.6
45 and over	4,189	197	4.7	18.3

This reduction becomes even more noteworthy when the condition of the trichinae, the relationship of age to prevalence, and the intensity of infection are considered. Only 27 (12.9 percent) of the 210 positive samples in our study contained living trichinae. Living trichinae can generally be considered indicative of relatively recent infections. Calcification of cysts, which is generally accompanied by death of the larvae, usually begins 6 to 18 months after infection (3). Occasionally, however, calcification may be delayed or the trichinae may live in calcified cysts for extended periods (25). The NIH study also indicated this rapid calcification, since three of the four positive cases in the age

group 5 to 9 years were represented by dead larvae (1). Therefore, one could theorize that only 27 (0.54 percent) of the 5,000 diaphragms examined came from persons who had been infected in the 6-18 months preceding our study; some of these infections may have occurred even 20 to 30 years ago. In contrast to the present results, 45 percent of the positive samples in the earlier NIH study contained living larvae. Therefore, more than 7 percent of the persons whose cadavers were examined three decades ago may have had relatively recent infections.

The observed relationship of age to prevalence further substantiates the assumption that trichiniasis is rapidly becoming less prevalent in the United States. Among persons 44 years and under at death, positive results were obtained from only 13 (1.6 percent) of 811 diaphragm samples. In contrast, the prevalence rate was 4.6 percent for persons 45 years and over. The earlier NIH study showed much less contrast between age groups; the prevalence for the group 1-44 years was 12.6 percent and for the group 45 years and older, 18.3 percent. The relatively low prevalence rates obtained for the younger age groups in our study, along with the predominance of calcified cysts in the positive samples, indicates that relatively few infections of recent origin have been detected. Many of the infections detected may have been acquired during, or even before, the decade 1930-40, a period when trichiniasis was prominent in all age groups in the United States.

A prevalence of 12.6 percent was obtained for the age groups 44 years and under in the earlier NIH study. The persons who were in this age classification at that time would be in the 45-74 year age groups now—age groups in which we have obtained a prevalence of trichiniasis of 4.0 percent among the 2,936 persons examined. Thus, a reduction in prevalence of 8.6 percent in the age groups now 45-74 years has taken place, even though these persons had probably incurred additional infections in the 30 years since the NIH study. In the trichinoscopic examinations in the current study, it has not been unusual to observe partially resorbed cysts which are devoid of trichinae. There is usually little or no evidence of calcification in these cysts. This clearing effect may at least partially explain the difference in results

in the two studies for the age groups 44 years and under and 45 years and older at death.

It is somewhat more difficult to appraise possible changes in the level of intensity of infections. Hall and Collins (26), early in the NIH study, defined an infection with 100 larvae or more per gram of diaphragm as one capable of causing clinical trichiniasis in man. After completion of the NIH study, Wright and co-workers (1) revised these arbitrary standards to indicate that 51–100 larvae per gram could result in severe illness with pronounced symptoms, while 11–50 larvae per gram might induce pronounced symptoms. They stressed that these numerical groups were selected only for comparison and that the degree of illness and the symptoms would vary with each infected person. Using these guides, we found that four (1.9 percent) of the 210 infections detected in our study may have produced clinical illness, while 16 (7.6 percent) may have induced pronounced symptoms. In the earlier NIH study, 4.5 percent of the positive samples were in the category of more than 50 trichinae per gram, while 9.8 percent contained 11–50 trichinae per gram. This result tends to indicate that the infections detected in the current study were somewhat less intense than those detected in the NIH study. Since, however, all the positive samples in these categories contained dead larvae, the apparent clearing effect previously discussed may be a factor in this apparent difference.

The role of superimposed infections also influences the interpretation of heavy infections. Wright and co-workers (1) advance the following hypotheses to explain the predominance of heavy infections in older persons: (a) exposure to heavier infective doses in previous years, (b) surviving infectious levels that were fatal to others, and (c) superimposed infections. These workers stated that superimposed infections had more basis than the other two hypotheses and cited numerous examples of such infections. The mixed infections in our study were possibly superimposed. The varying degrees of calcification exhibited in samples representing heavy infections may also indicate multiple infections, but this relationship is difficult to determine. Possible decreases in exposure levels with the passage of time could also be a factor in our

results since there are indications that the overall intensity of infections in swine has decreased in the past three decades (19, 22).

A better indication of the current tendency of infections to be light can be obtained by studying the 27 samples in the current study containing living trichinae. Sixteen of them yielded fewer than one trichina per gram; 13 of these 16 yielded less than 0.1 larva per gram. Ten yielded 1–10 larvae per gram. Only one of the samples which contained living larvae yielded more than 10 trichinae per gram; that sample represented a mixed, and possibly superimposed, infection. These results may indicate that nearly all *Trichinella spiralis* infections which are recent, that is, those characterized by living trichinae, have been relatively light in intensity. This conclusion is supported by the sharp decrease in reported clinical cases during 1966 and 1967.

Trichiniasis is not peculiar to any State or region of the United States. The relatively even distribution found thus far in this study, indicates that the disease is national in character. A much wider range of prevalence rates, however, has been obtained within certain States. The areas of high endemicity generally have high densities of persons of Italian, German, or Polish extraction.

The decrease in human trichiniasis indicated in this and other studies was found to correlate closely with the decrease of the disease in swine during the past three decades. The incidence in garbage-fed pigs decreased from 11 to 0.5 percent in this period, whereas that for farm-raised swine which constitute 98.5 percent of the U.S. pork supply, decreased from nearly 1 percent to 0.1 or less. The relationship would be expected since infected pork is the source of nearly all cases of trichiniasis in human beings in the United States.

Even with the marked reduction of trichiniasis in man and swine, this study indicates that the disease still persists in the United States at a higher than desirable rate. The reductions that are now evident have come without any specific trichina control program. With the increased interest in the control of trichiniasis, perhaps a specific program will now be formulated to control and to eventually eradicate the disease in the United States.

Summary

To determine the prevalence of *Trichinella spiralis* infections in the U.S. population, a statistically designed study has been initiated at the Veterinary Medical Research Institute, Iowa State University of Science and Technology, Ames. The study has an approximate goal of examining 10,000 human diaphragms solicited from all 50 States and the District of Columbia.

Five thousand diaphragm samples were examined during the period from February 1, 1966, through May 20, 1968. The samples were obtained from 130 hospitals in 37 States and the District of Columbia. Trichina larvae or cysts were found in 210 (4.2 percent) of the diaphragms examined. The infected diaphragms came from 33 States and the District of Columbia. The 4.2 percent prevalence of trichiniasis that was observed represents a marked reduction from the prevalence found in a similar study by the National Institutes of Health, Public Health Service, conducted during the years 1936-41; 16.1 percent of the 5,313 diaphragms examined in that earlier study were found to contain trichinae.

Prevalences of 1.6 percent for persons 44 years and under and of 4.7 percent for persons 45 years and over have been obtained in the current study. Studies on the condition of the larvae have revealed a predominance of dead trichinae; only 12.9 percent of the positive samples yielded living trichinae. The infections have generally been light; 80 of the 210 positive diaphragm samples yielded less than one trichina per gram, and only two samples yielded more than 100 per gram.

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California Colleges and Hospitals To Design Instruction Systems for Training Medical and Dental Technicians

A group of southern California hospitals and colleges will conduct a research project aimed at developing effective 2-year training programs in community colleges to meet the pressing national need for medical and dental technicians.

Upon completion of the 4-year study, researchers plan to make available to community colleges complete instructional systems to train students for careers as physical therapist, occupational therapist, X-ray technician, prosthetist, practical nurse, dental assistant, dental laboratory technician, nuclear medical technician, or medical records technician.

The curriculums will enable students who wish to go on to higher academic degrees to apply their 2-year programs for maximum credit. The project also is designed to provide continuing education for technicians already on the job.

The Bureau of Research, U.S. Office of Education, will provide \$1.6 million for support of the project under the Vocational Education Act of 1963, which requires that up to 10 percent of funds spent under the act must be for training and for research and development.

Instructional materials produced through the project will be tested at the participating community colleges as they are developed. When fully developed, the instructional systems will use the most recent educational knowledge and technology, including self-instruction techniques and new educational media.

The first phase in the project will be a nationwide survey of subprofessional jobs currently available in the health disciplines and the level of skills these jobs demand. A curriculum will then be designed for teaching each occupation. Most programs will include on-the-job training in clinics and hospitals. Prospective health workers will be taught skills basic to several related occupations in order to improve their job mobility.

Health and education officials have forecast the need for an increase of about 1 million allied health profession workers by 1975, with a need to prepare an additional 100,000 workers each year.

Director of the project is Dr. Melvin L. Barlow, director of the division of vocational education at the University of California, Los Angeles. Twenty-one community colleges and eight hospitals will participate. These institutions include the University of California and the seven colleges of City Junior College District, Los Angeles; the State and city colleges at Long Beach; Mt. San Jacinto Junior College, Gilman Hot Springs; and the 10 schools comprising San Diego City College. Participating hospitals are the University of California Medical Center and Cedars-Sinai Medical Center, Los Angeles; Los Angeles and San Fernando Veterans' Administration Hospitals and Los Angeles County General, Rancho Los Amigos, and Harbor General, Los Angeles County; and Veterans' Administration Hospital, Long Beach.