What is the influence of vaccination upon the epidemiology of poliomyelitis? Knowledge to answer this question is still inadequate, and the following paper summarizes a series of studies undertaken to remedy this situation. The results seem to indicate that immunization with killed polio vaccines will protect only those inoculated.

INFLUENCE OF VACCINATION WITH FORMALIN INACTIVATED VACCINE UPON GASTRO-INTESTINAL INFECTION WITH POLIOVIRUSES

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THIS STUDY was carried out in order to determine what effect vaccination with formalin inactivated poliomyelitis vaccine might have upon the susceptibility of the gastrointestinal tract to poliovirus infection subsequent to natural exposure. Our interest in this matter concerns the possible influence that widespread vaccination may have upon the epidemiology of poliomyelitis. If administration of vaccine were significantly to reduce susceptibility to infection, two results might be expected. First, along with the reduction in paralytic disease the total number of persons excreting virus would be decreased, thus limiting the opportunity for infection of those members of the community who were nonimmune. Second, the virus should eventually disappear from the population, which would mean that immunity could only be acquired from vaccination. On the other hand, if vaccination were not to influence susceptibility to infection, then natural immunization would continue at the same rate as it now does, thus reinforcing immunity artificially acquired. Under these conditions, the need for vaccination in adult life would probably be less.

A number of observations already suggest that vaccination does not significantly influence alimentary infection. Lipson, Robbins, and Woods,[1] Davis, et al.,[2] and Gelfand, Fox, and LeBlanc[3] have all reported that persons, who had received one or two doses of vaccine and were subsequently exposed to poliomyelitis in the family, developed gastrointestinal infection as readily as did nonvaccinated family members similarly exposed. Also, no effect of vaccination could be demonstrated upon the amount of virus in the feces or upon the duration of virus excretion. Few observations have been made in regard to the susceptibility of persons who have received three doses of vaccine properly spaced. However, the meager data available indicate no significant effect upon gastrointestinal infection.[4] Experiments in which subjects previously vaccinated

Table 1—Vaccination Status of Persons Studied

Poliovirus Infection in Family	Not Vaccinated		Vaccinated Children		
	Adults	Children	1 Dose	2 Doses	3 Doses
Yes (67 Families)	107	99	29	37	8
No (57 Families)	101	108	30	25	8

with Salk vaccine have been fed attenuated polioviruses have also indicated that susceptibility of the alimentary tract to infection had not been altered.[5-7]

In this report we summarize studies conducted in our laboratory since 1954. The family contacts of patients with clinical poliomyelitis were selected for investigation, since it could be expected that among them the incidence of infection should be high enough to permit statistical analysis. The excretion of poliovirus by vaccinated and nonvaccinated persons was compared. Determinations of poliomyelitis neutralizing antibody were made on the sera of all persons studied. The immunologic status of the vaccinated children could be contrasted with that of the unimmunized family members, thus providing some evidence concerning the potency of the vaccine.

Plan of Study

Description of the Population

From 1954 through 1957 the members of 124 families were studied. At least one person in each of 67 of these families had acute poliomyelitis. The other 57 families were admitted to the study because of a member in each who had symptoms compatible with clinical poliomyelitis. However, investigation in the laboratory showed that the infection was not due to poliovirus. In some instances the etiology of the case was found to be a Coxsackie or ECHO virus, but in the majority no etiologic agent was defined by the methods employed.

The serologic data from the latter group of families were included solely for the purpose of providing additional information concerning the effect of the vaccine. They are of particular value in this regard since the antibody determinations were not influenced by recent poliovirus infection.

The families were recruited from the vicinity of South Bend, Ind., in 1954, and from Cleveland and environs during the subsequent years. Those from Indiana, 25 in number, were all participants in the 1954 poliomyelitis vaccine field trials and a case of poliomyelitis occurred in each of them.

The socioeconomic status of the study families from the Cleveland area was relatively high. The majority was white and both urban and suburban dwellers were represented. The average family size was five persons with a range of from three to ten. The families in which poliovirus infection was not present included a few more urban dwellers and Negroes.

The number of vaccinated and unvaccinated children and their degree of immunization are presented in Table 1. None of the adults had been vaccinated. Most of the children had received their last dose of vaccine three or more months before they were studied, and in none was the interval less than one month. It is evident that only 16 children, who had received three doses of vaccine properly spaced

were available for study. There were eight additional children who had been given three injections at monthly intervals, according to the schedule employed during the vaccine field trials, but they were arbitrarily considered as having received the equivalent of two effective doses.

All vaccination histories were checked as carefully as possible with the school, health department, private physician, or other authoritative source. It was possible to verify the vaccination of 80 per cent of the children, including all those who had received three doses. In the remaining 20 per cent the statement of the parents had to be accepted.

Investigation of the Patient

A single fecal specimen was obtained for virus isolation within one week of admission to the hospital from each of 123 cases in 119 families. Multiple cases occurred in three families. No fecal specimen was obtained from the patient in five families.

One of the three types of poliovirus was isolated from the case in 58 families. To these 58 families, nine others were added, although no virus was isolated from the patient. In seven the case was characteristic of poliomyelitis and poliovirus was isolated from family contacts. In two others the patient was an adult with severe paralysis; no poliovirus was isolated from either patient or his contacts.

Forty-nine of the cases were paralytic and 18 nonparalytic. Forty-two infections were due to type 1, eight to type 2, and 15 to type 3 virus. The types of virus causing infection in the two previously mentioned cases are unknown.

Sixty-one cases of aseptic meningitis occurred in 57 additional families. Fecal specimens were obtained from 59 of these patients. Twenty of these yielded enteroviruses, none of which proved to be poliovirus. Paired serum specimens from 45 of these 61 cases were tested for poliomyelitis neutralizing antibody, and in no instance was a significant rise in titer demonstrated.

Investigation of Family Contacts

As soon as the index case was admitted to the hospital and the family selected for study, an attempt was made to obtain a fecal and a serum specimen from all household contacts. A stool specimen was secured from each of 281 family contacts of poliomyelitis patients in 67 families.

The specimen was obtained from the residents of the Cleveland area within less than one week of the time that the index case was recognized, except in one family where the interval was ten days. In Indiana, collection was less prompt. Fecal specimens were obtained from 97 persons in 25 families. Fifty-nine specimens were secured within two weeks after recognition of the index case and 38 between two and four weeks.

A serum specimen was drawn at approximately the same time as the fecal sample was obtained. Sera were secured from 163 of the 180 contacts under 16 years of age and from 104 of the 107 adults. No effort was made to acquire a second sample from these persons.

Those families in which the case was not poliomyelitis were all from the vicinity of Cleveland. A fecal specimen was obtained from 240 of 280 contacts and poliovirus was isolated from only one. This virus was type 2 and the donor was an adult who had had only casual contact with one of the cases. No other member of the family was found to be excreting this virus; nor did any of them show serologic evidence of type 2 poliovirus infection.

Paired sera from 66 per cent of the contacts within these families were tested for poliomyelitis neutralizing antibody. None showed a significant rise in titer, providing further evidence that no recent poliovirus infection had occurred.

Table 2—Presence of Poliomyelitis Virus in Feces of Family Contacts of Poliomyelitis Patients

Age	Not Vaccinated			1 Dose			2 Doses			3 Doses		
	Studied	Number Positive	Per cent	Studied	Number Positive	Per cent	Studied	Number Positive	Per cent	Studied	Number Positive	Per cent
0 to 4 years	44	36	82	4	2	–	8	6	–	3	2	–
5 to 9 years	32	21	65	19	11	58	25	15	60	2	1	–
10 to 16 years	23	6	26	5	3	–	5	0	0	3	0	0
	—	—	—	—	—	—	—	—	—	—	—	—
Total	99	63	64	28	16	57	38	21	55	8	3	–
16 years and over	105	11	10									

Materials and Methods

Virus Isolations

All virus isolations were performed in monolayer tissue cultures of trypsin dispersed monkey kidney cells according to the method of Youngner.[8]

Negative cultures were held for seven days. The tissue culture fluid was then harvested and passed to new cultures which again were observed for seven days. If they were still negative no further passages were attempted but the isolation was repeated with an inoculum of 1.0 ml.

Viruses isolated were identified by neutralization with standard hyperimmune poliomyelitis monkey sera. Sera supplied by Dr. Herbert Wenner as well as some produced in our own laboratory were used. Agents which were not neutralized by the individual antisera were then tested with a mixture of the three types. Agents not neutralized by the mixture were considered to be viruses other than poliomyelitis.

Serum Neutralization Tests

Neutralizing serum antibody was determined by the metabolic inhibition test of Salk, Youngner, and Ward.[9] Serial twofold dilutions of serum were made starting at 1:4 with one tube per dilution. Virus strains used were Mahoney (type 1), MEF (type 2), and Saukett (type 3). A calculated 100 ID50 was employed in each test, but the actual dose varied between 10 and 1,000 ID50. Results are expressed as the reciprocal of the initial serum dilution.

Results

Virus Excretion

Table 2 presents the results of virus isolations from fecal specimens of family contacts of poliomyelitis cases by age and vaccination status. Results from 1954 through 1957 have been totaled,

although the vaccine used may have differed in potency from year to year, and many different lots from the various manufacturers are represented.

The age groups are unequal in size and due to the method of vaccine distribution, particularly in 1955 and early in 1956, the majority of vaccinated children were in the five-to-nine-year-age group. Indeed, in 1955 and 1956, it was difficult to find children within that age group who had not received vaccine. Consequently, the unvaccinated children five to nine years in age were mainly from Indiana in 1954.

It is evident from examination of the columns entitled "not vaccinated" that the rate of virus isolation is very high (82 per cent) from children less than four years of age, and decreases as age increases. Sixty-five per cent of those five to nine years old, 26 per cent of those 10-16 years old, and 10 per cent of the adults were found to be excreting the type of poliovirus responsible for the family infection.

There are too few children less than four years of age who had received vaccine to permit comparison with the very large group who had not. However, within the age group five to nine, comparison is possible. Sixty-five per cent of the unvaccinated children, 58 per cent of those who had received one dose of vaccine, and 60 per cent of those who had received two doses of vaccine were found to be excreting virus. These differences are not significant when tested by the chi square method.

If the results on all children under 16 years of age are totaled, the groups are larger and percentages somewhat more valid. It will be seen that 64 per cent of the unvaccinated controls were excreting poliovirus, whereas 57 per cent and 55 per cent of those who had received one and two doses of vaccine, respectively, were positive.

Of the eight children tested who had received three doses of vaccine, three were excreting virus. It is worth noting that three of the five who were not infected were over ten years of age.

Antibody Data

The results of the determinations of neutralizing antibodies in the sera of the family contacts were analyzed from two points of view. First, did the vaccinated individuals differ immunologically from those not vaccinated, thus providing a criterion of the effectiveness of the immunization? Secondly, was there any evidence that circulating antibody did or did not influence susceptibility of the gastrointestinal tract to infection?

The results of tests for neutralizing antibodies in families not infected with poliovirus will be considered first (Figures 1, 2, and 3). The titer of antibody to each type of poliovirus is shown in a separate figure. All results included are those on the first serum secured from the individual, usually at the time that the fecal specimen was obtained. It will be recalled that these were all from Cleveland and vicinity and were studied in 1955 and 1956. The age distribution within the various categories is shown in Table 3. It is evident that the average age of the unvaccinated children is somewhat lower

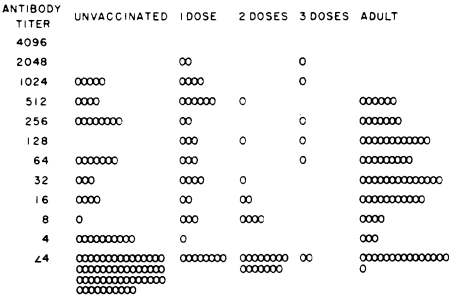

Figure 1—Poliomyelitis Antibodies in Individuals Without Recent Poliomyelitis Infection Type I

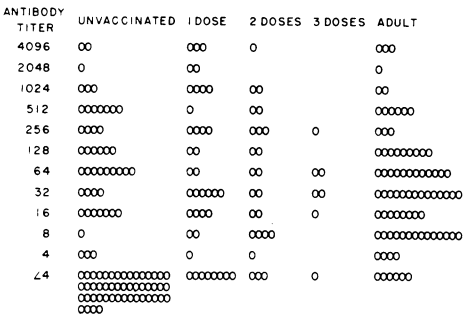

Figure 2—Poliomyelitis Antibodies in Individuals Without Recent Poliomyelitis Infection Type II

than that of the vaccinated ones and this must be taken into consideration in evaluating the results.

On inspection of the figures no striking difference between the unvaccinated and vaccinated children is apparent. Fifty per cent of the unvaccinated children had antibody titers of less than four to type 1 virus. Only eight, or 21 per cent, of the 38 children who had received a single dose of vaccine had no detectable antibody, but surprisingly 15 or 66 per cent of the 24 who had had two doses lacked antibody to type 1 virus. Only seven children were studied who had been given three injections and two of them had no antibody. Among the 82 adults, 16 or approximately 20 per cent had antibody titers of less than four.

When the antibody to type 2 virus is considered the results in the unvaccinated children and those vaccinated once are similar to those for type 1. However, only three of the children who had received two doses of vaccine and one of those with three doses lacked antibody to type 2. More of the adults were found to have type 2 antibody than type 1. The pattern of type 3 antibodies does not differ to any great degree from that observed for type 1.

Thus, from these data it is difficult to demonstrate that vaccination as performed in 1955 and 1956 had any significant effect in increasing the numbers of persons possessing antibodies to types 1 and 3 polioviruses, or upon the levels of antibody in their sera. Some effect in regard to type 2 antibody is evident, but it is not striking.

Contacts of poliomyelitis patients were studied in the same manner. The evaluation of these results was complicated by the presence of infection with one of the three types of polioviruses at the time that the sera were obtained. Thus, few observations were available concerning the possible effect of vaccination upon type 1 antibody, since most of the infections were due to this type of virus. Although a few individuals did not exhibit homotypic antibody, even though vaccinated, the majority possessed significant levels which could have been the result of the present exposure and could not be ascribed to vaccine. The levels of heterotypic antibody were not different to a noticeable degree from those observed in the families in whom recent poliomyelitis exposure was not a factor.

Figure 4 presents an analysis of heterotypic antibody status of all family contacts of poliomyelitis cases by age and vaccination status. The columns indicate the per cent in each age group with a level of 1:4 or greater of neutralizing antibody to each type of virus.

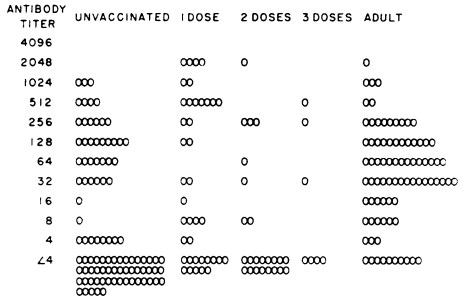

Figure 3—Poliomyelitis Antibodies in Individuals Without Recent Poliomyelitis Infection Type III

Only results on vaccinated children in the five to nine-year-age group are presented, since the number of vaccinated children in the other age groups was too small to allow for adequate comparison. Also, no breakdown was made according to the number of doses of vaccine the children had received, again because of the small size of the groups. The children, five to nine years of age, were more likely to possess antibody to each of the types of poliovirus than were persons within any of the other age groups. Some benefit of vaccination is evident within the specific age group. However, the difference is not great, particularly in regard to type 1 antibody.

Obviously, the data presented in this report do not lend themselves to any analysis of the influence of homotypic antibody present prior to exposure since infection was established within the family before sera were obtained. In contrast to homotypic antibody, it is probably reasonable to assume that heterotypic antibodies were present before the individual was exposed to the virus currently causing infection in the family. An analysis was made of the possible effect of heterotypic type 2 antibody upon susceptibility of the alimentary tract to infection with polioviruses types 1 and 3. Salk[10] and Hammon, et al.,[11] have presented evidence indicating that in human beings presence of type 2 antibody confers some degree of protection against paralysis upon infection with type 1 virus. Bodian has reported similar observations in monkeys.[12] The data of Brown and Ainslie[13] suggest that the presence of type 2 antibody may alter gastrointestinal infection with type 1 virus. Indeed, Salk has proposed that there is some antigenic relationship between type 2 virus and types 1 and 3.

As can readily be seen on inspection of Table 4, children possessing type 2 antibody in their sera had the same rate of infection with types 1 and 3 viruses as did those with no antibody to this type. Conversely, among those found to be excreting type 1 or 3 virus the same proportions were found to have type 2 antibody as among those with no virus in their feces. Although not presented in the table, there was no difference between the results in the vaccinated and unvaccinated children; nor did the titer of antibody appear to influence the findings. These data do not support the hypothesis that the prior existence of type 2 antibody reduces the susceptibility of the gastrointestinal tract to infection with heterotypic polioviruses.

Additional evidence indicating that heterotypic antibody has little influence upon gastrointestinal infection is provided by comparing the data in Figure

Table 3—Age Distribution of Vaccinated and Unvaccinated Members of 57 Families Without Recent Poliomyelitis Infection

Age	Not Vaccinated	Vaccination Status		
		1 Dose	2 Doses	3 Doses
0 to 4 years	55	4	8	2
5 to 9 years	27	23	13	5
10 to 16 years	26	3	4	1
Total	108	30	25	8
16 years and over	101	0	0	0

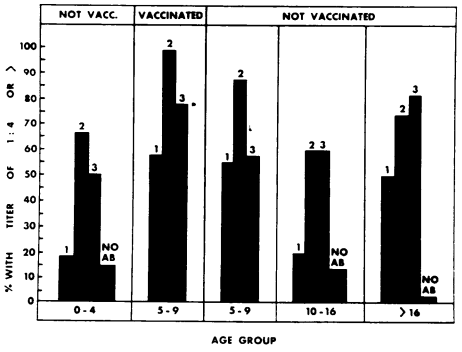

Figure 4—Family Contacts of Poliomyelitis Cases Heterotypic Neutralizing Antibody by Age Group and Vaccination Status

4 on the presence of antibody in various age groups with the results of virus isolation in these same persons (Table 2). It is immediately apparent that there is no correlation between the incidence of demonstrable heterotypic neutralizing antibodies and the numbers of persons from whom virus was isolated. For example, a greater proportion of children in the five-to-nine-age group was found to possess poliomyelitis antibodies than did those in the 10-to-16-year-age group. However, 65 per cent of the former were found to be infected as compared to 26 per cent of the latter. On the other hand, there was good correlation with age of the individual: the older the person, the less likely was he to be excreting virus. If one assumes that the data in Figure 4 concerning heterotypic antibody roughly indicate the incidence of antibody in the study population to the three types of poliovirus prior to exposure to infection. it would seem that there is also a lack of correlation between the presence of homotypic antibody and susceptibility to infection.

The marked effect of age upon the incidence of gastrointestinal infection. apparently independent of the presence of circulating antibody. has been of considerable interest to us. Further evidence concerning this is furnished by the following observation. Among the total group of children exposed to poliovirus in the home, there were 19 who were found to have homotypic antibody titers of less than four. Fecal specimens were available from 15 of these and poliovirus was isolated from ten. It is perhaps worth mentioning that four of the five children who did not have virus in their stools were siblings exposed to a case due to type 3 virus and their exposure to the patient, whose disease followed tonsillectomy, was minimal as compared to the situation in other families. In contrast to the children, 13 adults who also possessed no homotypic antibody in their sera were examined and only two were found to be excreting poliovirus. This discrepancy might be explained in several ways. The adult may have less opportunity of becoming infected than the child. Even though infection occurs, it might be more difficult to demonstrate virus in the fecal specimen of the adult than in that of the child. Finally, it is possible that the cells of the adult intestine develop a resistance to poliovirus infection that is not related to serum antibody.

It was observed that only three of the 11 parents from whom virus was isolated were fathers. This suggests that differences in exposure do exist within the family group and may, in part, explain the lower rate of virus isolation from adults. There is also evidence to indicate that virus is less often isolated from the adult than from the child. even though infection is known to have occurred. Sabin and Ward,[14] in 1941 and, more recently, Svedmyr[15] noted that poliovirus was isolated more frequently from children with paralytic poliomyelitis than from adults. The results in our own laboratory are entirely comparable with those of the other investigators mentioned. Virus was

isolated from the feces of 89 per cent of 159 children 16 years of age or younger with paralytic poliomyelitis, whereas only 72 per cent of 69 adults with paralytic disease were demonstrated to have virus in their gastrointestinal tracts. The reason why it is more difficult to demonstrate virus in the alimentary tract of the infected adult is not known. Regardless of the reason, it would seem that the frequency with which family contacts can be demonstrated by stool isolation procedures to be infected with poliovirus is to a considerable extent dependent upon the age of the subjects and, to some degree, independent of the presence or absence of neutralizing serum antibody. Thus, in attempting to compare two groups of persons in regard to virus excretion it is important to consider the age distribution within the groups.

Discussion

The results of this study would indicate that the prior administration of one or two doses of inactivated poliomyelitis vaccine does not reduce the susceptibility of the lower gastrointestinal tract of man to poliovirus infection. These results are in accord with those of Fox,[4] Davis,[2] Koprowski,[16] and Sabin.[5]

The epidemiologic implications of these findings have already been suggested in the introductory paragraphs. Vaccination cannot be expected to decrease significantly the number of persons in the community suffering from inapparent poliovirus infections. Therefore, the opportunities of becoming infected will be the same as before vaccine was used, although paralytic disease can be expected to be less frequent. Thus, in order to achieve the maximum degree of protection from paralytic poliomyelitis with the present killed vaccine, vaccination should be as universal as possible throughout childhood and early adult life.

Two major deficiencies in our investigation warrant comment.

First, we have no data concerning the effect of vaccination upon virus in the pharynx. Wehrle[17] has presented evidence suggesting that poliovirus is less frequently demonstrated in the throats of vaccinated persons exposed to poliovirus in the home than in the throats of those not vaccinated. The epidemiologic significance of this observation is difficult to assess since the importance of pharyngeal virus in the transmission of poliomyelitis is not known (Sabin[18]). More data in this regard would be highly desirable.

Second, few observations have been made upon children who were properly

Table 4—The Influence of Type 2 Antibody upon the Susceptibility to Gastrointestinal Infection with Types 1 and 3 Polioviruses*

	Type 2 Antibody Present	Type 2 Antibody Absent	Total	Per cent with Type 2 Antibody
Feces + for virus	64	16	80	80
No virus in feces	43	11	54	80
Total	107	27	134	
Per cent Positive	60	60	60	

* Data limited to children under 16 years of age.

immunized with three or more injections of vaccine. The few data we have presented, as well as those of Fox,[4] indicate that such children are not entirely resistant to infection and probably do not differ from those less well immunized. If circulating antibody does not influence susceptibility of the bowel to infection, one would not anticipate that additional injections of vaccine would alter the results.

This raises the question of whether or not antibody per se does influence the susceptibility of the bowel to infection. We are fully aware that the evidence we have presented in regard to the influence of homotypic antibody is indirect and, to some extent, suspect. However, it does suggest that infection of the lower gastrointestinal tract of man has little relationship to the presence or absence of neutralizing serum antibody. The observations of Koprowski[19] and Sabin[5] with avirulent viruses, and Fox[4] with natural infection provide more direct evidence concerning this question. They indicate that antibody, either acquired passively from the mother or resulting from vaccination with killed vaccine, has no effect upon the susceptibility of the bowel.

Data that would appear to contradict those presented above have been recorded by Howe[20,21] from experiments in chimpanzees. He found that vaccinated chimpanzees were less easily infected than unvaccinated controls and, if infected, they excreted less virus for a shorter period of time. Also, he did find a correlation between the level of antibody in the serum of the animal and the ease with which gastrointestinal infections could be established. The different results in man and the chimpanzee may be explained by the fact that according to Sabin,[18] the cells of the lower bowel of the chimpanzee do not support the multiplication of poliovirus as readily as do those of man. Thus, most of the virus detected in the feces of the chimpanzee is the result of multiplication in the pharynx whereas in man viral growth is greater in the lower bowel. The different findings in man and the chimpanzee would be compatible with the hypothesis that multiplication of virus in the pharynx is inhibited by antibody present in the blood, but multiplication in the lower bowel is not.

Some comment should be made concerning the antibody levels observed in the sera of vaccinated children. It will be recalled that the sera for antibody determination were obtained in the late summer and, in most instances, the vaccine had been administered the preceding spring. Our failure to find any clear-cut differences between the vaccinated and unvaccinated children either in regard to the presence of antibody or levels of antibody is somewhat disturbing. Some doubt might be raised concerning the potency of the vaccines used in the population studied. One might also regard these data as emphasizing the importance of giving more than two doses of vaccine.

If the findings of our study indicate the true situation, it might well be asked why the incidence of poliomyelitis in the United States has fallen so dramatically within the past two years, coincident with the introduction of vaccination. Among the significant number of persons not yet immunized cases should occur if vaccination has not reduced the opportunity for exposure. Obviously, no definitive answer is possible, particularly in view of our poor state of knowledge concerning the method of spread of the poliovirus. However, several possibilities come to mind:

1. It may be that by the methods we have employed it is not possible to detect relatively small differences in the viral excretion by vaccinated and unvaccinated persons. Also, little information is available concerning the effect of three or more doses of vaccine. As pointed out by Bodian,[22] in those parts of the world

with good sanitation, such as the United States, the polioviruses seem to spread throughout the community with some difficulty. This balance may be so delicate that a relatively minor change in conditions could have a marked effect upon the ecology of the virus in nature.

2. As indicated earlier, few data are available concerning the influence of vaccination upon pharyngeal virus. However, the data of Wehrle[17] do suggest that vaccination reduces the susceptibility of the pharynx to poliovirus infection and this may prove to be of epidemiologic significance.

3. The decreased incidence of poliomyelitis may be unrelated to vaccination, but due solely to the unexplained natural fluctuations of the disease.

All three possibilities are suggested on speculative grounds and are not susceptible of proof in the present state of our knowledge. However, it would seem wise at this time to assume that vaccination with killed virus will not limit to a significant degree spread of the poliovirus.

Summary

The influence of vaccination with killed poliomyelitis vaccine upon the susceptibility of the gastrointestinal tract to polioviruses was investigated. Family contacts of known cases of poliomyelitis were studied. Children vaccinated with one or two doses were found to be excreting virus as frequently in their feces as were their unvaccinated peers. Only eight children who had received three properly spaced injections of vaccine were available for study and poliovirus was isolated from three.

In order to determine whether or not vaccination had been effective in evoking neutralizing antibody, tests were run on the sera of many of the family contacts of poliomyelitis patients. Additional data of the same type were accumulated from persons in families in which there was no poliovirus infection. Comparisons in regard to the presence or absence of antibody and the titer of antibody revealed little differences between the vaccinated and unvaccinated children. What differences were observed indicated that the type 2 component of the vaccine was a better antigen than types 1 and 3.

Data are presented which suggest that neutralizing antibody in the blood has little influence upon the susceptibility of the lower intestinal tract of man to poliovirus infection. However, the age of the individual, unrelated to the presence of antibody, correlates well with the presence of virus in the feces. The younger the person, the more likely is he to be infected. Evidence is also presented, in confirmation of that of others, indicating that even in persons known to be infected with poliovirus, the virus is more frequently isolated from children than from adults.

It is concluded that immunization with killed poliomyelitis vaccines cannot be expected to decrease the numbers of persons in the community with alimentary poliovirus infection. Thus, vaccination, while of value to the persons immunized, is unlikely to provide protection to those not vaccinated.

ACKNOWLEDGMENT—The authors wish to express their appreciation to Pauline M. Staples for her technical assistance.

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This study was aided by a grant from the National Foundation and, in part, by the U. S. Public Health Service Contract No. 68294.

Portions of this study were presented at the 48th Annual Meeting of the American Society for Clinical Investigation held in Atlantic City, N. J., April 30, 1956, and at the 85th Annual Meeting of the American Public Health Association in Cleveland, Ohio, November 11-15, 1957.

Spring Activity: Affiliated Societies and Regional Branches

Those interested in attending meetings of our affiliates may note the fact that during April and May, 25 of the affiliates and branches of the APHA will be conducting their annual meetings, as shown on the calendar of events on page 616 in this issue. For complete listings of Affiliated Societies and Regional Branches and the names and addresses of their secretaries, readers are referred to page 582.