

remember that 1911 was a year of unusually great exposure, due to an extraordinary amount of field service.

DECREASE IN TYPHOID FOLLOWING ANTITYPHOID VACCINATION

Year.	Cases		Deaths		Vaccinated Persons	
	No.	Ratio per 1,000 Mean Strength.	No.	Ratio per 1,000 Mean Strength.	Cases.	Deaths.
1901	552	6.74	72	.88	..	..
1902	565	6.90	69	.85	..	..
1903	348	5.14	30	.44	..	..
1904	280	4.77	20	.33	..	..
1905	193	3.39	17	.29	..	..
1906	347	6.15	15	.26	..	..
1907	208	3.87	16	.29	..	..
1908	239	3.20	24	.31	0	..
1909	282	3.35	22	.26	0	..
1910	198	2.43	14	.17	0	..
1911	68	0.82	8	.097	12	1
1912*	7	0.20	1	.003	3	0

* Ratio for 1912 based on experiments for first half year.

For the present year, 1912, there have been reported during the first six months, seven cases, only three of which were in immunized persons; two of the remaining four developed in recruits within two weeks of the date of their entry into the service; should this rate continue we should not expect more than fifteen or twenty cases during the entire year.

The statement of these three results: those obtained in the Southern Maneuver Division, in the whole army in 1911, and in the first four months of 1912, should convince any one of the high protective value of this form of prophylaxis. Excellent results have been obtained in the past, particularly by the British in India, yet as the measure was to a certain extent a voluntary one, the objection has been made that the statistics conveyed a false impression as to its value, since the men who volunteered, being careful and thoughtful individuals, would probably not have contracted the disease in any event. This objection we have disposed of in our service by making the vaccination obligatory on every person under the control of the commanding general. In fact, it is difficult to conceive of a more complete and thorough-going test of any measure than has been given this, and the results are evident.

FEASIBILITY OF GENERAL INOCULATION

A word as to the necessity for this form of prophylaxis. It is generally admitted by the opponents and more numerous luke-warm adherents of antityphoid vaccination, that it is essential for the Army and the militia of the several states, in times of war and mobilization. Has it not, however, a field of usefulness in civil life in this country? It has been repeatedly shown that the incidence of typhoid fever is higher in hospitals than in the cities in which the hospitals are situated,⁵ and there is pretty general agreement that the medical and nursing staffs and employees should be vaccinated. For the same reason all who in any way come in contact with the sick should be immunized, since typhoid, like other exanthems, is contagious during the prodromal stage.⁶ In this group we may place the personnel of dispensaries, various charities and undertakers.

Another large group comprises those who live in industrial villages, mining towns, isolated communities where the typhoid death-rate is above the average. Work-houses, asylums and especially schools come in this category.

There is another large group of persons living under conditions simulating those occurring with an army in

the field, although without the same sanitary safeguards. I refer to the camps of engineers, contractors and pleasure seekers. Here, if anywhere, the use of the typhoid prophylactic would richly repay the time and trouble necessary for its administration. Its usefulness, however, is not limited to these classes of persons. The typhoid death-rates for New York, Boston, Chicago and most other large cities in the North are low, varying from 4.7 in Bridgeport, Conn., to 17.5 in Philadelphia, and as long as the inhabitants of these cities remain at home they run little danger of contracting the disease. Remaining at home, however, is a thing most of us do not do; we send our patients, families and go ourselves to the seaside and mountains where the typhoid rate is five and ten times as high as at home. In the cities we depend on pure water, proper disposal of wastes and the intelligent activities of an energetic municipal health department. In going into the country or traveling from place to place where the usual safeguards are lacking, why not avail ourselves of this form of individual prophylaxis which is efficient in all places and at all times?

INOCULATION AGAINST TYPHOID

IN PUBLIC INSTITUTIONS AND IN CIVIL COMMUNITIES:
A FURTHER REPORT*

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BALTIMORE

Since the experimental inoculations of Wright¹ and of Pfeiffer and Kolle,² in 1896, immunization against typhoid fever not only has been tested out in various armies and proved of inestimable value in reducing the number of cases of this disease in military camps, but also has been used in hospitals to lower the attack-rate among nurses and attendants. More recently, even certain state and city boards of health have adopted this procedure in their fight against typhoid.

The utility of this measure in military life is settled beyond debate, while its usefulness in protecting those exposed to infection in hospitals cannot be disputed. Indeed, it is our belief that the time is not far distant when those in charge of such institutions not offering this means of protection to their nurses and attendants will be considered culpably careless.

Again, it is our firm conviction, based on results we have obtained, that inoculation against typhoid is adaptable to preventing epidemic and sporadic cases in public institutions, particularly those for the insane and feeble-minded.

The advisability of extending typhoid vaccination to civil communities at large, however, may be considered an open question. It might be argued that the various measures now used in the war against enteric fever are all that are essential; that if cities and towns direct their attention to obtaining pure water, clean milk, the proper disposal of sewage, and freedom from flies; if shell-fish and green vegetables are obtained from sources above the suspicion of pollution; and if reports of all cases of typhoid fever are followed by placarding the houses, screening the patients and disinfecting the excreta, bed-

* Read in the Symposium on Anti-Typhoid Inoculation in the Section on Preventive Medicine and Public Health of the American Medical Association, at the Sixty-Third Annual Session, held at Atlantic City, June, 1912.

¹ From the Bacteriologic Laboratory of State and City Boards of Health.

1. Wright: *Lancet*, London, Sept. 19, 1896.

2. Pfeiffer and Kolle: *Deutsch. med. Wchnschr.*, 1896, **xxii**, 735.

5. Richardson and Spooner: *Boston Med. and Surg. Jour.*, 1911, **clxiv**, 8.
6. Conradt: *Klin. Jahrb.*, 1907, **xvii**, 207.

ding and utensils likely to be contaminated by such excreta, it will be unnecessary to add typhoid vaccine to their armamentarium.

Such a position, however, seems little more tenable than to hold that they should direct their attention to the proper disinfection of the dejecta to the exclusion of all other means of prevention. For our large cities, much less our smaller towns, have not attained, and in the near future are not likely to attain, this advanced state of sanitary control over the above-mentioned carriers of infection. In the meantime are they content to remain supine and to allow the annual sacrifice without offering their poorer citizens this method of prophylaxis, and without at least advising its adoption by those citizens who can afford to do so? Again, even in a community in which this ideal of sanitation is an accomplished fact there would still be the bacillus-carrier, the contact case and the danger of introduction from without either by visitors or by residents.

When all things are considered we feel that there is a field for antityphoid inoculation in the prevention of enteric fever in civil life, and that those state and city boards of health that are supplying vaccine to the citizens of their respective states and cities are acting wisely.

For more than two years the department of health of Baltimore has furnished vaccine to the various hospitals within the city, and it has recently decided to give it free to citizens who are unable to purchase it. The state department of health of Maryland since the summer of 1911 has prepared antityphoid vaccine for several state institutions. Altogether, since March, 1910, between 2,700 and 2,800 persons have been inoculated with vaccine from the conjoint laboratory of the state and city boards of health, and reports have been obtained from 2,044 of these, we ourselves having immunized only 140 of this number.

The immunization of 650 of the 2,700 and odd has not been completed, so that no report of the reactions can be made at present. This includes 250 citizens of a town of 6,000 inhabitants, in which there are certain districts showing an excessive attack-rate. The other 400 are inmates of Springfield State Hospital. In addition to these the inoculation of volunteers from the unvaccinated members of the Fourth Infantry, Maryland National Guard, is in progress. The number of these is at present not ascertainable.

Of the total number of those from whom we have procured records, 309 were resident physicians, nurses and attendants in general hospitals; 1,551 were inmates, nurses and attendants in two state hospitals for the insane, and 184 were private citizens of Baltimore and of rural districts. This latter class includes physicians, nurses in private practice, medical students, commercial travelers, laboratory workers, members of infected households and people going to summer resorts; in short, persons specially exposed to infection.

Table 1 shows in detail the distribution of the 2,044 persons from whom reports have been obtained.

Before analyzing the reports thus far received we shall briefly describe the preparation of the vaccine employed. This has been prepared in two different ways. At first it was made from a mixture of six different strains of *Bacillus typhosus*, five of which had recently been isolated from blood-cultures. The other bacillus had been under cultivation in the laboratory for several years. These six organisms were inoculated into a flask con-

taining 100 c.c. of broth incubated from eighteen to twenty-four hours, and from this mixed growth agar-cultures were made. At the end of twenty-four hours the latter were washed off with sterile normal salt solution, and the bacilli were killed by holding the suspension at 58 C. for forty-five minutes. This was then preserved by adding 0.25 per cent. of tricresol. From the beginning of 1911 to the present time the vaccine has been prepared from a typhoid bacillus furnished us through the courtesy of Major Russell, this being the same avirulent strain with which the Army has been immunized. In the preparation of the vaccine from this bacillus it has been our custom to kill the organism by the use of 0.5 per cent. phenol (carbolic acid). In the main the various stocks of vaccine were standardized by Wright's method. Occasionally, however, Harrison's modification of this method was employed. Before distribution the death of the typhoid bacillus and the freedom from contamination were determined by making aerobic and anaerobic cultures. As a further safeguard white mice and guinea-pigs were inoculated.

The injections were made subcutaneously into the arm near the insertion of the deltoid. At first the site of inoculation was prepared by rubbing briskly with 95 per

TABLE 1.—DISTRIBUTION OF PERSONS INOCULATED FROM WHOM REPORTS HAVE BEEN OBTAINED

Springfield State Hospital, inoculated under the direction of Dr. J. Clement Clark, 1911.....	887
Spring Grove Hospital, inoculated under the direction of Dr. J. Percy Wade, 1911.....	664
Mercy Hospital, inoculated under the direction of Dr. Eckhart, 1910.....	68
Mercy Hospital, inoculated under the direction of Dr. Gillis, 1912.....	25
Franklin Square Hospital, inoculated under the direction of Dr. Pearce Kintzing, 1910.....	16
Franklin Square Hospital, inoculated under the direction of Dr. Pearce Kintzing, 1912.....	11
University Hospital, inoculated under the direction of Dr. H. J. Maldels, 1911.....	88
University Hospital, inoculated under the direction of Dr. H. J. Maldels, 1912.....	18
St. Joseph's Hospital, inoculated under the direction of Dr. E. H. Hayward, 1911.....	34
Homeopathic Hospital, inoculated under the direction of Dr. H. M. Stevenson, 1911.....	11
St. Agnes Hospital, inoculated under the direction of Dr. J. A. Chatard, 1911.....	38
Private cases, inoculated under the direction of numerous physicians, 1911-1912.....	44
Civilians (including physicians, nurses, students, etc.), inoculated by the authors, 1911-1912.....	140
	2,044

cent. alcohol, but a little later a solution of phenol or mercuric chlorid was substituted for this. Since the summer of 1911 we have advised the thorough cleansing of the arm and the application of tincture of iodine round the point of insertion of the needle both before and after the inoculation.

The doses employed have been increased since we first started. We felt that if we were going to succeed in having antityphoid vaccine generally adopted by hospitals and institutions it was necessary at first to avoid any unduly severe reactions; we therefore began with the administration of 125 million, 250 million and 500 million dead typhoid bacilli at intervals of from seven to ten days. Later when this preventive measure became more firmly established in these institutions, we felt it was both safe and wise to increase the doses to 250 million, 500 million and 1,000 million bacilli, to be given at intervals of a week to ten days. We did not advise this, however, until these doses had been tried on students who had volunteered, and it was found that there was little or no perceptible increase in the severity of the reaction.

We have a record of the ages of 1,326 of those immunized: fourteen were in the second decade of life; 367

† Since this paper was read the distribution of vaccine has been extended to all citizens.

were in the third decade; 943 were in the fourth, and two were in the sixth. Of those between 10 and 20 years of age eleven were nurses in training, and eight of these gave a moderately severe reaction, certainly an inordinate number; the other three in the second decade were students, and these escaped without any systemic disturbance. There is no noticeable difference in the severity of the reaction to the vaccine for the other periods of life.

On analyzing the records we find that redness and local tenderness were present in all cases, but infection never ensued. Malaise followed the inoculation in 775 cases; headache in 835; muscular pains in 106; nausea and vomiting in sixty; chills in fifty-seven and rise of temperature in 884 cases. In 1,160, or 56.7 per cent., constitutional symptoms failed to follow the injections.

As already mentioned, 1,160, or 56.7 per cent., of those immunized did not develop fever. The temperature ranged from normal to 101 F. in 785, or 38.4 per cent., of the cases; from 101 F. to 103 F. in eighty-two, or 4 per cent.; and in the remaining seventeen, or 0.8 per cent., it exceeded 103 F.

Of the 884 showing constitutional reaction 874 state the inoculation which this followed. The analysis of these 874 records discloses that the reaction occurred after the first injection only in 132 persons; after the second only in 255; after the third alone in 382; after the first and second in fifty-nine; the second and third in fourteen; the first and third in ten; and all three in twenty-two cases. From these figures Table 2 has been constructed.

TABLE 2.—STATEMENT OF INOCULATIONS WHICH WERE FOLLOWED BY CONSTITUTIONAL REACTIONS

Dose	Number of Records	Number Showing Systemic Reaction	Per Cent.
First alone	2,044	132	6.4
Second alone	2,044	255	12.4
Third alone	2,044	382	18.6
First and second	2,044	59	2.8
Second and third	2,044	14	0.6
First and third	2,044	10	0.4
First, second and third	2,044	22	1.0
Not noted	2,044	10	0.4

Table 3 shows the percentage of reactions following each dose.

TABLE 3.—PERCENTAGE OF REACTIONS FOLLOWING EACH DOSE

Dose	Number of Records	Number Showing Systemic Reaction	Per Cent.
First	2,044	223	10.9
Second	2,044	350	17.1
Third	2,044	428	20.9

In 246 of the 884 having a systemic reaction this lasted from one to six hours in fourteen cases; it persisted from six to twelve hours in ninety-six; it disappeared in from twelve to twenty-four hours in eighty-nine; from one to two days in forty-three; from two to three days in five; from three to four days in six instances; in five days in one; and it lasted over ten days in two persons. One of these, a female patient at Springfield Hospital, was suffering from chronic mania. In this case a low grade of temperature persisted for two

weeks and pulmonary tuberculosis was suspected; and while no sputum could be obtained for examination for the tubercle bacillus, the patient had a dry, hacking cough and dulness over a portion of one lung. The other patient was an extremely hysterical woman. She suffered from gastric distress for ten days after the inoculation. She, however, has had similar attacks before and since that time. In another institution two tuberculous persons were vaccinated; one of these reacted with moderate severity, the other but very slightly.

Although the number of patients inoculated with the polyvalent vaccine has been comparatively small, we have drawn up a table comparing the reactions following the use of this with those resulting from the use of that prepared from the Russell strain. These are shown in Table 4.

TABLE 4.—COMPARISON OF REACTIONS FOLLOWING INOCULATIONS OF POLYVALENT VACCINE AND MONOVALENT VACCINE OF THE RUSSELL STRAIN

Reaction	Polyvalent Vaccine		Monovalent Vaccine	
	Number	Percentage	Number	Percentage
No reaction	56	56.5	1,104	56.7
Slight (temperature normal, 101 F.)	24	24.2	701	39.1
Moderately severe (temperature 101-103 F.)	16	16.1	66	3.3
Severe (temperature over 103 F.)	3	3.0	14	0.7

This shows that in more than half the cases no reaction ensued after the use of either type of vaccine. In addition, we find that 95.8 per cent. of persons immunized with the single avirulent strain had either no elevation of temperature or a rise to less than 101 F., while but 80.7 per cent. of those receiving the other vaccine had a like result; moderately severe and severe reactions, therefore, more frequently occurred after the administration of the polyvalent type.

We feel, nevertheless, that no conclusions should be drawn from this comparative table, since they would be invalidated by the small number of persons that have been immunized with the polyvalent as compared with those protected with the monovalent vaccine. We believe, however, that one prepared from a number of strains of avirulent typhoid bacilli would subserve its purpose better than a vaccine made from a single strain. These organisms should be carefully selected; only those capable of producing large quantities of antibodies and at the same time not causing severe general disturbances should be used.

As already mentioned, we have increased the dosage of vaccine since the spring of 1911. In order to compare the reactions following the larger and smaller doses we have carefully gone over the reports received. The first inoculations with the increased doses were made into medical students, and as there was scarcely any increase in the severity of the reactions we have since then used them in the immunization of all adults.

In making the comparison we have included only the cases of patients inoculated with the monovalent vaccine. This has been done because those injected with the other invariably received the smaller doses, and we therefore believe it is only fair to omit these altogether.

The examination of the records of those immunized with the single avirulent strain shows that 635 persons received 125 million, 250 million and 500 million, and 310 were given 250 million, 500 million and 1,000 mil-

lion dead typhoid bacilli. Of the former 58.4 per cent. escaped without a general reaction; 39 per cent. had but a slight one; 1.8 per cent. suffered a moderately severe one; and 0.6 per cent. had a severe reaction. Of the latter 47.7 per cent. had no systemic symptoms; 39.3 per cent. reacted but slightly; 11.6 per cent. had a moderately severe, and 1.2 per cent. a severe reaction. Thus we find that 97.4 per cent. of those injected with the smaller doses showed either no constitutional disturbance or but a slight one, while only 87 per cent. of those receiving the larger quantities had a similar experience. Despite the somewhat larger proportion of moderately severe reactions we believe the use of the bigger doses is more than warranted by the greater protection that must almost certainly ensue.

Of the 310 injected with the larger amount 187 were nurses in hospitals, and it has been our experience that they show a disproportionate number of moderately severe and severe reactions. The fact, therefore, that so large a percentage of these cases was of this class explains to a great extent the differences noted above. Table 5 shows these differences in a striking manner.

TABLE 5.—COMPARISON SHOWING GREATER REACTION IN NURSES

Dose	No Reaction		Slight Reaction		Moderate Reaction		Severe Reaction	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
125, 250 and 500 million	950	58.4	639	39.0	30	1.8	10	0.6
250, 500 and 1,000 million	148	47.7	122	30.3	36	11.6	4	1.2
125, 250 and 500 million (nurses alone)	3	7.0	30	79.9	3	7.0	2	5.2
250, 500 and 1,000 million (nurses alone)	68	30.3	89	47.6	26	13.0	4	2.1
125, 250 and 500 million (nurses excluded)	953	59.6	600	38.1	27	1.7	8	0.5
250, 500 and 1,000 million (nurses excluded)	80	65.0	33	20.8	10	8.1	0	0.0

As for more than two years antityphoid vaccine has been distributed by the conjoint laboratory of the state and city boards of health, we deem it important to tabulate the immunized cases according to the time that has since elapsed (Table 6).

TABLE 6.—CASES IMMUNIZED SINCE VACCINE HAS BEEN DISTRIBUTED

	Hospital Nurses and Attendants	Inmates Public Institutions	Civilians	Total	Typhoid Among Immunized
2-2½ years ..	84	0	15	99	0
1-1½ years ..	0	0	56	56	0
1 year	171	887	36	1,094	0
9 mos.-1 yr. . .	0	330	0	330	0
6-9 months . . .	0	334	18	352	0
3-6 months . . .	11	0	55	66	0
1-3 months . . .	43	0	4	47	0
Total	300	1,551	184	2,044	0

Besides giving the length of time the various classes of people have been inoculated this table also shows that none of the immunized have developed typhoid. This latter fact is of peculiar interest when it is seen that the persons vaccinated have largely been those especially exposed to infection.

Thus, 309 were nurses and attendants in general hospitals in a city in which typhoid is very prevalent. Now Joslin and Overlander³ found that the attack-rate for nurses in six Boston hospitals for the years 1902 to 1905 was 161 per 10,000 as compared with twenty per 10,000, which was approximately the morbidity for the whole of Massachusetts. Again, as previously noted by Hachtel and Stoner,⁴ for the five years preceding the adoption of this prophylactic measure the attack-rate for nurses and attendants in six Baltimore hospitals was about 500 per 10,000. Since in the city at large the number of cases for the same years has ranged from 24.5 to 42.2 per 10,000 inhabitants;⁵ therefore, in these hospitals the nurses and attendants appear to be about twelve to twenty times as liable to infection with enteric fever as the citizens of Baltimore. As before stated, the attack-rate before immunization was instituted was 5 per cent., while that for vaccinated nurses and attendants has been *nil*. Add to this that in five of these same institutions eighty-two nurses were not injected, and seven of these, or 8.5 per cent., contracted typhoid, and we have a most striking comparison.

Then again, 887 of the vaccinated were inmates and employees of an institution for the insane, principally the former. In this asylum the morbidity from enteric fever for the previous years was 1 per cent. a year. Now while not one of the inoculated developed this disease, three out of 333 not immunized suffered from typhoid.

Still further, the 184 civilians were persons particularly subjected to infection, such as physicians, nurses in private practice, laboratory workers, medical students and traveling salesmen. Besides this, eleven of these were members of infected households, and in several instances either nursed or assisted in the nursing of the patient.

In conclusion, we are convinced that antityphoid vaccination is of incalculable value in the protection against enteric fever, and owing to the undue incidence of this disease in hospital nurses and attendants, they should be urged to submit to inoculation. Indeed, we feel that the authorities in control of such institutions who do not offer their nurses this protective measure are negligent in the extreme. In public institutions, especially in hospitals for the insane and mentally deficient, inoculation should be employed in reducing the number of cases of this malady. In the latter hospitals great care should be exercised as to the selection of patients for immunization, avoiding those of advanced years and those suffering from chronic organic disturbances such as arteriosclerosis and cardiac and renal diseases.

Considering the brilliant results obtained, the very slight inconvenience usually experienced following the vaccination, the atrocious number of cases of typhoid fever occurring yearly in both the city and the country, and the extreme complexity of the problem of lessening this attack-rate by sanitation, it is our firm conviction that all civilians should be advised to be inoculated against this disease. Naturally we do not advise antityphoid vaccination as a substitute for proper sanitary control. When we think of the extreme difficulty of coping with typhoid, however, and the length of time it will require to attain the ideal of sanitation; when we consider that even under the best sanitary conditions we

3. Joslin and Overlander: Boston Med. and Surg. Jour., civl, 247.

4. Hachtel and Stoner: Am. Jour. Pub. Health, 11, No. 3, p. 157.

5. As the report of typhoid cases in Baltimore is not complete, these figures are estimated from the reported deaths on a basis of a 10 per cent. fatality.

still have to fear the typhoid carrier, direct contact and the danger of introduction from without by visitors and by citizens, we believe that antityphoid inoculation will have a place in the prevention of this disease in civil life, and that boards of health should not only advise the adoption of this measure, but should also distribute the vaccine free of charge for the immunization of the citizens of their respective communities.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRs. SPOONER, RUSSELL AND HACHTEL AND STONER

DR. M. P. RAVENEL, Madison, Wis.: The State Hygienic Laboratory of Wisconsin began issuing antityphoid vaccine free of charge to physicians of the state about nine months ago. Our experience is that inoculation into the arm as recommended in the Army produces less reaction than in other parts of the body. I wish to confirm what Dr. Spooner has said about the mildness of the attack in those who have been partially vaccinated or in whom infection has already taken place when the vaccination was done. We have had several cases which confirm this statement. We have urged strongly the vaccination of nurses in hospitals throughout Wisconsin and it is being done to a considerable extent. The following case is of interest: A woman was suffering from typhoid fever. The attending physician wished to vaccinate the husband and two trained nurses in charge. We sent the vaccine. One nurse, however, refused the vaccination, saying that she was immune. Soon after leaving the case she was taken sick with typhoid. The husband and the other nurse remained well.

We have vaccinated about 1,900 people in Wisconsin, including approximately 1,000 of the National Guard. The reactions have been almost invariably mild. Two severe reactions occurred on the third injection which were hard to explain. Inquiries showed that both men had been drinking. Our experience, though comparatively small, has convinced us of the great value of the process. In one institution we apparently stopped a bad outbreak at once. In a small town where typhoid was raging we vaccinated 116 persons. We have not had the report of a single case occurring in any of those vaccinated. We are using a polyvalent vaccine, and are urging on the physicians of the state the further adoption of the practice.

DR. MALCOLM C. ROSE, New York: It is a great thing when a physician can say that he has had this preventive treatment himself; perhaps Major Russell and Dr. Spooner have had it; I would like to know their personal experience and learn just how it feels, because the next trip of the American Medical Association will probably be away to the West—we shall have to travel on cars, boats and other means of transportation where we shall be exposed. Dr. Spooner speaks about the severe reaction; but exactly what he saw I am not quite sure. Then, also, how long does this immunization last?

Does vaccination help to prevent relapse when a typhoid patient is vaccinated in the home? Does it help to prevent relapse, or what some doctors call a relapse, when it is a new running of the disease? I call a relapse the result of improper care or improper feeding.

DR. LESLEY H. SPOONER, Boston: I have not used the interscapular region for a long time. I have inoculated only 500 in the back; but I have been impressed by the fact that the circumference of induration was not so great nor complaints so frequent as when other regions were employed. There is one thing to be said, however, in limitation of that statement: those persons who have been inoculated in the back have been chiefly private patients. I find that in the latter class less severe reactions are met than among nurses and physicians. This may account for the discrepancy in our findings.

An episode connected with the little epidemic which I have described before parallels Dr. Ravenel's experience of similar exposure to the two nurses engaged on the same case. Two table girls were employed at the hotel which was the hotbed of this epidemic, since about half the cases originated there.

These girls were doing exactly the same work; they shared the same room and slept in the same bed. One was inoculated, the other was not. The former had the most severe reaction of any one in that group of cases. She did not contract the disease. Two weeks after the last inoculation, the uninoculated table girl contracted the disease. In regard to personal inconvenience, I will say that I inoculated myself twice and was given the third injection by a confrère three years ago. On only one occasion did I feel any constitutional reaction. It consisted of such symptoms as one expects on the eve of a cold. The following day they had entirely disappeared. There was, as I recall, slight local soreness. I felt nothing to prejudice one the least against undergoing the treatment.

DR. F. F. RUSSELL, Washington, D. C.: Since we do not know accurately the duration of the immunity, we recommend revaccination of soldiers once in each enlistment, giving two doses on the second vaccination, rather than three. Among civilians we suggest revaccination only on exposure. It is important to refuse vaccination of persons who are not well. Our refusal to vaccinate all but the healthy may explain our good results and complete lack of accidental complications. Many are using polyvalent vaccines with the idea that they are better than vaccines made from a single strain of the bacillus. We have always used a single, selected strain, which confers protection wherever used. There is more reason for adding a little paratyphoid to the vaccine. At present we do not know how prevalent paratyphoid fever is; we are encouraging our men to use blood-culture methods, that this point may be accurately known.

The importance of Dr. Spooner's work in the Greensboro epidemic and of vaccinating the nurses while on duty in the hospital is great. It is a different problem from ours. At Torrington, Conn., last summer, vaccine was used extensively in an epidemic; there was only one case among the vaccinated, and that a mild one. I do not remember the total number of cases, but eighty nurses were employed, of whom forty-five accepted and thirty-five refused vaccination. Among the forty-five there were no cases, while three occurred among the thirty-five unvaccinated. Vaccine was used in a small epidemic among 2,500 marines at Guantanamo, Cuba. In the one case in which typhoid developed after vaccination, autopsy showed that the patient was undoubtedly infected before. Wright and Leishman used vaccine during the height of an epidemic at Maidstone, England, with excellent results. Cullison, a pupil of Wright, vaccinated the attendants and nurses of an insane asylum in Dublin, during an epidemic, with the same good results. The vaccine was used the past year in an epidemic in Cedar Rapids, Iowa, where the outcome was also satisfactory. Dr. Spooner's paper again emphasizes the fact that we need have no fear of an injurious negative phase; that we can safely vaccinate against typhoid just as we do against small-pox.

It seems probable that the way in which the vaccination is done has something to do with the severity of the reaction. The absorption of vaccine should be as slow as possible. We think it should be put into the subcutaneous tissue, and not into the muscle; some men have vaccinated directly into the muscle, where the absorption is too rapid, producing a decided reaction. If the second or third dose is injected into a region still indurated from a previous inoculation there may be rapid absorption, with severe reaction.

DR. HARRY W. STONER, Baltimore: Several striking instances occurred in our experience with the vaccine: In one institution eighty-eight out of ninety-one nurses and attendants were inoculated in 1911. One of the three nurses not inoculated developed typhoid fever and died. At another hospital a nurse who was on her vacation at the time the inoculations were made was not immunized. A few weeks after she returned to the hospital she developed typhoid. In still another institution in which the nurses were immunized in 1910, three out of eight new nurses who came in in 1911, and who had not received the vaccine, were stricken with typhoid fever during the latter part of that year, while none of the inoculated nurses remaining in the hospital were attacked.

The question how long immunity lasts is a pertinent one and not easily answered. From studies we have made with the serum of rabbits inoculated with typhoid vaccine, we have found a gradual rise in the bacteriotropic substances—bacteriolysins, agglutinins and opsonins—corresponding closely, and following about the same curve as that occurring in human beings. These substances were demonstrable in the blood for from six months to a year, gradually decreasing until they finally disappeared. When these animals were reinoculated with similar doses of the same vaccine it was found that there was a much quicker production of these substances than at first. We believe that the first inoculation sensitized certain cells, which on reinoculation responded more readily to the production of these substances, and that a person immunized by typhoid vaccine is protected from typhoid by the rapid formation of these antibodies. Since the curve of the formation and duration of these bacteriotropic substances in the blood of immunized individuals corresponds closely with their production and durations in the blood of patients with typhoid fever, it would seem that an immunized individual would be as well protected as is the individual who has had typhoid fever.

As to personal experience, Dr. Haecht and myself were the first in our series of cases to receive the vaccine. Neither of us suffered any great reaction. Following the second injection I had a slight rise in temperature and a dull headache lasting about two hours. The other two injections did not give rise to any symptoms.

A STUDY OF THE ULTIMATE RESULTS IN THE DISPENSARY TREATMENT OF TUBERCULOSIS*

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Without the dispensary, such control as we now have of the tuberculosis problem would have been hardly possible. Its importance in the tuberculosis crusade cannot be overestimated, and yet it is extremely difficult to establish in terms of cases with disease arrested just how efficient it really is. Compared with statistics dealing with sanatorium patients, there are few statistics to show the ultimate results obtained in patients whose treatment was received entirely in a dispensary. When the tuberculosis dispensaries were first introduced it was hoped and believed that the majority of patients could be treated efficiently by these agencies. After a few years' trial, however, there was considerable disappointment with the results obtained, and with the increasing number of sanatoriums more and more cases were at once sent to these institutions. Here, again, the results have not measured up to expectations, so that at present there is considerable uncertainty in regard to the best way to proceed.

In the meantime, dispensary treatment itself has undergone many changes and in each instance for the better. The lesson has been learned that there is a limit to the number of cases which can be handled efficiently; supervision in the home has been made something more than a mere inspection visit, and above all, there has come about a very general appreciation that there are economic and social as well as medical aspects of the tuberculosis problem.

It is particularly the economic and social aspects of the problem that have emphasized the need of redoub-

ling our efforts along the line first attempted by the dispensary, namely, the handling in their homes of patients who appear to have a chance of being benefited. This involves the improvement or the attempt at improvement of living conditions, without which no very rapid improvement in the situation can be hoped for. From this point of view the experiments about to be inaugurated in New York City and Cincinnati, whereby the problem is attacked as a family problem in the home, will be watched with the keenest interest.

It should be borne in mind that the results detailed in this paper represent the dispensary as it was in its incipient state. Furthermore, the Phipps Institute dispensary, at the time of its foundation, was the only place of its kind in eastern Pennsylvania, and to it flocked patients from all over Philadelphia, the adjoining towns and even the neighboring State of New Jersey. Of necessity, supervision was impossible in many instances and even where practiced, inadequate, as we understand supervision to-day.

The patients under consideration visited the Phipps Institute in the second year of its existence; namely, from Feb. 1, 1904, to Feb. 1, 1905. The investigation was completed Sept. 1, 1911, so that an interval of nearly seven years had elapsed. Any one who has not attempted an investigation of this sort can hardly appreciate the difficulties encountered in such a study. The long interval which had elapsed and the constant shifting of their abode on the part of many of the patients made the obtaining of information a slow and tedious process. One of the gratifying results, however, was the receipt of many letters, which indicated that the instructions received had been productive of good.

The total number of patients applying to the Institute in the year under consideration was 1,067. They have been divided into four groups: first, those known to be dead; second, those untraced; third, those refused treatment, because of being either not tuberculous or not destitute; and fourth, those known to be living. The information was obtained from the records of the institute, the official death records at the City Hall, from letters and from the investigations of a nurse.

I. PATIENTS KNOWN TO BE DEAD

Of the 915 patients with a positive diagnosis of tuberculosis, 380 (41.5 per cent.) are known to have died of tuberculosis. In addition, there are thirty-one patients who have a diagnosis of tuberculosis on the records of the institute, but who according to the official death-returns are reported as having died of other causes. In a few cases, as for instance several deaths from violence, the returns are correct. Not less than twenty-three patients of this group, however, in all probability died of tuberculosis, notably eleven whose deaths are officially returned as due to heart disease. While there is a certain amount of confusion between tuberculosis and certain forms of heart disease, particularly mitral stenosis, the mistake is usually that of considering a heart case as being tuberculous rather than the reverse.

TABLE 1.—NUMBER OF DEATHS FOR THE SEVEN YEARS

	1904	1905	1906	1907	1908	1909	1910	1911
Official report	20	37	19	10	4	12	8	0
Phipps' report	82	40	5	4	1	0	2	0
Investigation	5	23	9	9	7	7	3	1
Letters	4	16	12	4	1	0	7	4
Total	111	116	45	27	13	19	20	5

No date specified in 24.

* Read before the Eighth Annual Meeting of the National Association for the Study and Prevention of Tuberculosis, in Washington, May, 1912.