

The extension apparatus, already mentioned, will be found of inestimable value in this operation. It is impossible to take up in detail all the special fractures, but sufficient has been said, I think, to show that an era of better treatment of fractures is at hand and that it behooves all of us who expect to treat these cases, not only to familiarize ourselves with the methods, but also to perfect ourselves in the technic if we would hope to secure the results for our patients which they are certain to demand.

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RESULTS OF ANTITYPHOID VACCINATION
IN THE ARMY IN 1911, AND ITS SUIT-
ABILITY FOR USE IN CIVIL
COMMUNITIES *

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The Medical Corps of the Army has been endeavoring to protect large numbers of individuals against typhoid fever by means of prophylactic vaccination with killed bacterial cultures. In the Army, during times of peace, our posts are like small communities, with their own water-supplies, sewerage systems and organized administration of community affairs. So long as the troops are in garrison they have no more disease than exists in the adjoining communities. We are, however, not content with this condition of safety, but must descend from our fastnesses, and in the absence of real war, engage in mimic battles and campaigns. From the purely military point of view these movements are maneuvers, not war, but from the standpoint of health and disease there exists the same real danger as in actual war.

As the Medical Corps is charged with the preservation of the health of the Army, we have endeavored to protect it against typhoid, not merely in garrison, but also in the field, in campaign and on the march. The principles of prophylaxis applicable to cities fail us utterly, and our main reliance has come to be the protection of each and every individual composing the Army. The mere question of numbers is of little moment since whole nations have been immunized against small-pox, and we think little of the number of persons involved.

Another question is of more importance, whether vaccination against typhoid fever actually protects against the disease, and whether it can be accomplished without danger. It is this question that we believe has at last been settled in such a way and on such a scale as to leave no doubt in the mind of any reasoning person.

Our knowledge of vaccination against typhoid fever begins with the work of Pfeiffer and Kolle,³ who, in 1896, immunized two men and made complete and comprehensive studies of the blood-changes following inoculation with killed cultures, showing, as far as laboratory methods permit, the identity of the immunity following an attack of the disease, and the artificial immunity produced by inoculation. At about the same time,

Wright,⁴ of London, inoculated two men with killed typhoid bacilli, but his main work was published in the following year, 1897, when he reported the successful immunization of seventeen persons. In 1898, he continued the work in India, where 4,000 British soldiers were vaccinated. On the outbreak of the Boer War in 1900, he, together with Leishman of the Royal Army Medical Corps, undertook the preparation of the vaccine and supervision of the inoculation of the British troops, of whom some 100,000 were treated. In India, where it was first used on an extensive scale, the results obtained were quite encouraging, but for various reasons the same procedure in South Africa was not as satisfactory as had been anticipated. Indeed, considerable opposition was aroused and there were not a few who contended that, when carried out in an endemic area, vaccination did more harm than good by virtue of a mysterious negative phase which for a time rendered the vaccinated more susceptible to infection than the untreated. It is very doubtful if a negative phase of such importance ever existed. Indeed, all our recent experience has failed to show a negative phase of clinical importance.

A few years later, in 1904, the Germans in the Herero campaign in southern West Africa, resorted to the use of prophylactic vaccination on the advice of Prof. Robert Koch. Vaccination was voluntary and only about one-half of the command, 7,287 men, availed themselves of it. The results, while good, fell short of expectations. There was, roughly speaking, only one-half as much disease among the protected as among the unprotected, while the number of deaths was reduced to one-quarter of the number among the non-immunized.

The second period in the history of antityphoid vaccination begins with the work of Sir William B. Leishman, in 1904. He took up the subject when Wright left the Army, and has remained in charge up to the present time. In his Harben lecture⁵ of 1910 he explains, in a measure, the lack of success in earlier years, by showing that a vaccine may be made less efficient by the use of too great heat in killing the bacilli, and by stating his belief that much of the vaccine used in South Africa was damaged in its preparation by overheating. Since the year 1904, an improved vaccine has been used among the British troops in India in ever-increasing quantities with uniformly satisfactory results. They have vaccinated more than 100,000 men without any untoward results. The most recent figures from India, reported by Col. R. H. Firth,⁶ cover the first six months of the year 1911.

"In that period there were, in all India, 112 cases of typhoid with six deaths, among the protected men, and forty-five cases with four deaths among the non-protected. The protected population was 63,624 persons, and the non-protected, 8,481. From these data we find the case incidence per thousand among the protected to be 1.7 and among the non-protected to be 5.3. If we take the mortality and express it as per million, then the ratio for the protected is 94, and for the non-protected, 471. That is to say, the incidence for typhoid for the first half year was roughly five times as great among the non-protected as among the protected."

Our own experience with antityphoid vaccination began in 1908, and early in 1909 we vaccinated all who volunteered. In 1909 we immunized 1,887 persons, in 1910, 16,073. For 1911, the figures are not yet com-

* Read before the Buffalo, N. Y., Medical Union, Jan. 24, 1912. Published with the permission of the Surgeon-General, U. S. Army. The introductory portion of this address is omitted from THE JOURNAL, but appears in full in the author's reprints. In it Major Russell discusses the general subject of the prophylaxis of typhoid fever.
3. Pfeiffer and Kolle: *Deutsch. med. Wchnschr.*, 1896, xxii, 735.

4. Wright: *Lancet*, London, Sept. 19, 1896, p. 807; *Brit. Med. Jour.*, Jan. 30, 1897, p. 16.
5. Leishman, W. B.: *Jour. Roy. Inst. Pub. Health*, London, 1910, xviii, 394.
6. Firth, R. H.: *Jour. Roy. Army Med. Corps*, London, 1911, xvii, 495.

plete, but are estimated at over 80,000, making the total number of persons immunized approximately 100,000. Over 80 per cent. of these have received the full course of three doses. The vaccine has been prepared in the laboratory of the Army Medical School, and the immunization has been carried out without accidents. In 1910, we shipped to various posts in the service and to other institutions, 75,843 c.c., and in 1911, 312,101 c.c.

The preparation of the vaccine is comparatively simple. An avirulent culture of the typhoid bacillus is grown for twenty-four hours on agar, washed off in normal salt solution, standardized by counting the bacilli, killed by heating to 55 C. for one hour and then 0.25 per cent. of tricresol is added as a matter of safety. Our object has been to immunize with a bacillus which has been changed as little as possible by heat or chemicals in the preparation of the vaccine, and for this reason very little work has been done with extracts, non-toxic portions, or the many modifications which have been suggested.

Up to the present time, a single strain of the bacillus has been used, not with the idea that that was the best method, but in order to simplify our problem as much as possible, and in this we have followed the example of the English. In preliminary experiments it was found that inoculations with this culture gave rise to the production of immune bodies in large quantities and produced, according to laboratory standards, a high degree of immunity, without, at the same time, causing severe general or local reactions.

	Number of Doses	Reaction, Absent	Reaction, Mild	Reaction, Moderate	Reaction, Severe
First dose . . .	45,680	68.2%	28.9%	2.4%	0.3%
Second dose . .	44,321	71.3%	25.7%	2.6%	0.2%
Third dose . . .	38,902	78.0%	20.3%	1.5%	0.1%

Had our results with the vaccine been poor or only fair the next step would naturally have been the search for a better one. As the problem has developed, however, we realized that the results were extraordinarily good, almost incredible in fact, and in view of this we have hesitated to alter the vaccine in any way. There are, no doubt, some improvements possible, but we have no real reason for dissatisfaction with the vaccine used at present.

In preparing a vaccine undue complexity must be avoided, as it is essential to have an adequate supply promptly when needed. It does not keep indefinitely and cannot, therefore, be made up in large quantities and stored for use in emergencies. To be of value it must admit of preparation on short notice, and this is particularly necessary in the military service where every mobilization, as the Texas maneuvers, comes as a surprise.

The vaccine is injected into the subcutaneous connective tissue (not into the muscles or into the skin) of the arm, at the level of the deltoid insertion, the necessary skin sterilization having been accomplished by tincture of iodine. Intramuscular injections should be avoided since the rapid absorption of the bacteria may lead to unpleasant anaphylactic general reactions and to unnecessary pain on movement.

Three doses are given at ten-day intervals: the first contains 500 million bacteria, the second and third 1 billion each. As a rule, there is a local reaction consisting of a red and tender area about the size of the palm of the hand, which usually subsides within forty-

eight hours. The general reaction, when present, shows itself by malaise, headache, fever, occasional chills, quite rarely by nausea, vomiting or diarrhea, and in exceptional instances, by transient albuminuria. The general reactions in 128,903 doses have been tabulated and show that the severe type of reaction occurs in only one to three persons per thousand.

As the occasional severe reactions are followed by no serious trouble their occurrence does not constitute a valid objection to the use of the prophylactic. In children or young people they rarely appear. We have always insisted, however, that no one, not in good health at the time, should be vaccinated, in order to avoid the vaccination of persons in the incubation stage of typhoid and other diseases.

The recent mobilization of troops in Texas has afforded an exceptional opportunity to test the method of individual protection by means of prophylactic vaccination. Large numbers of troops have been vaccinated by the English in South Africa and in India, and in the United States during the past two years, but this is the first time in the history of the subject that vaccination against typhoid has been compulsory.

The vaccination of volunteers had been in progress for over two years and a small number of men had already been protected before orders for mobilization were issued. On arrival at the maneuver camp all others were vaccinated as rapidly as vaccine could be prepared and shipped to Texas. In about one month from the beginning of the movement, the immunization of the entire command was completed. The whole program was carried out under the direction of the chief surgeon, Colonel Birmingham, promptly and systematically and without protest, either in or out of the service, as the idea was not new to either officers or men, since some one had received the treatment voluntarily at every post in the Army during our preliminary campaign of education.

An unusual feature of the Texas maneuvers was the large number of recruits forwarded to the front from New York, St. Louis and Denver, as rapidly as they could be enlisted and equipped; on arrival they were segregated in quarantine camps, to prevent the introduction of contagious diseases into the command, and advantage was taken of this period of detention to administer the typhoid prophylactic. Many cases of measles and mumps developed among the newly enlisted men, but no typhoid fever occurred. At San Antonio the three diseases causing the highest non-effective rate were venereal diseases (4.1 per thousand), and measles and mumps (3.1 per thousand). Typhoid fever was a negligible factor in the health of the division. One case occurred in the person of a hospital corps man who developed symptoms of fever before the third dose of vaccine was administered; the disease was mild, and was considered influenza until a blood-culture revealed the true diagnosis. One other case occurred in camp, the patient being a civilian, employed as a teamster by the quartermaster; this man, together with other civil employees of the Army, had been given an opportunity to be vaccinated, but had refused, and after this experience the quartermaster declined to employ men who refused protection by vaccination.

In addition to the main divisional camp at San Antonio, smaller camps occupied by separate brigades were established at Galveston, Tex., and at San Diego, Cal. At Galveston there were about 4,500 persons, and at San Diego about 3,000. No cases of typhoid were reported from Galveston and only one from San Diego.

Other detachments, smaller in size, were scattered along the border and among them there was no typhoid.

Colonel Kean,⁷ in an article on the sanitary record of the Maneuver Division, makes the following statement:

The immense advance in camp sanitation and particularly the value of this protective measure can be estimated by comparing the typhoid incidence of this camp with that of the Second Division, Seventh Army Corps, which was organized at Jacksonville, Fla., about June 1, 1898, and remained there in camp until October; some of the regiments leaving in September. This division was not conspicuously unfortunate in

1898
TABLE SHOWING FOR THE REGIMENTS OF THE SECOND DIVISION OF THE SEVENTH ARMY CORPS, ASSEMBLED AT JACKSONVILLE, FLA., THE MORTALITY AND MORBIDITY FROM TYPHOID FEVER

Regiments	Mean Strength	Cases of Typhoid Fever		Deaths from Typhoid Fever	Deaths from All Diseases
		Certain	Certain and Probable		
Second Illinois	1,095	253	341	18	22
First North Carolina	1,164	147	227	16	20
Second New Jersey	1,153	185	318	29	32
First Wisconsin	1,232	209	311	40	48
Fiftieth Iowa	1,097	164	253	33	33
Ninth Illinois	1,288	153	248	18	28
Second Virginia	1,220	105	152	17	20
Fourth Virginia	1,274	135	231	21	28
Forty-Ninth Iowa	1,236	378	612	50	50
Total	10,759	1,729	2,693	248	281

1911
TABLE SHOWING FOR THE ORGANIZATIONS COMPOSING THE MANEUVER DIVISION AT SAN ANTONIO, TEXAS, THE MORBIDITY AND MORTALITY FROM TYPHOID FEVER, MARCH 10 TO JULY 10, 1911

Organization	Mean Strength June	Cases of Typhoid, Certain and Probable	Deaths from Typhoid Fever	Deaths from All Diseases
Eleventh Infantry	924	..	..	..
Fifteenth Infantry	969	..	..	12
Eighteenth Infantry	1,022	..	..	..
Thirteenth Infantry	929	..	..	..
Twenty-second Infantry	1,033	..	..	..
Tenth Infantry	1,016	..	..	1
Seventeenth Infantry	954	..	..	..
Twenty-eighth Infantry	951	..	..	12
Third field artillery	847	..	..	1
Fourth field artillery	741	..	..	1
Engineer battalion	536	..	..	..
Signal corps	197	..	..	..
Ninth cavalry	744	..	..	3
Eleventh cavalry	1,143	..	..	..
Sanitary troops	795	1	..	1
Total	12,801	1	0	11

its typhoid record for that time, and is selected because of the close similarity of its conditions of service to those of the Maneuver Division. The two divisions were encamped in nearly the same latitude and for about the same length of time, each had a good camp site and an artesian water-supply of unimpeachable purity. While the period in camp of the Second Division, Seventh Army Corps was later in the year, the number of men involved is larger for the Maneuver Division. The accompanying table referring to the former is taken

from the celebrated "Report on Typhoid Fever in U. S. Military Camps in the Spanish War," by Reed, Vaughan and Shakespeare, Vol. 1, page 609.

The troops remained in their several camps from March 10, 1911, to the middle of July, a period of approximately four months, and during that time there were two cases of typhoid with no deaths.

As the divisional camp at San Antonio was the largest and best known of the maneuver camps the interest of the public has centered on it. Any one who visited it or who has kept in touch with the improvements in field sanitation knows that all the elements which tend to affect the health of men under canvas were controlled better than they ever have been before. The sanitary difficulties of camp life arise mainly from the lack of sewer- and water-systems and the necessity of developing a scavenger system. Another source of great trouble arises from the necessity of living on the same ground and in close contact with innumerable animals; at San Antonio there were 6,000 horses and mules in temporary corrals, and on picket lines scattered here and there among the troops. The arrangement of a cavalry or horse artillery camp brings a line of horses in close proximity to each row of tents; the necessary horses of each infantry regiment or ambulance company are picketed close to the troops to insure their proper care.

It is a simple matter to pipe a water-supply into camp, but troublesome to dispose of the wastes; and many expedients have been devised to overcome such difficulties. The camp at San Antonio is noteworthy as exemplifying the best system so far devised for the disposal of camp wastes. One of the lessons taught by the Spanish War was the importance of the house-fly in the spread of intestinal diseases. The fly is dangerous merely as a carrier of infectious material from the latrines to the food-supplies and it remains a harmless nuisance, no matter how numerous, if it has access to neither of these things. Nevertheless, the simplest way of circumventing the fly is to exterminate it by destroying its breeding-places and this was done most thoroughly at San Antonio. As its principal breeding-place is in stable-wastes, arrangements were made in advance for carting all manure to a dumping ground about one mile from camp, where it was burned under the supervision of enlisted men of the medical department. Flies, however, will breed not only in manure, but also in soil soaked with excreta and other organic matter, and the destruction of ova and larva was accomplished by frequently burning over the picket lines with crude oil and refuse forage. As a result, the number of flies, at first rather large, tended constantly to diminish.

No single measure, however good, is sufficient in dealing with this ubiquitous pest; kitchens and mess tents were screened, and kitchen wastes, both liquid and solid, were disposed of in what has come to be known as the kitchen crematory. This is merely a pit 1 foot deep, 2½ feet wide and 4½ feet long, walled up for 1 foot and lined with a layer of cobble-stones. In this simple contrivance all the liquid and solid wastes, except the bath and wash water, can be consumed.

The disposal of excreta in camps⁸ in recent years, more especially since the Spanish War, has passed through three stages, the latrine pit, the Reed trough, with excavator attachment, and the so-called incinerator. In the old latrine pit no attempt was made to treat the excreta, except perhaps by the desultory application of a little earth or lime, and this system has been justly

7. Kean: THE JOURNAL A. M. A., Aug. 26, 1911, p. 713.

8. Ann. Report of the Surgeon-General, U. S. Army, 1911.

condemned and cast aside. The Reed trough, with its leaky excavator, long haul, attendant stream of soil pollution and enforced abandonment in freezing weather, has also failed to meet the requirements. The incinerator, aside from the matter of expense and disagreeable odor is, on account of its weight and the delays attending its installation, impossible as a part of the equipment of a mobile army. In the camp at San Antonio the excreta were successfully disposed of by using a narrow latrine pit, 18 to 24 inches in width, covered by a tightly fitting wooden box with self-closing seat covers. The contents of the pit were sterilized daily by fire, using a gallon of crude oil sprinkled over a thin layer of hay for each burning and this was sufficient even after three months' constant use to rid the latrines of odor and flies.

No camp has ever been so free from nuisances and flies as this, and the sick-rate from all causes was low; consequently, there were those who questioned the true value of vaccination in preventing typhoid. The point is important and with the data at hand the answer should not be difficult.

There is no doubt but that the hygiene and health of the men received almost ideal care; the difficulty was, however, that the men were not confined to camp, but had liberty and opportunity to visit the neighboring cities of San Antonio and Galveston. Thousands spent more or less time in these cities, where they dined and lunched and drank and slept—in fact, became, for the time being, a part of the community. In Galveston, especially, where a ten minutes' ride carried one from the camp to the heart of the city, the number of men visiting town was large. The soldier always has a good appetite, and he drank and ate everywhere, in good restaurants and bad, in the numerous lunch-wagons and at street-corner stands. Fruits and pies and sweets in enormous quantities were purchased of hucksters lined up along the camp boundaries; they even invaded the company streets carrying their various sorts of indigestible and infectious products from tent to tent. The best kind of camp sanitation could not keep down typhoid in the presence of all these possible chances of infection, if typhoid existed to any extent among the local population.

During this period of four months there were reported to the health office forty-nine cases of typhoid with nineteen deaths among the civil population of the city of San Antonio, and in Galveston, 192 cases were recorded during the same period. These two cities can therefore serve as controls and indicate what might have happened to our troops in the absence of vaccination.

Aside from the sources of infection in the adjoining cities, we must believe that the men were also exposed to the influence of an unknown number of chronic bacillus-carriers among our own men. There is every reason to believe that among 18,000 men there were one or more carriers in each regiment, yet they spread no disease, and one of the most important conclusions to be drawn from our recent experience is that in vaccination we have the only effective protection against the elusive carrier.

Another experience which may help us in forming an opinion has been related by Major Lyster.⁹ The Eleventh United States Cavalry participated in a military tournament in Nashville, Tenn., lasting ten days, and, on the return to Fort Oglethorpe, Ga., typhoid appeared and spread until ten cases had occurred. At this time only 165 of the command had been immunized. The

post commander therefore took measures which resulted in the immunization of 736 persons in the regiment and of seventy civilians at the post. The epidemic promptly ceased on completion of the immunization and soon afterward the regiment, with the exception of one troop, left the post on a twenty-one-day march, going to Knoxville, Tenn., and return, some 300 miles. Major Lyster says:

There was no attempt to boil or sterilize the drinking-water used on this march, the supply being from whatever was used locally. On the return of the command, after spending twenty-one days in a country where typhoid is prevalent practically throughout the year and living under war conditions, the sick report was stated by the commanding officer to have been *nil*. No subsequent cases of typhoid developed. While from the nature of the experiment the result is only presumptive evidence in favor of inoculation it cannot well be made conclusive for obvious reasons.

Viewed in the light of our recent experience in Texas and on the Mexican border, it is perfectly apparent that the regiment owed its freedom from typhoid to the prophylactic treatment it had received before the march began.

The duration of the immunity following vaccination still remains a subject for speculation. Colonel Firth¹⁰ concluded from statistics recently collected in India that the degree of immunity begins to diminish between the second and third years after vaccination, and in order to maintain the troops in a maximum state of resistance he recommends reinoculation after two and one-half years. His tables also show that even after the fourth and fifth years considerable immunity remains, as the rate per thousand is roughly only one-fourth of that of unprotected troops. In our own service, the measure is of too recent introduction for any conclusions to be drawn. Up to the end of September, we had vaccinated 81,340 men, and among these only twelve cases of typhoid, with no deaths, had been reported. Since three doses are used in our service (in the English only two) of a somewhat different vaccine, we expect the protection to exceed that obtained in India.

The effect on the morbidity from this disease for the entire Army is now becoming apparent; the admission and death-rate for 1910 were the best as yet recorded, and in the year 1911 the number of admissions had fallen to one-quarter (from 2.4 per thousand to 0.6) of that of last year; there is also some improvement in the death-rate. There were only forty-five cases in the Army in the United States during 1911, and seven of these were contracted before enlistment or while on furlough. As this has been a year of unusual exposure this reduction in the amount of fever is a source of considerable satisfaction. The significance of this low rate appears when a comparison with preceding years is made; in 1909 there were 173 cases and sixteen deaths; in 1910, 143 cases and ten deaths, and in 1911, forty-five cases and eight deaths.

We are, therefore, justified in believing that under the conditions encountered in the Army, vaccination is harmless and efficient.

In civil life, the conditions are somewhat different, being, in many ways, simple compared to those in the Army. In cities, all the general principles of sanitation can be put in force and there may not be the same urgent reasons for universal vaccination as exist in the Army, yet there is no doubt but that vaccination would diminish greatly the amount of typhoid. There is no

9. Lyster: Mil. Surgeon, 1911, xxviii, 528.

10. Firth: Jour. Roy. Army Med. Corps, 1911, xvi, 589.

conflict, moreover, between vaccination and general sanitary reforms; each has its sphere and, perhaps, in the far distant future, when sanitation is perfect, there may be little necessity for vaccination; in the meantime, in this and the succeeding four or five generations most of the typhoid now occurring in our cities and country districts can be prevented by vaccination. All whose duty or profession brings them into contact with the sick should certainly be vaccinated. Those especially exposed, as travelers, campers, engineers, plumbers and workers in industrial villages, should also be treated. We have found that children bear the immunization rather better than adults, as it seldom interferes with their play. They should be immunized if living in a district where the typhoid-rate is high, or before leaving a healthy city for a summer vacation. Contacts in houses or families in which a case of typhoid has developed should be vaccinated if they are well and free from fever at the time; not that a dose of vaccine would do any real harm even were the patient in the incubation stage of the disease, but should typhoid fever follow immediately after vaccination it would tend to discredit the procedure in the eyes of the public. On the appearance of an epidemic outbreak those in the infected area who have not already had the disease should be protected. This has been done many times and there is no convincing reason for fearing a negative phase or condition of increased susceptibility. Cullinan,¹¹ in 1901, vaccinated 500 persons at the Richmond Asylum, during an epidemic lasting five months, and among these only 1.36 per cent. contracted the disease, and almost all of these were in the incubation stage at the time, while 14.9 per cent. of 114 uninoculated nurses were attacked.

Leishman has related the following experience bearing on this point:¹²

To my mind, however, the most important evidence bearing on this question of the negative phase is to be sought, not in the laboratory but in actual practice; in other words, in a study of the evidence for and against any increased period of susceptibility to enteric fever in the case of men recently inoculated. I may say that, from a very early period, I felt that its dangers, if existent, must be trivial, for the following reason. At the time of the Maidstone epidemic, in 1897, a considerable number of inoculations were carried out by Sir A. E. Wright, Colonel Semple and myself on the attendants at the Barming Asylum, which at the time was heavily infected. Subsequent to our inoculations, which totalled about one hundred, other cases occurred, so that it was evident that our inoculations were done at a time when these attendants were still exposed to infection. The results of the inoculations in this instance were excellent, no case being recorded among the inoculated. Now here, if ever, we should have seen evidence of increased susceptibility if a negative phase was present in these attendants, inoculated as they were during the height of the epidemic; and, further, inoculated with doses of the vaccine considerably larger than are ever employed nowadays. Still no single case occurred, and I cannot help thinking that this points clearly in the direction of the safety of inoculating in the presence of the disease and is strong evidence that the dangers of a negative phase are more theoretical than real.

In this country, Richardson and Spooner¹³ vaccinated 100 nurses in the Massachusetts General Hospital while there were typhoid cases in the wards, with the result that for the first year in the history of the institution there were no cases among the nurses or attendants.

D. J. Davis, in Chicago, has had much the same experience, as has Lambert in the New York hospitals (personal communication). The same procedure has been carried out in many other hospitals and always with the same good results, and it is now proper to recognize that vaccination may be carried out in the presence of an epidemic. This has recently been done in Torrington, Conn., Guantanamo, Cuba, and several other places.

"Torrington has a population of about 17,000 people. Early in September typhoid fever broke out, the cause of which has been traced to an infected water-supply. Two hundred and twenty-seven cases of typhoid were reported in September, fifty-four in October, and five in November, a total of 286 cases with twenty deaths, not including patients infected there and taken sick elsewhere. Of the fifty-nine patients taken sick in October and November nearly if not all of them were secondary cases. At the onset of the epidemic some of the physicians advocated typhoid vaccination and between three and four hundred inoculations were made. The cases were all carefully selected and no inoculations were given to persons with fever or any indication of ill health. The physicians report that the usual history was a slight chill and rise of temperature, 99 to 100 F., with indefinite aches in the back and limbs for about twelve hours, and local swelling and soreness at site of inoculation. Some had no reaction whatever, and only in a few cases were the individuals indisposed for two or three days. The usual technic was followed, the inoculations being given ten days apart. No cases of typhoid occurred among the vaccinated except one man who developed the fever after his second inoculation and ran a mild and very short case of typhoid. Forty-five of the eighty nurses were vaccinated, the others refused it. Two cases developed among the unvaccinated nurses. One physician writes that at the outbreak of the epidemic he inoculated himself, wife and two children, and added, 'None of us experienced any ill effect and all had a feeling of safety in the depression and panic that pervaded the community.'"¹⁴

Since this report I have learned of one additional case among the unvaccinated nurses, making three out of the thirty-five refusing prophylactic immunization.

Antityphoid vaccine is also, I feel convinced, destined to play an important part in the treatment of typhoid fever. As an agent powerful enough to give the immunity it does against infection it can certainly be counted on to hasten the development of the immunity which brings with it cure and convalescence in typhoid.

CONCLUSIONS .

1. Antityphoid vaccination in healthy persons is a harmless procedure.
2. It confers almost absolute immunity against infection.
3. It is the principal cause of the immunity of our troops against typhoid in the recent Texas maneuvers.
4. The duration of the immunity is not yet determined, but is assuredly two and one-half years, and probably longer.
5. Only in exceptional instances does its administration cause an appreciable degree of personal discomfort.
6. It apparently protects against the chronic bacillus-carrier, and is, at present, the only known means by which a person can be protected against typhoid under all conditions.
7. All persons whose professions or duty involves contact with the sick should be immunized.
8. The general vaccination of an entire community is feasible and could be done without interfering with general sanitary improvements, and should be urged wherever the typhoid-rate is high.

11. Quoted by Wright: *Brit. Med. Jour.*, Oct. 20, 1901, p. 1226.

12. Leishman: *Harben Lecture, Jour. Roy. Inst. Pub. Health, London, 1910, xviii, 515.*

13. Richardson and Spooner: *Boston Med. and Surg. Jour.*, 1911, clix, 8.

14. *Monthly Bulletin Connecticut State Board of Health, November, 1911.*