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Local & Munl. (1898) Department.

MISCELLANEOUS.

G.O., No. 258-M.

DATED 29-1-98

INDEXED. *CR*

[Despatch Abstract.]

Bubonic Plague

Recording letter from the Govt of Ind-
forwarding for information copy of lett
from M^{rs}. W. M. Haffkine, suggesting
a system of preventive inoculation aga
plague on an extensive scale.

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BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

Local & Munl. (1898) Department.

CURRENT No. 399 M

From The Under Secretary to the Govt. of India

His Order No. 258 His D 27.1.98

Recorded

18
27/1/98

28/1/98

No. 122

Dated 19.1.98

Received 25.1.98

Registered 25.1.98

Enclosures 2

Spare copies.

SUBJECT.

Note

The joint report by Mons. W. M. Hoffmann and Captain Major Lyons on the effect of preventive inoculation in Lome, Damaun has already been printed & circulated in S.O. 2521 N. D. 26-11-97.

Forwarding for information copy of letter from Mons. W. M. Hoffmann suggesting a system for preventive inoculation against plague on an extensive scale.

BACK PAPERS.

G.O.	No.	Department.	Date.
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"	2446	His	6-4-97
"	2448	"	6-4-97

FURTHER PAPERS.

G.O.	No.	Department.	Date.

Dated Hardwar, the 20th November 1897.

From—Mons. W. M. HAPKINE,

To—The Secretary to the Government of India, Home Department.

I HAVE the honour to submit a Report, by Surgeon-Major Lyons and myself, on the epidemic of plague in Lower Damaon and on the effect of preventive inoculation there.

The delay in forwarding this report was due to the fact that, while the observations collected in Damaon were being studied and classified, two epidemics occurred, one after another, in Lanowlie and in Kirkee, in conditions which permitted of making a very accurate investigation on the effect of inoculation. I decided to delay the preparation of the present report, and to take immediate advantage of the two outbreaks, for repeating the experiments made in Damaon, and verifying, for a second and for a third time, the results obtained in the former place.

In both epidemics just referred to, as will be seen from the reports to follow, the results were slightly below those obtained in Damaon, which was due to my having been unable, while away in the affected districts, to renew the stock of lymph stored up in Bombay, and to my having had to use material of (gradually) inferior quality, when the stronger was exhausted. The effect differed, however, inconsiderably, and represented, in Damaon, as will be seen from the adjoined report, a reduction of 89.2, per cent. of the plague mortality, in Lanowlie a reduction of 85.7 per cent., and in Kirkee of 77.9 per cent.

2. I beg, Sir, to point out, in the submitted report, the following features: the great readiness and spontaneity with which the population came forward for inoculation, without any pressure being brought to bear upon them, except that of the dreaded disease; the rapidity with which the effect of the treatment was perceived and appreciated, and the fact that one assistant, deputed to the place, was able to inoculate, in a few days, large numbers of people, the inhabitants providing all the necessary accommodation and help. When compared with the circumstances connected with the attempts at destroying the bacilli of plague in villages and in big towns, and at keeping the sick and the healthy away from each other, and from the infected localities, the method of combatting the epidemic by inoculation presents inestimable facilities.

3. I shall submit my full reports on the operations in Lanowlie and Kirkee—in order to confirm the conviction which imposes itself on studying the Damaon epidemic—as early as my present absence from my office, and the time required for compiling the documents, will allow me. In view, however, of the great urgency of the case, I believe it opportune to consider, from the present, the possibility of Government deciding to introduce preventive inoculation as a means of combatting the plague, on lines similar to vaccination,—combining this method, in the commencement, with other measures, but assigning to it, in the programme, a very important part. I give, therefore, below a brief sketch of the organisation necessary for that—

(a) The staff sufficient for securing a supply of lymph for India would consist of:—

one Commissioned Medical Officer, as a permanent assistant, who will be trained to carry out and supervise all the Laboratory preparations connected with the plague prophylactic;

one Military Assistant Surgeon;

one Apothecary;

one Clerk;

two Laboratory boys;

one Peon, for packing and despatching of parcels, and

one Hamal.

I suppose, of course, that the above staff will be free from any work connected with the actual inoculations, or from any investigation duty, and will devote undividedly their whole time to the manufacturing of lymph.

(b) The raw materials necessary for the preparation of one hundred doses of lymph cost below Rs.

(c) In case the Laboratory remains in Bombay, a house for its accommodation, containing 30 rooms, provided with gas and water, with an extensive compound and several out-houses and stables, is placed at our disposal, free of charge, by His Highness Aga Khan, in a suitable locality of Bombay. If the Laboratory is located elsewhere, accommodation will be required of ten rooms, for the preparation and storing up of the plague prophylactic, and of another half dozen rooms for carrying on investigation work.

(d) The actual inoculation should be carried on by the flying columns, or parties at present engaged in combatting the plague in the affected districts, and which, with regard to the inoculations, should be subject to the same regulations as are in force for vaccination against small-pox. It is desirable that, in the beginning, in every new place, the inoculations should be started by a Commissioned Medical Officer, whom I shall guide personally in his first set of operations, and whose duty it should be to keep my office informed on the effect produced upon the epidemic. Afterwards, and very soon, the operations will be entrusted to an Assistant Surgeon or a Hospital Assistant.

4. I propose, unless you advise me to the contrary, to remain in Hardwar for the time necessary for ascertaining whether the disease contracted by the monkeys, and which caused only an insignificant mortality among them, is the same as the bubonic plague in men; and to return to Bombay after that.

Joint Report on the Epidemic of Plague in Lower Damaun, Portuguese India, and on the effect of Preventive Inoculation there.

BY

MONS. W. M. HAFFKINE

AND

SURGEON-MAJOR LYONS, I.M.S., *President,*
Government Committee for Investigation of the Bubonic Plague in Bombay.

The plague prophylactic referred to in the present report has been described by Mons. W. M. Haffkine in the "British Medical Journal," May 1897, and in the "Indian Medical Gazette," June 1897.

The facts reported here have been collected by Professors Koch and Gaffky, the heads of the German Scientific Mission to Bombay, and Monsieur Haffkine, on a visit to Damaun on the 20th and 21st May last; at the end of the same month a house-to-house visitation at Damaun was undertaken and carried out, at Monsieur Haffkine's request, by Surgeon-Major Lyons, President of the Bubonic Plague Research Committee, in order to complete, by exact details, the information gathered on the first visit.

At the German Scientists and Monsieur Haffkine's inquiry at Damaun, their informants were:

His Excellency Col. J. P. KUCHENBUCK VILLAR, Governor of Damaun;
Mr. JUDGE, Assistant Collector, Salt and Revenue Department, in charge of the Preventive Police and the Plague operations on the Damaun Frontier;
Shet SORABJEE MANOCKJEE DAMAUNWALLA, head of the Parsee community, assisted by his Secretary;
Dr. VIRGILIO POIARES, Physician in charge of the Plague Hospital;
Dr. PROENÇA, Health Officer;
Dr. PINTO, in charge of the Plague Operations in Damaun Town; and
Dr. DA CUNHA, L.R.C.P. (Edinburgh),
Dr. MONIZ, L.M.S., and
Dr. FERNANDEZ, } Medical Practitioners of Damaun.

The Medical Officers abovementioned were assembled, on the 20th May 1897, by H. E. the Governor, who was also present, and to whom we are indebted for affording every facility for making the enquiry complete. The general information given below, in the preliminary part of this report, was reported at this meeting and was supplemented by documents from the respective offices.

The history of the Damaun epidemic appears to be as follows—

The town of Damaun is divided by a river into two parts: Lower Damaun, the largest business part of the town; and the Fort, or Upper Damaun, where the Government house and the Government offices are situated.

will be

1/29 May 1898

(b) The raw materials necessary for the proper, having, in ordinary times, a doses of 1,500 inhabitants; Katheria, the property of Shet Sorabjee Damaunwalla, with a population of 4,700; and Khadiwadi, with a population of 1,200. This part of the town was in active business communication with the Bombay Presidency, and is densely populated, the inhabitants living in small houses crowded together. The Fort was cut off by a cordon from Lower Damaun as soon as the epidemic began to increase in proportion, and had only some 1 dozen imported cases.

The first attacks came to notice in February last, and occurred amongst new arrivals from Bulsar, a neighbouring town which was badly affected at the time, and amongst sailors from Kurrachee arriving at Damaun by sea, in native crafts. Before the end of the same month local cases began to appear among the fishermen, who have their *busti* close to the river, where crafts are moored, behind the Damaun Municipal School. In the last days of the month a hurried exodus of people began from Lower Damaun, increasing daily as the epidemic gained in intensity, until, on the 23rd of March, the Governor placed a cordon along the river, and stopped communication between the Lower and Upper parts of the town; while a week later, on the 30th March, the Bombay Government, on their part, closed British territory to the inhabitants of Damaun. By this time, it was estimated, over 2,000 people had quitted the place.

The worst period of the epidemic corresponded to the month following the closing of the Damaun frontiers. The climax was reached in the middle of April, when the daily number of deaths remained stationary for about 8 days and then began to decline. The largest number of deaths which occurred in one day was 80.

Up to the 25th of April the daily mortality, which was closely watched by the Parsee community who kept peons on the burial and burning grounds, was recorded officially from the information given by the inhabitants coming to the Registration Office to declare cases of deaths in their families. On the 25th April, the Governor placed a guard of his own on the burial and burning grounds, and on that day, though the number of deaths reported by the inhabitants was 11, the number of bodies disposed of in the presence of the guard was 34. From the above date the Governor's guard was kept permanently on the grounds, and the official information became complete. The following is the number of bodies registered by this means from the 25th April up to the date of investigation:—

25th April 1897	34	8th May 1897	33
26th "	31	9th "	18
27th "	21	10th "	24
28th "	49	11th "	27
29th "	41	12th "	15
30th "	58	13th "	13
		14th "	17
1st May 1897	41	15th "	13
2nd "	22	16th "	20
3rd "	29	17th "	6
4th "	47	18th "	8
5th "	33	19th "	13
6th "	31		
7th "	31	25 days.	675 deaths.

and 19th May 1897, at a time when the mortality had dropped to 8 a day, by desertion and death, and when the mortality had dropped to 8 a day. Damaun, total number of bodies disposed of was 675, giving an average of 25 deaths a day. His Excellency the Governor and the medical gentlemen present at the meeting stated that they would be well within the real figure if they estimated the number of deaths which occurred in the fully populated town, in the first period and during the height of the epidemic, i.e., up to the time of placing the guard, at an average of 30 a day, counting from the 1st March and neglecting the mortality before that date. This estimate gives a total of 2,325 deaths as having occurred in Damaun from the beginning of the epidemic up to the time of the Scientific Committee's visit. Of this number, 2,093 deaths were afterwards authenticated in the particular families where they had taken place, during a house-to-house enquiry instituted by Shet Sorabjee Damaunwalla, the owner of Katheria.*

As the immunity of the inoculated in Damaun will be estimated from a comparison with the mortality in the uninoculated population, it is essential, in order to avoid the possibility of exaggerating the power of inoculation, to take for guidance the lowest figure admissible as representing the real death-rate in the place. In the following calculations, therefore, the number of deaths from plague which occurred in Damaun from the commencement of the epidemic up to the visit of the Scientific Committee is accepted as 2,093, which is the number authenticated by an enquiry in each of the affected families. This figure gives an average daily mortality from the commencement of the epidemic up to the time of placing guards on the burial and burning grounds, as being close upon 26 deaths a day. From the 21st of May up to the end of the same month, that is to say, up to the date when Surgeon-Major Lyons concluded the additional inquiry, of which the details are given below, there occurred 96 deaths more, giving a total of 2,189 deaths from plague which took place in Damaun during the period under observation.

In this number of deaths there were 24 in those inoculated, personally observed by the Medical Officers of the place; plus a small number of others of

* The number of deaths from plague which took place during the whole epidemic up to the end of July, and a record of which could be obtained by an enquiry in the households, was 2,352 and was distributed amongst the different castes inhabiting Damaun as follows:—

Parsees	6	Tailors	48
Brahmins	26	Ghatia	21
Parbhias	4	Potters	16
Shrawaks	11	Portuguese	34
Banias	23	Dhandarees	22
Lohannas	4	Bhayas	5
Gujrathi Goldsmiths	15	Bhatell	1
Daxini Goldsmiths	80	Dhobis	16
Hindu Barbers	27	Moobis	23
Khatris	87	Kolis	19
Coppersmiths	11	Borahs	5
Machis	600	Khojas	4
Carpenters	104	Lohars	13
Mussalmans	240	Mangals	7
Golas	108	Hindoo Low Castes	351
Chhipas	23	Caste unknown	200
		TOTAL	2,352

which they knew, but which they had not seen personally. 15 deaths of the 24 were reported by Dr. Moniz, who was said to have treated the largest number of plague patients in the place; 4 by Dr. Poiars, who also saw 4 other cases which recovered; 3 cases by Dr. Proença, all of whom recovered (these had been seen also by Dr. DaCunha); 3 deaths were known to Dr. DaCunha, and 2 to Dr. Pinto (in addition to one mentioned by Dr. Moniz which Dr. Pinto had seen with him).

Considering the small extent of the town, the limited number of inhabitants, and the number of Medical Officers who were looking after the place, it appeared probable that not many attacks among the inoculated, escaped their notice, as such attacks usually excite much comment amongst the inhabitants and attract general attention. Indeed, the gentlemen present at the meeting seemed to know between them every place in the town where inoculated people lived, and every house which had suffered from plague or happened to have escaped. As has been mentioned already, they stated at the time that there was a small number of inoculated attacked whom they did not see, but of whom, they informed us, a record existed in the office of Shet Sorabjee Damaunwalla, where, during the plague, a dispensary was opened for distributing gratuitous medicines to the affected population.

It was on the initiative of that Parsee gentleman that the inoculations were introduced. He had a personal knowledge of the people who were inoculated, and kept a watch over the effect of the operation, collecting, with the help of his office establishment, a large number of details in this connection.

From his information it appeared that the total number of deaths amongst the inoculated was under 40, each of the cases being known to him; that amongst those inoculated in a first series of inoculation, done in March last, a smaller proportion got affected and died than amongst those done a month later; and that in a series of inoculations carried out by the Physician in charge of the Damaun Plague Hospital, with lymph supplied from our Bombay Laboratory, the number of attacks was larger than amongst those inoculated by Dr. Kalapesi, Dr. Haffkine's assistant, sent from the Laboratory. These details were found afterwards, in the course of the close investigation carried out by us, to be scrupulously correct.

Mr. Sorabjee had also a guard of his own kept on the burial and burning grounds, watching the course of the mortality, and his information concurred with the statements recorded above. The number of people inoculated up to the time of the Scientific Committee's visit was 1,645; over four times that number remained uninoculated. The latter had lost from plague close upon one-third of their number, and, he considered, there could be no doubt that the inoculated exhibited a most striking degree of immunity.

The effects of inoculation were closely watched by the inhabitants, as will be seen from the following observations which they brought to our notice.

There were altogether 306 Parsees in Lower Damaun, including males, females and children. Of these, 276 were inoculated twice, and one once, all the

particulars being given in our inoculation register. The names and particulars of the 29 who remained uninoculated were supplied to us on the spot. The attacks and casualties from plague which occurred in the two groups after the introduction of inoculation are given below.* No deaths from any other cause occurred in the community from the beginning of the epidemic.

Occurrences of plague amongst the 277 inoculated Parsees.

- (1) Jerbai, wife of Manekji Bacha, age 35, belonging to a well-to-do family; was five months pregnant; inoculated once on 17th April 1897, in the right arm. For about 24 hours before, she had fever and pain in the groin, but this was not known at the time of inoculation. Developed characteristic plague in the evening of the day of inoculation had an abortion on 20th morning, died same day.
- (2) Seven other Parsees inoculated were attacked, respectively, three days, one week, twelve days, a fortnight, one month, one month and five weeks after inoculation, but all these recovered.

Occurrences of plague amongst the 29 uninoculated Parsees.

- (1) Nanabhai Jivajee, male, age 60, belonging to a well-to-do family where all the other members (14 in number), except himself, were inoculated. Attacked on 16th April 1897; bubo in left groin; died on 20th.
- (2) Merbai, daughter of Bairamjee, age 20 years, of a well-to-do family, where eight members were inoculated and four, including Merbai, were not inoculated; attacked about same time as Nanabhai Jivajee; bubo in right groin; died on 20th April.
- (3) Ratanbai Ratanjee, female, age 35, of a well-to-do family; attacked and died in the first days of May 1897, having had fever and a bubo.
- (4) An old woman, Avabai, widow of Rustomjee, age about 75 years, of a well-to-do family, where fourteen others were inoculated, Avabai and Gulbai, her daughter-in-law, being the only uninoculated. Avabai got attacked on 11th May, developed bubo two days later, died on the 13th.

Thus in the 29 uninoculated Parsees there were 4 deaths from plague, or a mortality of 13.8 per cent., while in the 277 inoculated there were 8 attacks with only 1 death, the one who died being a woman attacked *before* inoculation, and the mortality thus produced in the inoculated being 0.36 per cent., or 38.3 times lower than in the uninoculated.

Another significant instance, in a limited number of people, was furnished by the servants belonging to Shet Sorabjee's house and to his garden. There are 50 servants in the house where he lives and about 150 in his garden, half a mile distant from the house. Round the garden the epidemic was raging violently. Of the whole number of servants one, a deformed individual, remained uninoculated, all the others were inoculated twice. Plague appeared among the servants on the 16th May when the only person uninoculated was attacked and succumbed on the 19th; the total number of inoculated lost also one, a child of 4 years.

The other instances given were in isolated families and referred to smaller numbers of people.

The German Commissioners completed this part of the inquiry by collecting information as to the soil of Upper and Lower Damaun, the hydrographic and climatic conditions obtaining in both, their comparative hygienic circumstances, etc. The facts supplied on these points were of an approximate character. The Committee returned to Bombay on the morning of the 22nd May.

* See also attached Rolls.

Surgeon-Major Lyons went to Lower Damaun on the 26th May 1897, the object of his visit being to find out accurately, by a minute inquiry in each house, the number of deaths which occurred amongst those inoculated. For this purpose he divided the town into 4 sections, and during 4 days between the 26th and 30th May 1897, visited all the houses, section by section. And as a number of dwellings had been vacated and the inhabitants encamped in the fields outside the town, Dr. Lyons visited them in their encampments and collected information from all of them. The frontier around the town being closed and guarded by a British and a Portuguese cordon, the conditions for collecting the necessary information were particularly complete.

In this manner Dr. Lyons collected the history of 33 deaths and 54 attacks with recovery which had occurred in the inoculated up to the 19th May (the time of the Scientific Committee's visit), and of 3 deaths* and 1 attack with recovery which occurred between that date and the 31st of May inclusive.

In the appendix are reproduced 88 "Investigation sheets" filled up by Dr. Lyons during the house-to-house visitation, as well as one sent afterwards by His Excellency the Governor. Each of the investigation sheets contains particulars of a house where inoculated people lived, and where cases of plague had occurred, either among the inoculated or the uninoculated members of the family. These sheets, therefore, do not make mention of the inoculated households where no cases of plague occurred, nor of any of the attacked houses where there were no inoculated persons.

Comparative Analysis of the Mortality from Plague in Lower Damaun, in the inoculated and uninoculated between the 26th March and the end of May 1897.

The inoculations in Damaun were done in four series:

First Series.—Between the 23rd and 26th March 1897, 846 persons were inoculated by Dr. R. M. Kalapesi, who was sent from the Laboratory, and between the 4th and 7th April, 171 persons by the Portuguese Physician in charge of the Plague Hospital in Damaun, Dr. Virgilio Poiarés, who was supplied with material also from the Bombay Laboratory. The lymph used by Drs. Kalapesi and Poiarés on that occasion, as will be described later on, was prepared from a strong virus, and produced a high febrile reaction when injected in the prescribed small standard doses. The operations of these two gentlemen differed in that Dr. Poiarés gave doses much weaker than those given by Dr. Kalapesi, as is shown by the detailed records of their operations. It will be observed from the results given below that, though Dr. Poiarés' patients appear to have given a considerable reduction of mortality when compared with the rest of the population, the results from his small doses were lower than those obtained from the same material given in larger doses.

Second Series.—A few weeks after the first series, the demand for further inoculations coming from Damaun became exceedingly persistent, as was the case, after an interval, in the six other places where inoculations were performed,—in

* In this number of 3 deaths is included one additional, in the person of Ghopal Bicaris, 9 years, communicated by Dr. Fernandez through H. E. the Governor of Damaun.

Bombay, Mora, Damaun, Poona, Balsar and Tarapore; and though the Laboratory had run short of strong material, Dr. Kalapesi was deputed again, with a much weaker lymph than that used on the first occasion, as will be detailed later on. Between the 17th and 27th April, *i.e.*, about a month after his first visit, he performed 529 fresh inoculations, and between the 24th April and 2nd May 1897, 99 more were done by Dr. Poiarés with a similar material obtained for him from the Bombay Laboratory by the Bombay Portuguese Consulate. The lymph used on this occasion, even when injected in doses 2 to 3 times larger than the standard ones, failed to produce marked rise of temperature, though it caused considerable local reaction. As will be seen below, both Dr. Kalapesi's and Dr. Poiarés' operations, on this occasion, gave a smaller lowering of mortality than those previously performed, though they had both been working with increased doses.

Third Series.—Between the 21st and 23rd of May Dr. Kalapesi inoculated 362 persons with a similarly weak lymph, while Dr. DaCunha, another Portuguese Physician, who had been working in Damaun with Dr. Kalapesi, inoculated 190 persons with the same material.

Fourth Series.—Lastly, in August last, Dr. DaCunha inoculated over 100 persons with material supplied to him from the Bombay Laboratory.

Thus, altogether 2,297 persons were inoculated in Lower Damaun.

The visit of the Scientific Committee coincided with the time of the third series of inoculation, and Dr. Lyons' investigation extended to twelve days later, when the worst part of the epidemic was over, and the daily mortality had come down to below a dozen a day. The present analysis refers, therefore, to the occurrence of attacks and deaths amongst the 2,197 inoculated on the first three occasions, and is divided into three periods of observation, the first corresponding to the interval between the first and second series of inoculations, the second to the interval between the second and third series, and the third to the interval between the third series and the end of the month of May 1897, when the investigation was concluded.

First Period (between the First and Second Series of Inoculations).

At the time when the first series of inoculations was completed, the 26th March 1897, the total number of inhabitants in the affected villages of Damaun, namely 10,900, had been reduced by 670, who had died of plague before that time, and by about 2,000 who had left the place before the closing of the frontiers.

Of the 8,230 remaining, 846 were inoculated by Dr. Kalapesi and 171 by Dr. Poiarés in their first series of inoculations, while 7,213 remained uninoculated.

From that time up to the time when the second series of inoculations was completed, *i.e.*, the 23rd of April, the following were the occurrences in the respective groups of people:—

- (a) Amongst the 846 inoculated by Dr. Kalapesi, there were 17 cases with 3 deaths.* (Total mortality, 0.4 per cent.; case mortality, *i.e.*, percentage of deaths to attacks, 17.6 per cent.)

*See attached Rolls.

(b) Amongst the 171 inoculated by Dr. Poiares, there were 6 cases with 3 deaths.* (Total mortality, 1.8 per cent.; case mortality, 50 per cent.)

(c) Amongst the 7,213 uninoculated, there were 716 deaths.† (Total mortality, 9.9 per cent.)

It will be seen that, if the 1,017 inoculated had exhibited the same susceptibility for plague as the uninoculated, and had had the same mortality of 9.9 per cent., the number of deaths amongst them would have been 101 instead of 6, a difference of 91.1 per cent.

Second Period (between the Second Series of inoculation and the Third Series, or the time of the Scientific Committee's visit).

By the time when the second series of inoculations was completed, the number of those inoculated by Dr. Kalapesi had decreased by the 3 deaths mentioned above, and increased by 529 newly inoculated, giving a total of 1,372.

The number of inoculated by Dr. Poiares had decreased by 3 deaths, and increased by 99 newly inoculated, giving a total of 267.

The number of uninoculated had decreased by 716 deaths and by the 628 newly inoculated, leaving a total of 5,869 uninoculated.

From the time of the second series of inoculations up to the time of the Scientific Committee's visit, viz., 19th of May last, the following were the occurrences in the three groups:

(a) Amongst the 1,372 inoculated by Dr. Kalapesi, there were 52 cases with 18 deaths.* (Total mortality, 1.3 per cent.; case mortality, 34.6 per cent.)

(b) Amongst the 267 inoculated by Dr. Poiares, there were 12 cases with 9 deaths.* (Total mortality, 3.3 per cent.; case mortality, 75 per cent.).

(c) Amongst the 5,869 uninoculated, there were 674 deaths. (Total mortality, 11.5 per cent.)

It will be observed that, if during the second period of observation the 1,639 inoculated had had the same mortality as the 5,869 uninoculated, they should have lost 188 instead of 27, which represents a difference of 85.6 per cent.

Third Period (between the Third Series of inoculations and the end of May, or the time when Surgeon-Major Lyons concluded his investigation).

At the time of the Scientific Committee's visit to Damaun, the number of inoculated by Dr. Kalapesi had decreased by 18 deaths, and increased by 552 inoculated by him and Dr. DaCunha, giving a total of 1,906.

The number of inoculated by Dr. Poiares had decreased by 9 deaths, leaving a total of 258 inoculated.

* See attached Rolls.

† As a matter of fact, much more than that, the figure 716 deaths, 9.9 per cent., implying that during the initial three weeks of the epidemic, before the introduction of inoculation and during the first period of 4 weeks after the inoculations, the worst period in the whole epidemic, the mortality was uniform, 36 deaths a day, which, of course was not the case.

The number of uninoculated had decreased by 674 deaths and by 552 who got themselves inoculated, leaving 4,643 uninoculated.

During the 12 days which elapsed till Dr. Lyons completed his investigation, these groups produced—

(a) The 1,906 inoculated by Dr. Kalapesi, 1 case with 1 death.* (Mortality 0.05 per cent.)

(b) The 258 inoculated by Dr. Poiares, 3 cases with 2 deaths.* (Mortality 0.8 per cent.)

(c) The 4,643 uninoculated—93 deaths. (Mortality 2 per cent.)

Calculating upon the death-rate amongst the uninoculated, the 2,164 inoculated should have had 43 deaths instead of the 3, which is a difference of 93 per cent.

During the three periods of observation put together, between the 26th March and the end of May, 6,033 uninoculated had 1,482 deaths (24.6 per cent.) while 2,197 inoculated had 36 deaths (1.6 per cent.). Calculating upon the death-rate among the uninoculated we have seen that the inoculated should have had altogether 332 deaths instead of 36. This represents a difference in mortality of 89.2 per cent.

Considering the large proportion in which the number of inoculated stands to the rest of the population (2,197 to 6,033), it is evidently impossible that the inoculated represented the upper, or any other particular, class of the population possessing a degree of personal or local immunity much different from that of the rest of the population, and to which their reduced death-rate could be ascribed.

This view is confirmed by the following comparison of the mortality which occurred in the inoculated and uninoculated persons belonging to the same families, who lived therefore under absolutely identical conditions of life.

In a large number of households the whole of the members of the family were inoculated, leaving none for comparison as regards susceptibility to the disease. This circumstance rendered it necessary to compare the whole inoculated population with the whole of the uninoculated population, as has been done above. However, in 62 of the inoculated families in which cases occurred, there were 124 persons who remained uninoculated, while the number of inoculated in these families was 250 (see attached Rolls). A comparison between this fraction of the inoculated population with their uninoculated relatives shows the following result:

124 uninoculated had 54 cases (43.5 per cent.) with 37 deaths (29.8 per cent., case mortality 68.5 per cent.).

250 inoculated had 50 cases (20 per cent.), with 20 deaths (8 per cent., case mortality 40 per cent.).

* See attached Rolls.

The inoculated households lived, therefore, under no specially immune conditions, as the mortality among their uninoculated members, 29·8 per cent., was 5·2 per cent. higher than the mortality in the general uninoculated population. This must invariably be the case, as only people from badly-affected or particularly-threatened localities present themselves for inoculation. It will be noticed also that this small number of 124 uninoculated had a mortality higher by 1 death than the total mortality sustained by the 2,197 inoculated inhabitants of Damaun; and that a comparison between the inoculated and uninoculated members of these families shows that if the 250 inoculated had exhibited the same susceptibility as their 124 uninoculated relatives, they should have had 75 deaths instead of 20, a difference of 73·3 per cent.*

A similar conclusion is arrived at on comparing the mortality in the Parsee community quoted above, and which shows that the inoculated members gave a reduction of 97·4 per cent. of deaths when compared with the uninoculated of the same community.

It has been mentioned that the lymph used in Damaun in the first series of inoculations was of an active stock, prepared from a highly virulent microbe, and produced a brisk febrile reaction when used in relatively small doses. Owing to the great pressure of work during the epidemic, no method for keeping up the strength of the plague bacilli has been worked out, and the microbe from which the plague lymph was manufactured was allowed to gradually sink in virulence till it became almost harmless when inoculated into rodents. It was lymph thus weakened that was used in the subsequent inoculations.

A comparison between the first and second series of inoculations † done with the strong and with the weak vaccines, respectively, shows a difference in result in direct correspondence with the difference in the material used, as will be seen from the following table ‡:—

1,017 inoculated on the first occasion had 49 cases (4·8 per cent.) with 15 deaths (1·5 per cent., case mortality 30·6 per cent.).

628 inoculated on the second occasion had 41 cases (6·5 per cent.) with 20 deaths (3·2 per cent., case mortality 48·8 per cent.).

The total mortality and the percentage of deaths to cases amongst the inoculated on the second occasion, though they were exposed to the risk of infection during the milder period of the epidemic, was, respectively, 2·2 and 1·6 times higher than amongst those inoculated on the first occasion.

Also as mentioned already, Dr. Poiars in his operations used doses considerably lower than those given by Dr. Kalapesi. The difference in the results

*As far as the small numbers from which the figure 73·3 per cent. is obtained permit of drawing conclusions, the comparison between this figure and 89·2 per cent. by which the mortality in the total inoculated population differed from the mortality in the total uninoculated, would seem to indicate that the presence of uninoculated members in a family reduces the safety of the inoculated, and that, like in small pox vaccination, the duty of the individual is to be inoculated for the safety of his neighbours in the community.

† The third series, done shortly before the conclusion of the observations, is left out of this comparison, only one death having occurred amongst those inoculated on the third occasion (see attached Rolls).

‡ See attached Rolls.

of these two groups of operations corresponded again to the difference in the method employed, as is seen below :—

Amongst the 1,924 inoculated by Dr. Kalapesi, there were 70 cases (3·6 per cent.) with 22 deaths (1·1 per cent., case mortality 31·4 per cent.).

Amongst the 270 inoculated by Dr. Poiars, there were 21 cases (7·8 per cent.) with 14 deaths (5·2 per cent., case mortality 66·7 per cent.).

Thus, amongst the inoculated with reduced doses, small though their death-rate (5·2 per cent.) was when compared with the death-rate in the uninoculated population (24·6 per cent.), the total mortality was 4·5 times and the case mortality 2·1 times higher than that amongst the inoculated with larger doses.

This variation of the results, answering faithfully to the variation in the strength of the lymph and in the doses given, shows the direct connection of cause and effect in the two series of facts, and makes it probable that it will be in our power to improve upon the results obtained in Damaun.

It also indicates, when the actual figures are examined, that the plague prophylactic has a greater influence upon the number of deaths than upon the number of attacks. This result repeated itself in all the observations collected up to the present on the plague inoculation, and seems to stand in a comprehensible connection with the plan followed in working it out. If this surmise is correct, it will be in our will to effect a further reduction in the number of attacks by correspondingly modifying the composition of the plague prophylactic.

The above satisfactory results were obtained in one of the most virulent outbreaks that have been observed in India in the present epidemic, and during the 9 weeks which corresponded to the highest stage of that outbreak.

The question as to the final duration of the effect of the plague inoculation remains unsolved, but loses its urgent interest in view of the above results.

(Sd.) W. M. HAFFKINE.

(Sd.) R. W. S. LYONS, SURGN.-MAJOR, I.M.S.

Dated Bombay, the 22nd December 1897.

From—MON. W. M. HAPKINE.

To—The Secretary to the Government of India, Home Department.

In continuation of my letter to you, dated Hardwar, 23rd November 1897, I have addressed to-day to the Secretary to the Surgeon-General with the Government of Bombay the following letter:—

“I have the honour to invite your attention to the joint report on the epidemic of plague in Lower Damaon and on the effect of preventive inoculation there, by the President of the Bubonic Plague Research Committee and myself, sent to your address from Hardwar on the 18th November last, and to enquire whether any action is being contemplated with regard to the introduction of anti-plague inoculation in affected areas.

“It will be noted that the results of the inoculations done in Damaon are in conformity with those which were observed in the outbreak of plague in the Byculla House of Correction in January last, and with the information obtained from the inoculated in Bombay during the plague epidemic of the first part of this year. As you are aware, I have afterwards tested the method again in two subsequent epidemics at Lonavla and Kirkee, where the inoculations, according to my most careful enquiries, appear to have lowered the mortality not less than by 85.7 and 77.9 per cent. respectively. As far as it is permitted to judge from these results, we have in the inoculations an extremely powerful and rapidly acting weapon for combating the plague, the application of the method being incomparably easier and more certain than any machinery of isolation and disinfection which can ever be put in work in big centres of population. I believe, therefore, that it is a matter of very great urgency that a scheme should be considered and worked out for the gradual introduction of the inoculations, in all the affected areas, as the specific measure for combating the existing epidemic.

“I have scarcely to point out that the plague has now been raging in Poona for the past three months without any signs of diminution, and has resulted in the desertion of the largest part of the population and in the seizure of some 6,000 and the death of 4,500 people, in spite of the most earnest and persistent measures. There is in the Presidency a number of affected or closely threatened places of almost equal importance as Poona, such as Belgaum, Surat, Sholapur, the neighbourhood of Karad, Hubli, Wai. The initiative taken by His Highness Aga Khan with regard to the plague in Poona and the introduction of preventive inoculation there by means of hired outside agents; the attached copies of a letter by the Municipal Commissioner for the City of Bombay; of a telegram from Surgeon-Major Foreman, Belgaum; of a letter from Mr. Vyankatesh R. Mudholkar, Editor of *Vaidharbha*, and Dr. Ramchandra N. Mudholkar, Brahmin gentlemen from Amraoti; of a letter from Mr. Prabhakar Vasudeo Nitkar, Brahmin gentleman from Poona, are persistent indications that people ask for help, which, under the present conditions, without any organisation existing for carrying out the inoculations, it is impossible for us to render.

“I beg, therefore, to request the favour of the Surgeon-General considering the feasibility of the following suggestions:—

“A certain number of responsible officers should be appointed to carry out the inoculations in the affected districts, and, if possible, the selection should at first be made either from amongst the officers of the Indian Medical Staff or the medical men sent out lately from England by the Secretary of State for plague duty here. To assist them in dealing with the people and also in keeping detailed records of their operations, it would be sufficient to provide each of them with a competent clerk as interpreter. In the course of their work these gentlemen can instruct in carrying on the inoculations private practitioners (European and Native Officers of the Subordinate Medical Service, to whom the work may be handed over later on, when the people will get more familiar with the inoculations.

"In order to bring to the knowledge of the population this method of combating the disease, analogous to vaccination against small-pox, the Government be requested to be pleased to direct the District Officers to publish the data reported by this Laboratory on the effect of inoculation, so that the knowledge of the advantages to be expected therefrom may be diffused among the Native officials and the masses of the population. The mamlatdars and patels be asked to render assistance to the operators, without, however, in any way forcing the people to undergo inoculation, or exaggerating the amount of success derived from it, as defined by the figures given above.

"It is desirable, further, that facilities should be given to the inoculated with regard to detention under observation or restrictions upon the freedom of travelling, as requested in many letters addressed to this Laboratory, a copy of one of which is attached to the present letter (enclosure No. 4). Such measures have already been taken in different places by the local authorities, as is also to be seen from one of the attached documents (*vide* enclosure No. 5). It is desirable that any measures of this kind, if judged admissible, be made general and published for the information of the public, as they are a powerful inducement for the people to avail themselves of the protection by inoculation.

"That it is easy, in spite of all adverse expectations which may be formed by those who have had no personal experience in the matter, to perform numberless operations in the affected districts, is proved by my personal experience in Bombay, Mora, Bulsar, Tarapur, Damaon, Lonavla, Kirkee, where it was found that, after the first series of inoculations performed, the people perceive rapidly their protective effect, and come forward eagerly, without pressure being brought to bear upon them. I need scarcely add also that this testimony acquires weight from my four years of anti-cholera inoculations, applied in some 150 towns and villages inhabited by all kinds of races of India.

"I have no doubt that the Surgeon-General will appreciate, from the above considerations as well as from the explanations which I had the pleasure of giving him personally, how very urgent this matter is, seeing the many hundreds of preventible deaths which occur daily, and bearing in mind that the experience gained up to now in this Laboratory entitles us to hope that, by a series of inoculations, of which many thousands can be performed in a single hour, the mortality from plague may be reduced instantly by $\frac{1}{10}$ ths of its extent.

"2. It is to be understood that the present suggestions are independent of the scheme, now contemplated by Government, of organising a small committee under my direction for the purpose of studying the life history of the plague microbe, which problem, as I have notified to the Director General of the Indian Medical Service, I shall be happy to undertake. This scheme is referred to in another letter addressed to you simultaneously with the present one." (Enclosure No. 6.)

(Enclosure No. 1.)

No. 23755, dated Bombay, the 16th December 1897.

From—P. C. H. SNOW, Esq., I.C.S., Municipal Commissioner, Bombay.
To—Professor W. M. HAFFKINE.

In view of the increase of plague during the past week, I have the honour to request the favour of your arranging to open as early as possible a central station for inoculation by your prophylactic. Perhaps His Highness Aga Khan's bungalow in Nesbit Lane may be utilized for the purpose.

(Enclosure No. 2.)

Telegram.

From—Surgeon-Major FOREMAN, Belgaum.
To—DR. HAFFKINE, Bombay.

Commissioner wired 500; think can get more. Come if possible; will help you every way I can. Pleased to put you up.

(Enclosure No. 3.)

Amraoty, 6th December 1897.

DEAR SIR,—Your efforts in the direction of preventing the spread of the plague by the process of inoculation are highly spoken of everywhere.

We beg you, therefore, to be kind enough to supply us the information about the following particulars at your earliest convenience:—

- (a) Whether you have got any statistical results collected with you as to the effect of the process of inoculation.
 - (b) Whether you can send them to us.
 - (c) If you have not such results collected, whether you can let us know the source where we can get such information.
 - (2) What is the cost of each person's inoculation.
 - (3) Whether it will be necessary for us to come down to Bombay to get ourselves inoculated, or you can arrange to inoculate us here.
 - (4) What is the period during which the results of inoculation last.
- We beg to let you know that our province is not yet affected by the plague; it is hovering on the borders of the province and we think it to be advisable to take the preventive step before it reaches us.

Hoping therefore you will be kind enough to inform us about the above referred to particulars.

We beg to remain, etc.,

VYANKATESH B. MUDHOLKAR,
Editor "Vaidarbha."

RAMCHANDRA N. MUDHOLKAR, L.M.S.,
Medical Practitioner.

(Enclosure No. 4.)

The 13th December 1897.

RESPECTED SIR,—Will you have the kindness to let me know in short the rules pertaining to an inoculated person when travelling by Railway. Please let me know about the following:—

- (1) Whether he is kept in quarantines at different places.
- (2) Whether he is segregated, if any plague case occurred in his house.
- (3) Whether he is obliged to bathe on Railway Stations where such system is now-a-days going on.

Sir, I do not know even a bit about the above rules; and I want to go to my native place from Poona. I have inoculated in the Sassoon General Hospital on the 7th December, and I again wish to inoculate on the next Saturday. Sir, if the above rules be favourable, my (25) twenty-five friends are also willing to inoculate and lots of other men also; so I hope that your Honour will be kind enough to let me know the above rules; for which act of kindness I shall be ever indebted to your Honour.

I beg to remain, etc.,

PRABHAKAR VASUDEO PALINKAR,
in Badhwar Peth Kale's Wada No. 452,
Poona City.

(Enclosure No. 5.)

Extract from letter No. 908, dated ^{10th}/_{19th} December 1897, from the Medical Officer, Plague Flying Column No. II, Karad, to Professor W. M. HAFFKINE, Bombay.

"The persons who are at present being inoculated are chiefly residents in Karad town who wish to go to infected villages round Karad for trade purposes. These are granted passes on condition they submit to inoculation."

(Enclosure No. 6.)

Dated Bombay, the 22nd December 1897.

From—Mon. W. M. HAFKINE.

To—The Secretary to the Surgeon-General with the Government of Bombay.

I have the honour to enclose, for the information of the Surgeon-General, and return when done with, a telegram and letter received from Mr. H. M. Judge, Assistant Collector, Salt Revenue, Surat, asking for information as to the action of perchloride of mercury solution in the presence of cowdung.

The officers appointed to carry out the prescribed programme of combating the plague are constantly confronted with difficulties of this nature and refer to this Laboratory for advice. The answers, in many instances, can, however, be obtained only by new experimental work, for which my present establishment is not sufficient. I would, therefore, inquire, in order to enable me to reply to the correspondence on this subject, whether the scheme, communicated to me by the Director-General, Indian Medical Service, of placing a small Committee of Medical Officers under me for the purpose of investigating the life history of the plague bacilli, is about to be carried out?

Among the Medical Officers sent out by the Secretary of State for plague duty, the following have brought letters recommending them for Laboratory work, or have expressed a wish to engage in such work:—

Dr. Maitland Gibson,

Dr. Balfour Stewart, and

Dr. Marsh.

I beg to place before the Surgeon-General these names and the letters, in order that, in case the scheme in question is sanctioned, the selection might be made of or from among the above officers, or others whom the Surgeon-General may think fit.

Enclosure No. 11(a).

No. 2713, dated Calcutta, the 22nd December 1897.

From—J. P. HEWETT, Esq., C.I.E., Secretary to the Government of India, Home Department,

To—The Secretary to the Government of Bombay, General Department.

I am directed to forward, for the information of the Governor in Council, the accompanying copy of a letter, dated the 20th November 1897, from Mons. W. M. Hafkine, in which he suggests a system for preventive inoculation against plague on an extensive scale. M. Hafkine has been instructed to address the Government of Bombay on the subject of his proposals. The result of the inoculations performed at Damán, described in the joint report prepared by M. Hafkine and Surgeon-Major Lyons, appears to the Government of India to be distinctly encouraging, and they have no doubt that the Government of Bombay will afford M. Hafkine all practicable assistance in making a further trial of his system in the localities in the Bombay Presidency, which are at present infected with plague.

Enclosure No. 11(b).

No. 2714, dated Calcutta, the 22nd December 1897.

From—J. P. HEWETT, Esq., C.I.E., Secretary to the Government of India, Home Department,

To—Mons. W. M. HAFKINE, Hardwar.

I am directed to acknowledge the receipt of your letter, dated the 20th November 1897, forwarding a joint report prepared by Surgeon-Major Lyons and yourself on the epidemic of plague in Lower Damán, and on the result of preventive inoculation performed there.

The Government of India have, I am to say, read your report with the greatest interest, and consider the results of the inoculation experiments in Damán to be distinctly encouraging.

2. I am to request that you will address the Government of Bombay with regard to your suggestion that a system should be organized for carrying out preventive inoculation against plague on an extensive scale. That Government, to which a copy of your letter of 20th November has been sent, will no doubt afford you all practicable assistance in making a further trial of your system in the localities at present infected with plague.

No. 122

399 H

Copy forwarded
for information.

Government of Madras

By order,

Home Department.
(Sanitary)

N. Bonham Carter

Calcutta, the 19th Jan'y. 1898.

Under Secy. to the Govt. of India.

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