NOTES ON PLAGUE,

its Epidemicity and Prophylaxis.

THESIS for the Degree of M.D.,

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by

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NOTES ON PLAGUE.

These notes are the result of observations made and recorded during work in epidemics of Plague at 1. Sehore, Bhopal State, Central India, in, and subsequent to, 1908; and 2. At Sohagpur, Itarsi, Hoshangabad, Sioni Malwa, and their neighbouring villages, in Hoshangabad District, Central Provinces, in, and subsequent to, 1910. An outline map is appended indicating the position of these districts and places.

The writer has not attempted an exhaustive record of all the details observed, which are to be found fully recorded in text-books on the subject, but has tried rather to emphasize those facts observed which suggest the lines to be followed, and the methods to be adopted, in the management and suppression of outbreaks of plague. We seem now to have reached the stage when an active campaign will modify and greatly reduce the deadliness of an epidemic which would formerly have ravaged the infected community.

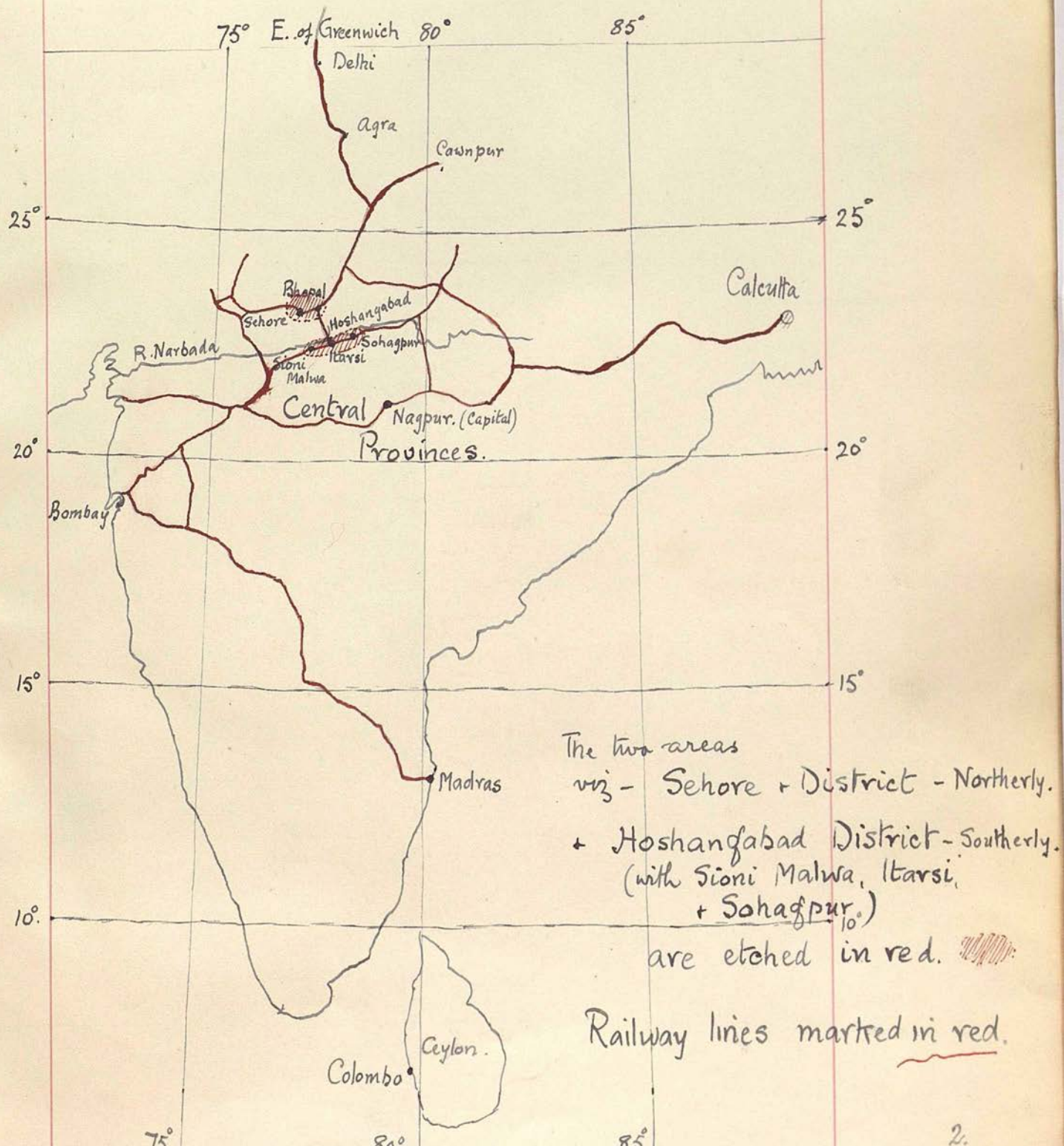
The press of administrative work and isolation in a remote station have prevented reference to any but the writer's own books, and to detailed reference even there, but he acknowledges indebtedness to the following:-

1. A Treatise on Plague. 1905, by W.J.Simpson, M.D., F.R.C.P., D.P.H.

2./

The cases of which brief notes are given herewith, were treated in Itarsi, the treatment being superintended and the medicines dispensed, by B. H. Backhouse, Esq., B.A., Resident Missionary at two villages, Sonasauri सोनासौरी and Mothuja मोतेमा , near

Name.	Village.	Age.	Sex.	Date of beginning of illness.	Date when first seen.	Position and number of bubos.	Whether cauterised or not.	Notes.
Indu.	Sona-sauri.	20	F.	12.2.1911	12.2.1911	One, left groin.	Yes	Bubo incised. Mixture (C) till 21/2/11 then (D). Bullae appeared on skin but disappeared without bursting. Bubo healed quickly when opened. At work on 8/3/11.
Moti ki bähū	"	25	F.	16.2.1911	20.2.1911	One, groin.	Yes.	Bubo in bad condition owing to branding. Temp. variable between 100.8° and 104.8°F. Patient very weak. Mixture (B) till death, 7/3/11.
Kodu ki stri	"	24	F.	13.2.1911	20.2.1911	One, left groin.	Yes	Bubo in very bad condition and patient weak. Bubo healed slowly, leaving indurated mass. Mixture (B) till 21/2/11 then (D). Temp. fell to 97.4° on 24/2/11 - 100.6° on 27/2/11. Recovered.
Radhe ki bahu	"	circ. 14	F.	not known	20.2.1911	One, left axilla.	Yes	Patient very weak when first seen. Bubo dressed with carbolic lint. Appeared likely to recover from first. Mixture (C) on 20/2/11, later Mixt. (D). Recovered.


75° E. of Greenwich
80°
85°
Delhi
Agra
Cawnpur
25°
Bhopal
Sehore
Hoshangabad
Sohagpur
Itarsi
R. Narbada
Sioni
Malwa
Calcutta
Central
Provinces.
Nagpur. (Capital)
20°
Bombay
15°
Madras
10°
Ceylon.
Colombo
The two areas
viz - Sehore + District - Northerly.
+ Hoshangabad District - Southerly.
(with Sioni Malwa, Itarsi,
+ Sohagpur.)
are etched in red.
Railway lines marked in red.

2. Diseases of Tropical Climates, by Sir Patrick Manson.

3. The Etiology and Epidemiology of Plague, compiled by the late Major George Lamb, I.M.S., being the Government of India's publication (1908) of a Summary of the Work of the Plague Commission.

Brief Description of the Districts and Places referred to in these Notes.

Northern District. - in Central India.

Sehore, where the writer lived for three years, is the Residence of the Political Agent in Bhopal - a large Mohamadam State, over whom the Begam rules.

Sehore is divided into:-		Population.
The Civil Station	about	7,300,
" Cantonment (Regimental)	"	900,
" Qasba or Native Quarter	"	4,400.

(Bhopal City, 24 miles away, is a most insanitary place, as may be inferred from the fact that though vaccination is supposed to be compulsory, there was recently a mortality of about 5,000 (out of a population of about 70,000) in a single epidemic - most being infants and children.)

Southern District - in the Central Provinces (British India).

Hoshangabad is the administrative centre of the District, which lies along the banks of the very sacred River Narbada, and south of Bhopal State.

Hoshangabad/

Hoshangabad has a population of about 11,000,
Itarsi - 12 miles S. of Hoshangabad - about 7,000,
Sioni Malwa - 24 miles W. of Itarsi - " 7,500,
Sohagpur - 30 " E. " " - " 7,000.

The District is dotted with a very large number of small villages - population averaging about 300 in each.

Itarsi is the junction between the mail lines running from Bombay - and going North from Itarsi to

1. the Punjab and Simla, and
2. East to Calcutta.

A little indication is given of the great ramification of the Railway systems and it may easily be seen how, in a country, where people are constantly travelling to and from Bombay and between other business centres throughout the country, carrying a roll of bedding, which is spread upon the floor at each lodging, the infection has been spread very widely among the towns, and thence, in the manner indicated later, into innumerable surrounding villages.

Were it possible to etch in red the places that have been infected at one time or another with plague, since 1896, upon a map having the railway lines marked upon it, the appearance would be that of a great number of red beads threaded upon the railway lines, lying more closely together near Bombay and usually less so in more remote places, and with some rather densely speckled areas, e.g., in the Punjab, and around certain large/

large cities, such as Agra, Lucknowe, Cawnpur, Delhi, etc., in Upper India, and elsewhere.

The facilities for, and popularity of railway travel have undoubtedly led to the rapid and wide dissemination of the infection of plague throughout the whole of India, and rendered the problem of controlling and stamping it out a vast and enormously difficult one.

Incidence of the Outbreaks.

In most cases, the outbreak of plague in one or other of the towns or villages where the writer has had an opportunity of observing it, has been clearly traceable to a person coming from a place known to be infected with the disease. Nearly always the person causing the outbreak has suffered definitely from plague on his arrival or immediately after. Owing to the reluctance of people to let the authorities know of an illness that might be plague, because of the fuss that would be made, it is possible that in some cases an outbreak, not traceable to an imported case, has really been caused by a mild case that has recovered without the nature of the illness being discovered.

Following the discovery of a case of imported plague, where immediate removal has not (as in several cases it has) terminated the infection, either on account of the death or recovery of the patient, there has invariably been evidence, after a period of some four to eight days, of/

of a more or less severe epizootic among the rats of the locality where further cases of plague have afterwards occurred. Among a very large number of rodents caught during epidemic times and on other occasions, the writer has never seen any other variety of rat than Mus Rattus, and a very few mice, probably Mus musculus. In Major G. Lamb's report of the work of the Plague Commission it is stated that Mus Rattus greatly preponderates also in the Punjab villages, where plague has been so rife.

Now-a-days villagers, even, recognise the close connection between an unusual rat mortality and the outbreak of plague, and many voluntarily evacuate their houses, when rats begin to fall from the roofs where they commonly disport themselves. In the districts referred to, marked on the accompanying map, it has been observed that a severe and extensive epizootic usually portends a serious outbreak of plague, while if few rats die and the area is restricted, the outbreak of plague is usually small and easily controlled, even though there may be rather a large number, relatively, of cases of human plague at the outset.

In this area is found, in large numbers, the chipmunk, commonly called a squirrel, which has a long bushy tail and annular markings on its greyish body, and lives in trees near the houses, or on the roofs of the latter. It has been observed frequently that an epizootic among rats is accompanied by a similar/

similar epizootic among the chipmunks.

It is now customary for natives to pour paraffin oil (commonly used by all for illuminating purposes) upon the dead bodies of rats and chipmunks, and then to fire and completely destroy them. This does not imply that they have any idea of destroying the fleas as well as the rodents.

We have observed in nearly all the outbreaks that the incidence of cases of human plague has occurred within a fortnight, usually nearer ten days, of the discovery of the epizootic.

Most of the houses in these districts are of the most flimsy description, few being constructed of kiln-burned bricks, and most having their walls either of sun-dried bricks or of mud plastered on to a framework formed of wood and interlaced twigs. The roofs are always made of tiles losely placed on split bamboos, and form a perfect home for rats, as well as snakes, scorpions, and centipedes. The floors are usually made of puddled earth and chaff, and cleaned at intervals with a lotion of cow-dung. Almost invariably neighbouring houses are connected by the regular runs or burrows of rats. The grain used as food is rarely kept in rat-proof containers, and in any case while being cleaned and prepared for cooking, it is shed on the floor. There is usually a heap of rubbish, rags, and odds and ends on the floor, and commonly a kind of loft for lumber is formed by placing bamboos/

bamboos across from wall to wall inside the house. In the bazaars, i.e., the thoroughfares where the shops are, the character of the buildings and the careless bestowal of food-stuffs, offer every inducement for the great propagation of rats, and, in fact, vermin of every kind. It has been, usually, in the neighbourhood of the shops where food-stuffs are sold, that the greatest incidence of the disease has occurred in the towns.

Once the epidemic has got started, in most of the various outbreaks certain classes have been specially attacked. Naturally, the neighbours have suffered first, but not always most severely. But grain-sellers, baniyas as they are called in the vernacular, have always suffered disproportionately, at any rate where they have not fled from fright early in the outbreak, as has frequently been the case. Then there has been a very large incidence of attacks among sweepers (mehtars) and washer people (dhobis). The former attend to the public and domestic latrines, and sweep the streets and some houses, and also carry away and dispose of deserted dead bodies. They also eat food thrown away by people of higher caste, and accept, and wear, old clothing. The dhobis are professional washer people (both men and women), and wash soiled clothing from all kinds of places.

Oil-sellers (telis) have been conspicuously spared in these out-breaks; and W.J.Simpson in his "Treatise on Plague" records the fact that such has been/

been the case in Bombay, and in other places. It may be that the oily state of the teli's person and surroundings is unpleasant or injurious to fleas.

In a general way the lower castes, living in the poorest and most crowded houses, and having lower vitality from excessive labour and poor and insufficient food, have suffered more than those of higher caste, who mostly live under distinctly better conditions.

But the most striking fact has been that the very young and the old are very rarely attacked, and the writer, in his experience, has known of only a few deaths in the young, and still fewer in the aged, from undoubted plague. The strong and healthy are proverbially attacked.

It has been noticeable that the case mortality is usually highest at the beginning of an outbreak, and apparently higher among those who remain in their houses than among those who are removed to a plague camp. But it is probable that the great inclination to hide the illness may lead to mild and non-fatal cases not being reported, and almost or quite entirely account for the apparent advantage of removal to a plague camp or hospital.

On several occasions there has been a panic on the discovery of the outbreak, and many people have evacuated their houses and gone to near or remote villages. This has led to an apparent check in the spread or intensity of the epidemic, with the result that the people have begun/

begun to return, and shortly afterwards an exacerbation of the epidemic has followed, and in addition the disease has been spread into many villages round about. There has been no outbreak in a town, in the areas referred to, in recent years, in which more or less severe outbreaks have not occurred in numerous surrounding villages. No realisation of the risk to others, nor consideration for them, has led those who have vacated their houses to content themselves with a local and temporary shelter.

At the end of the outbreak there have been numbers of ambulant and non-fatal cases in most epidemics.

One conspicuous feature has been the extreme rarity, if not entire absence, of attacks among those in attendance upon the plague-stricken when the latter have been removed from the place where they developed the illness.

On at least two occasions there has appeared to be some connection between the prevalence of famine and scarcity and the severity of the outbreak, for the epidemics (local) have begun unusually early, seasonally, and been attended with a greater mortality, in cool seasons following hot weathers when famine, or at least scarcity, has prevailed. The writer has no facts to indicate whether this state of affairs is to be attributed more to lowered vitality and deficient immunity among the people, or to an increased number of/

of young and susceptible rats following scarcity in the hot weather, when rats are most prolific.

The onset of all the severer outbreaks has been definitely related to the mean temperature - coming earlier seasonally when the cool weather set in early, and being postponed when the mean temperature remained high.

By the kindness of Colonel P. B. Haig, I.M.S., Agency Surgeon at Sehore, Bhopal State, I am able to present the appended statistics of the mortality from Plague in Bhopal State, Central India, during recent years. Owing to the reluctance of the people to declare the illness, the reported statistics of infection are too unreliable for publication, and give too high an apparent case mortality, especially during the period of decline, and so are not given.

The hot season commences roughly in March - April, when the nights as well as the days begin to be hot, and reaches its climax in June, when the rainy season is due to set in, and to terminate the hot season. There may be spells of really hot weather during the rainy season, when, as commonly happens, the rain ceases for a period of two or three weeks.

The figures show how plague mortality rises with the fall of temperature, and falls or disappears in the hot season.

Monthly/

Monthly Table, showing Deaths from Plague in Bhopal State.

Months.	1903.	1904.	1910.	1911.	1912.
January	Monthly details not available.	2232	-	46	953
February		2086	-	94	811
March		2642	-	244	Monthly Returns incomplete.
April		874	-	122	
May		82	-	16	
June		-	-	-	
July		4	-	10	
August		60	-	87	
September		140	-	901	
October		77	-	2631	
November		136	1	1048	
December		74	14	326	
	5106	8407	15	5526	

Monthly Table - showing Incidence of, and Mortality from, Plague, in Sehore Cantonment, (Civil Portion); supplied by Lieut. Col. P. B. Haig, I.M.S., Agency Surgeon in Bhopal.

1911	Cases.	Deaths.	Mortality.
January	-	-	-
February	5	4	80%
March	14	9	64%
April	28	27	96%
May	1	1	100%
June	2	2	100%
July	3	2	66%
August	20	12	60%
September	110	76	69%
October	78	52	67%
November	29	24	83%
December	1	-	Nil.
Totals	291	209	

Average Mortality 72%.

(The unexpected nature and variations of the incidence and mortality above recorded leads the writer to think that (1) the record is not complete; (2) there was probably reimportation during the course of the outbreak.)

Whether purely by coincidence, or for some unascertained reason, the writer cannot state, but in a large proportion of the outbreaks occurring in successive years in the same town, the earlier indigenous cases have occurred in the same quarter of the town, and sometimes in the same street or row of dwellings.

The writer can testify to the great individual protection resulting from timely inoculation with Haffkine's prophylactic. Among over 1,000 cases of inoculation with the vaccine, which he has personally performed and recorded, he has not come across a single case (though there may possibly have been a small number) in which the person (varying in age from seven months to about seventy years, but mostly young adults) has contracted plague in the same epidemic season. These people consisted partly of boys and girls in Christian boarding and industrial institutions, but, to the extent of at least 75%, of volunteers from the general non-Christian community.

It is noteworthy that in various epidemics, when the influence of missionaries has been sufficient to induce the native Christians to submit to inoculation, not a solitary case of the death of an inoculated Christian is known, and but a few attacks have occurred, though the majority of the Christians have been subject to the same risk of infection as the general community which/

which has suffered heavily during successive epidemics. During the panic at the beginning of an epidemic the writer has heard of non-Christian natives considering whether they should become Christians as the Christians were spared by the disease!

Except at Itarsi, there was no case of plague among Europeans, but at that place, where there is a Railway community of about fifty or sixty, mostly Eurasian, who refused to be inoculated, there were several attacks and deaths.

The particulars supplied by Major E. H. Sharman, Medical Officer of the 99th (Native) Infantry, at Sehore, show emphatically how great is the reduction in case mortality in cases of plague contracted by those who have been inoculated, even at so long a period as six months after inoculation.

These particulars will be found in an Appendix at the end of the notes.

Symptoms and Varieties of the Illness.

The writer's first contact with plague was in December 1904, while on a short railway journey from Itarsi to Hoshangabad. At Itarsi a native servant followed his master into the railway compartment where I was sitting. He appeared to me to be drunk, and he was speedily removed by his fellow-servants. I was struck with a curious stupor and dreaminess of the eyes that characterised him. At the next station, six/

six miles away, and fifteen minutes later, I was called to see a sick man, and found the same man lying dead, but still warm (the mid-day temperature even in the cool season is usually about 80 degrees F. in the shade) and suspecting plague, as cases not infrequently are met with on the trains, I looked for bubos and found one in each groin.

The appearance was very typical, and a similar state, with increasing instability or entire prostration, perhaps with stupor or delirium, characterises severe attacks. The temperature rises quickly, in say 18 to 24 hours to about 103° or 104°F., whence it may fall by quick lysis after three or four days, or remain high, fall low, or return even almost to normal in fatal cases. There has been almost invariably severe local pain preceding the appearance of bubos, and this may continue for several or even many days.

There is in most cases a quick pulse and agreat tendency to heart failure, and severe headache is a constant symptom. Many patients, who seemed to be making a good recovery, were lost by syncope through getting up either in delirium or to urinate or defæcate, not only in the early stages, but even after the temperature was falling satisfactorily. The breath of most patients had either a fœtid or a heavy musty smell.

The writer has seen no case which could confidently be/

be diagnosed as pneumonic, nor any cases of septicaemic plague.

At Itarsi there were two patients, brothers, who at first seemed to be affected with pneumonic plague. They had carried a dead relative's body (dead from plague) 12 miles to the River Narbada (a very sacred river to Hindus), to cremate the body on its banks and cast the ashes on to its waters. Late in the evening they bathed (for religious and ceremonial reasons) in the river, and returned in the coldish night in their wet clothes - only cotton garments being worn. They were exhausted with nursing the dead relative, and fearful of themselves contracting plague. Next day both had rigors, and when I saw them two days later there were all the symptoms of extensive lobar pneumonia in both brothers. They lingered for about six days, both seriously ill, and then died at or about the crisis. The duration of the disease, its regular symptomatology, and the non-occurrence of cases among those who nursed them incessantly, almost certainly eliminate the possibility of pneumonic plague.

Some of the patients from the first have no wish for food, while others take plenty of farinaceous food right through the illness, or almost until they died.

Only a small proportion of the bubos in the outbreaks in the southern area, and a rather greater proportion in the northern area, progressed to suppuration/

suppuration. But the native practive of cauterisation by the application of hot stones or iron over the bubo caused many painful and exhausting sores, some of which appeared to be the cause of death in patients who might otherwise have recovered. When treated by natives the sores usually persisted for a long time, and even under careful treatment healing was slow.

Suppurating bubos were opened by the knife, unless they had previously opened spontaneously. Healing, again in this case, was very slow, except where the contents of the gland were thoroughly evacuated, and the inside treated with an application of pure carbolic acid and then thoroughly washed with Rectified Spirit. In most of these cases healing was much quicker and in some cases remarkably so. The period of discharge from the bubo might commonly be only three or four days instead of as many weeks as was very usually the case.

Name.	Village.	Age.	Sex.	Beginning of illness.	First seen.	Number & position of bubos.	Whether branded or not.	Notes.
Hari Ram ki stri.	Mothuja.	20	F.	not known	22/2/1911	1. left groin.	Yes.	When first seen fever very high (reduced by Aspirin to 100.4° F.) severe pain in L. groin. On 23/2/11 sickness and temp. 105.6°. Calomel 4 gr. No more sickness Mixt. B from 22/2/11 till 5/3/11 then D. Temp. 25/2/11, 98.8°; 27/2/11, 104.2°; 2/3/11, 99°; 4/3/11, 97.4°. When temp. fell, extremities were cold and clammy. Hot bottles and bricks were applied. Recovered.
Hari Ram ki larki (daughter)	"	6	F.	" "	"	Both axillae	one branded.	At first 1/3 doses of Mixt. B and from 2/3/13 1/3 doses of D. Temp. 22/2/11, 101.7°; 23/2/11, 104°; 24/2/11, 100°; 25/2/11, 99°; 2/3/11, 97°. Recovered.
Umuja	"	25	F.	21/2/1911	"	Left groin	Yes.	Mixt. B given. Temp. 22nd, 104°; 23rd, 103.6°; 24th, 101.8°; 25th, 103.6°; 27th, 104.8°; 2/3/11, 101.1°. On 8/3/11 Bubo incised and temp. fell to 97.4°. Recovered.
Musuja	"	35	F.	18/2/1911	"	One groin	"	On way to recovery when seen. Temp. normal. Refused medicine. Recovered.
Chhumie ki stri	"	25	F.	24/2/1911	25/2/1911	Left axilla.	"	25/2/11 temp. 104.8°. Mild case, but suffered much pain from branding; wound dressed first with carbolic then corros. subl. Healed nicely. Cold extremities treated with hot bottles. Recovered.
Janki	Sona-sauri	45	F.	not known	27/2/1911	One cervical	No	After being ill for 4 or 5 days, developed pneumonic symptoms and <u>died</u> with hyperpyrexia.
Dhobi ka beta	"	12	M.	" "	"	One groin	No	Treated with ½ doses of Mixt. B. Recovered.
Irka Ram ki stri	"	20	F.	28/2/1911	28/2/1911	Left groin	Yes	Temp. 103.8°. Did not seem a bad case. Mixt. B given but not taken regularly. <u>Died</u> while sitting up and drinking 8/3/1911.
Ballu ki stri	"	35	F.	2/3/11	2/3/11	One groin	?	2/3/11, 99.5°. Refused medicine. <u>Died</u> 4/3/11.
Pyari ki stri	Mothuja	35	F.	7/3/11	8/3/11	Left groin	No.	8/3/11, temp. 103.2°; 14/3/11, 99°. Bubo incised. Recovered.

Two general features of the report of these 14 cases need elucidation, viz:- the very high recovery rate of 71.4°, explained by the fact that this outbreak occurred very late in an epidemic which started at Itarsi, about two miles away; and the almost complete exclusion of males, which is owing to the facts, (a) that I had inoculated almost all the males of both villages before infection reached them from Itarsi, and (b) most of the males were at that time not living actually in the villages but at work in the fields, where the nights also were spent.

The proportionate infection of cervical, axillary, and groin (not differentiated into inguinal and femoral) glands in this small number of cases, works out as:-

		Cases.
Cervical - 7%	=	1
Axillary - 22%	=	3
Groin - 96.8%	=	57 .

Analysis of the Statistics of Gland Infection in the 59 cases of plague in the 99th (Native) Infantry at Sehore. I am indebted to Major E. H. Sharman, I.M.S., for his kindly allowing me to examine his records for these particulars.

Percentage of attacks among Hindus	8.2
" " " " Mohamadans	5.3

Relative frequency of Infection of different Glands.

	Femoral.	Inguinal.	Axillary.	Cervical.
Hindus Cases 44	18	25	1	-
Mohamadans " 15	9	5	-	1

Giving a Percentage incidence in the respective classes of:-

	Femoral.	Inguinal.	Axillary.	Cervical.
Hindus - of 44 cases	40.9	56.8	2.3	-
Mohamadans - of 15 "	60.0	33.3	-	6.7

At first sight it appears strange that the religion of the sepoys should have had such a marked influence,

1. Upon the case incidence as between the two classes, - and —

2. Upon the ratio of infection of the femoral and inguinal glands in the two classes, for I take it that we may ignore, as being too few to give significant information, the two solitary cases of infection of axillary and cervical glands.

But as the clothing worn by the adherents of the two religions differs very considerably, the explanation is not far to seek. Both may wear the same form of/

of head gear, viz., the pagri or turban, and likewise a coat-like upper garment, with sleeves, called the kurta or anga, but, whereas the Mohamadan almost invariably wears long-legged trousers, narrow at the ankle and baggy at the waist, where the garment is secured by a waist-string, the Hindu wears a long piece of cloth draped around the hips, thighs and waist, and rarely reaching below the waist.

Hence the Mohamadan is much more protected against the bites of fleas, and when bitten is much more likely to be pricked in the abdominal region than the Hindu, whose legs are much more exposed, and in very close proximity to the ground and quite unprotected when he is squatting - this being the attitude of rest.

These facts seem to indicate clearly that to dress so as to prevent the attacks of fleas may confer a high degree of relative immunity against infection with plague.

So impressed was Major Sharman with the increased safety, during an outbreak of plague, resulting from the wearing of suitable clothes, that on his representation, the Commandant of the 99th (Native) Infantry issued instructions that all the sepoys should wear, not merely shoes, but boots, into which trousers were to be tucked, and that the men should not sit or squat upon the ground as is customary with almost all classes and races in India.

It appears probable that part at least of the relatively very great freedom from plague enjoyed by Europeans and Eurasians in India, is due to the exclusion of fleas by the kind of clothing usually worn, and by the fact that sitting upon chairs, etc., does not bring near to the ground the inevitable openings in the clothing worn, and that boots are very largely worn.

The small proportion of cases of axillary and cervical infection met with, is probably caused by the habit of many poor, and even some in better positions, of sleeping on a cloth or quilt laid upon the floor, and over whom rats commonly run during the night while the people are asleep.

The writer has seen no cases where carbuncles have appeared during an attack of plague.

One perplexing case is worthy of mention. An oldish woman was seized apparently with plague, having fever and bubos in both groins - inguinal in site. She progressed favourably, though the bubo on one side proceeded to suppuration and was incised. Though it was twice treated with an application of Ac. Carbol. Pur. and well washed out with Sp. Vin. Rect., it continued to discharge for over three months. Just before the woman died, about four months from the time she was first seen, it was found that she had an extensive venereal infection with vulvitis and vaginitis and a muco-purulent discharge. She had been living as a prostitute, and though no bacterial examination/

examination was made in her case, there is little doubt that her symptoms were due to venereal infection, and that they would have been recognised as such had she come under observation at any other time than during a plague epidemic.

Similarly, cases of malaria, which may occur at any time of the year, when occurring during the epidemic of plague, have laid the patient under suspicion of plague infection. On the other hand, mild attacks of plague may pass as malaria, etc.

The general character of the fever attending plague has been indicated in the notes on the 14 cases particularised, i.e., it has usually been about 103°-104°F. at the onset - sometimes even 105° and over, and there have frequently been exacerbations, usually associated with suppuration of bubos, during the period of lysis, by which the temperature has returned to normal. So great is the antipathy to, or fear of treatment by, cold wet packs by the natives of India, that the treatment could not be carried out in cases of hyperpyrexia.

By the kindness of Major Sharman I am able to give charts showing the character of the fever in the mild cases of plague in the 99th (Native) Infantry, which came on while the sepoys were still somewhat immunised by previous inoculation with Haffkine's prophylactic, administered about six months previously.

The fever was commonly similar to that of the mild and ambulant cases which occurred regularly at the termination/

termination of each epidemic at the onset of the hot season in March or April, when the mean atmospheric temperature rapidly rises very considerably above that prevailing from November to February, during the height of the epidemics.

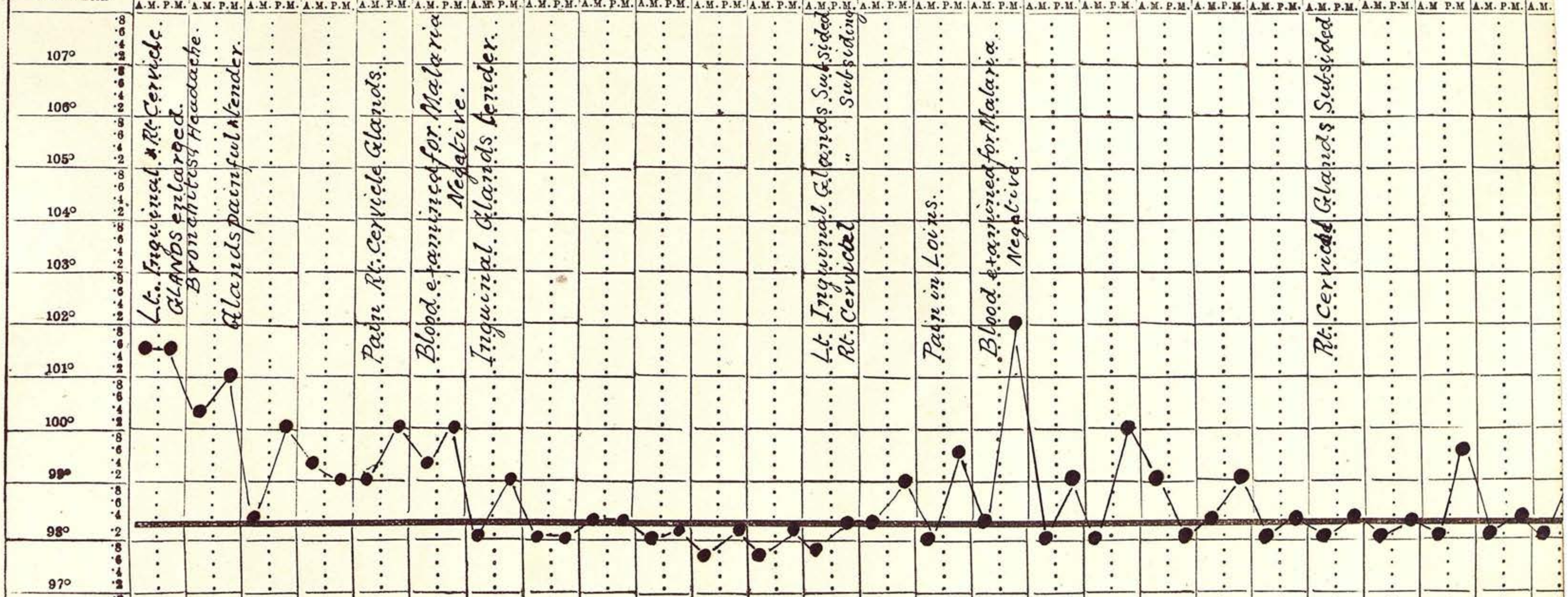
(To be attached to the case sheet.)

Corps 99th Infantry No. 3812 Rank and Name Sep. Chatterpal Singh. Age 29 Service ______ Hospital S[...]

Disease Plague. Date of admission 15-10-11 Date of Discharge ______ Result ______ Sehore.

Dates of Observation.	15 (October)	16	17	18	19	20	21	22	23	24	25	26	27
Day of Disease.	2	3	4	5	6	7	8	9	10	11	12	13	14
Temperature Fahrenheit.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.
Pulse per minute	120 / 122	128 / 120	100 / 122	116 / 120	122 / 118	102 / 104	90 / 110	82 / 80	76 / 74	74 / 78	72 / 80	74 / 82	78 / 80
Respirations per minute	26 / 24	22 / 24	20 / 22	26 / 24	23 / 23	22 / 21	19 / 21	18 / 19	17 / 18	18 / 18	18 / 19	20 / 22	18 / 18
Motions.	1 / 1	0 / 1	1 / 1	1 / 1	1 / 1	1 / 0	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1

Dates of Observation.	28	29	30	31	1 (November)	2	3	4	5 (1911)	6	7	8	9
Day of Disease.	15	16	17	18	19	20	21	22	23	24	25	26	2[...]
Temperature Fahrenheit.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Time. A.M. P.M.	Ti[...] A.M.
Pulse per minute	76 / 84	78 / 82	80 / 108	82 / 98	88 / 102	76 / 96	80 / 98	82 /	/	/	/ 102	86 / 84	84
Respirations per minute	18 / 19	18 / 19	20 / 24	18 / 20	19 / 22	20 / 21	19 / 22	19 /	/	/	/ 24	19 / 18	18
Motions.	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1

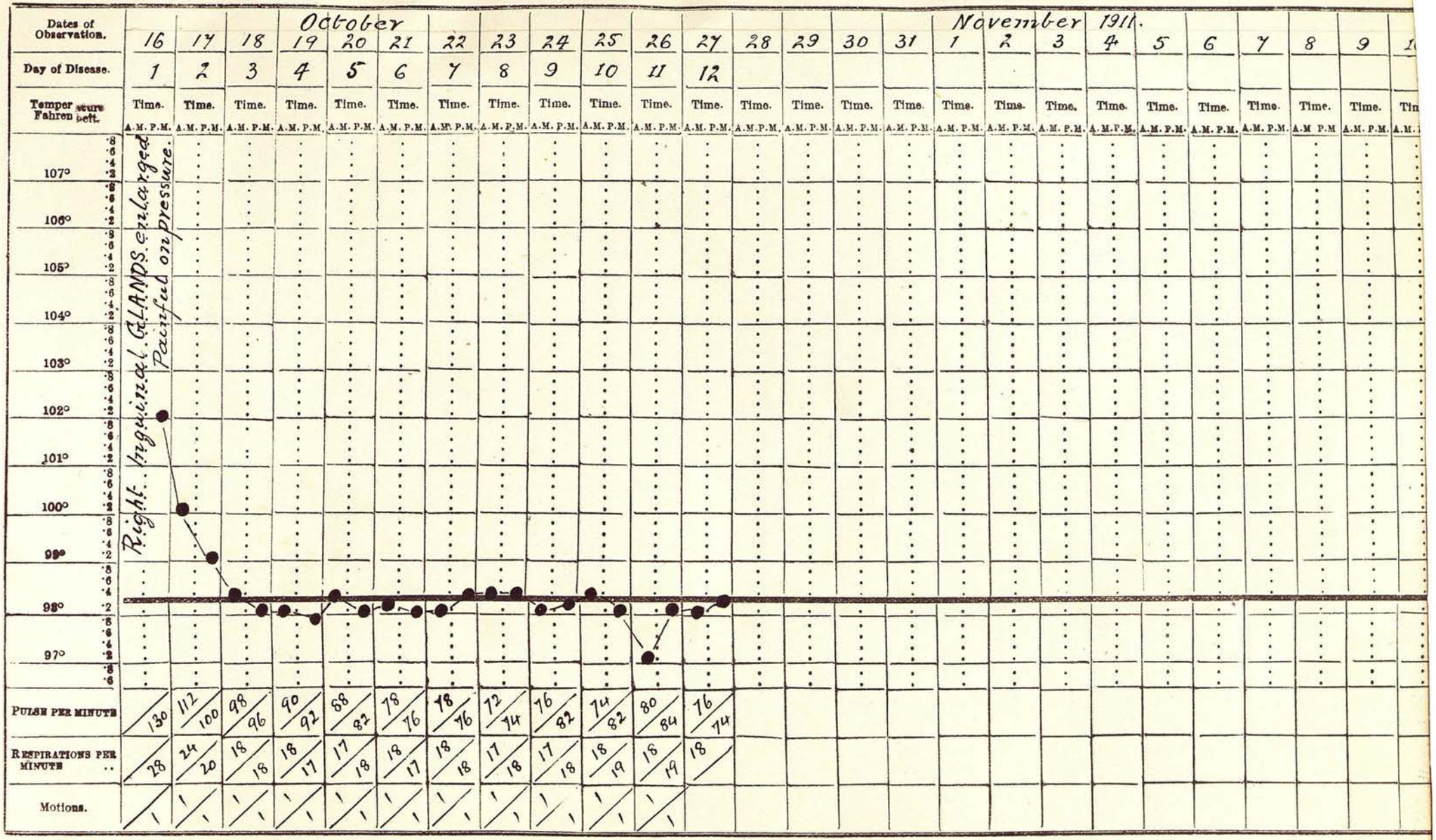


Signature ______

(To be attached to the case sheet.)

Corps 99th Infantry No. 3961 Rank and Name Sep. Latchand Age 26 Service Hospital S

Disease Plague. Date of admission 16.10.11 Date of Discharge Result Behore.



Signature

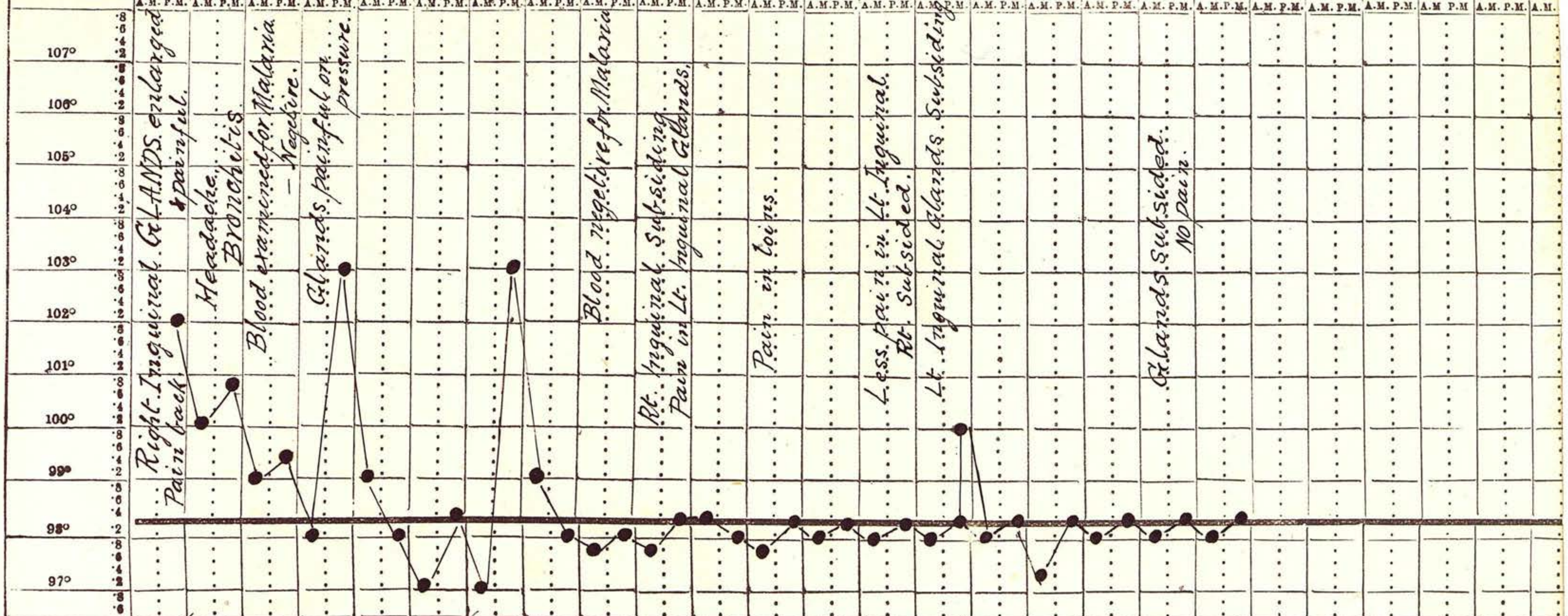
(To be attached to the case sheet.)

Corps 99th Infantry No. 4290 Rank and Name Chunnilal Age 22 Years Service Hospital S

Disease PLAGUE Date of admission 18·10·11 Date of Discharge Result Sehore.

Dates of Observation	Day of Disease	Pulse per minute (A.M. / P.M.)	Respirations per minute (A.M. / P.M.)	Motions (A.M. / P.M.)
October 18	1	/ 130	/ 28	/ 1
19	2	102 / 118	24 / 26	1 / 1
20	3	88 / 92	20 / 22	1 / 1
21	4	88 / 120	18 / 26	1 / 1
22	5	82 / 72	18 / 18	1 / 1
23	6	70 / 72	17 / 19	1 / 1
24	7	74 / 94	19 / 24	1 / 1
25	8	80 / 88	20 / 21	0 / 1
26	9	74 / 78	18 / 18	1 / 1
27	10	80 / 82	18 / 19	1 / 1
28	11	78 / 80	19 / 18	1 / 1
29	12	74	18	1 / 1
30	13			1 / 1
31	14			1
November 1	15			
2	16			
3	17			
4	18			
1911 5	19			
6	20			

Temperature Fahrenheit



Signature

30

(To be attached to the case sheet.)

Corps 99th Infantry. No. 3892 Rank and Name Sep. Jawaher khan. Age 36. Service Hospital S

Disease Plague. Date of admission 24.10.11 Date of Discharge Result Sehore.

Dates of Observation.	October 24	25	26	27	28	29	30	31	November 1	2	3	4	1911 5	6	7	8	9	10
Day of Disease.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Temperature Fahrenheit. Time. A.M. P.M.	GLANDS Rt. & Lt. Femoral Left Femoral tender	Pain all over body Headache - Bronchitis	Do - Pain Loins and Joints.		Blood examined for Malaria - Negative.				Glands Subsided.									
107°																		
106°																		
105°																		
104°																		
103°																		
102°																		
101°																		
100°																		
99°																		
98°																		
97°																		
PULSE PER MINUTE	96/120	98/102	96/112	94/118	90/108	96/98	82/88	76/86	74/80	72/	/	/	/	/	/	/	/	/
RESPIRATIONS PER MINUTE	23/24	20/23	21/23	20/24	20/22	19/20	19/21	18/19	18/19	18/19	18/	/	/	/	/	/	/	/
Motions.	0/1	1/1	2/0	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/2	1/1	1/	

Signature

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(To be attached to the case sheet.)

Corps 99th Infantry. No. 3556 Rank and Name L.NK. Ramsahai Singh. Age 36 Service Hospital S

Disease PLAGUE Date of admission 17.10.11 Date of Discharge Result Sehore.

Dates of Observation.	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10
	October															November 1911.									
Day of Disease.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21				
Temperature Fahrenheit. Time. A.M. P.M.																									
107°																									
106°																									
105°																									
104°																									
103°																									
102°																									
101°																									
100°																									
99°																									
98°																									
97°																									
Pulse per minute	129	102 / 104	92 / 110	90 / 96	92 / 88	76 / 74	72 / 74	74 / 78	78 / 82	80 / 84	78 / 80	74 / 78	72												
Respirations per minute	26	20 / 22	24 / 26	20 / 21	18 / 18	17 / 18	17 / 18	18 / 19	18 / 19	19 / 20	19 / 21	18 / 19	18												
Motions.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				

Left Inguinal GLANDS enlarged Slightly painful.

No pain in Glands. Blood for Malaria - Negative.

Conjunctivitis & Keratitis. Left. Severe.

Glands. Subsiding.

Iritis & Slight ulcer on cornea

Eye improving.

Distinct improvement.

Ulcer Cornea healing. Glands Subsided.

Signature

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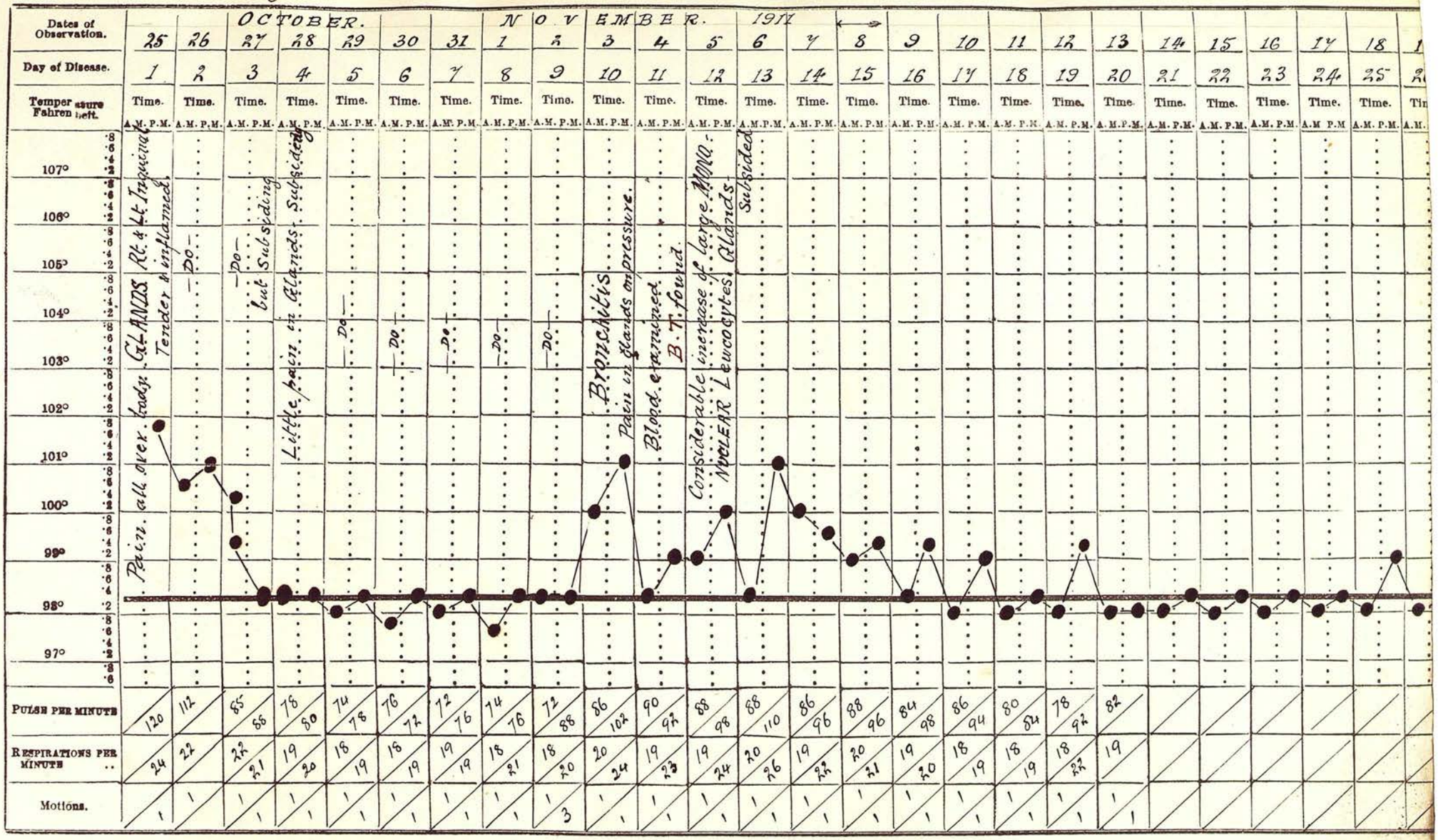
(To be attached to the case sheet.)

Corps 99th Infantry No. 4113 Rank and Name Sepoy Ramkhagath Age 22 Service Hospital S

Disease Plague Date of admission 25.10.11 Date of Discharge Result Sehore.



Signature

TREATMENT.

The writer is sorry to record that he has no evidence to offer of decided effect upon the case mortality of plague by any treatment he has tried or seen.

The mixtures referred to in the notes on 14 cases of plague in villages near Itarsi, which the writer has commonly used, are given below:-

℞ (Mixture B.)

Tr. Digit. vel Strophanth. m v

Ac. Carbolic m iij

Sp. Ammon Aromat m xxx vel Ammon Carb. gr. iv

Tr. Nucis Vom. mv

Aquam ad ʒi.

Misce.

Sig. Quartis horis sum.

℞ (Mist. D)

Liq. Strychn. Hydrochlor. m iij

Ac. Nitro-hydrochlor. Dil. mx

Tr. Chiratae vel Quass. m xv

Aquam ad ʒi.

Misce.

Sig. Ex. aq., a.c., t.d.s.

Major Sharman informs me that he usually gave:-

℞

Tr. Cinchon. Co. mxx

Ammon Carb. gr. v

Liq. Strychn. Hydrochl. m ij

Tr. Digitalis m ij

Aq. ad. ʒi.

Misce.

The Digitalis was omitted as soon as the pulse improved.

Natives are generally insistent upon some kind of local treatment for the bubos, so perhaps, much in the hope of averting the branding before referred to, with its very injurious and debilitating results, I have applied a liniment in almost all cases. Usually a mixture of equal parts of Lin. Bellad. and Lin. Iodi., though sometimes a solution of Acid. Carbolic Pur. in Lin. Belladonnae to a strength of 1 in 30 or 1 in 40.

As I was able to pay only flying visits to places away from Sohagpur, routine treatment with Mixt. B. - (Digit., Ac. Carbolic, Ammon. Carb. and Nux Vom.) was carried out, in the hope of averting the heart failure which so commonly supervened, and against which it was difficult to get the natives to guard, by refraining from sitting up or standing and walking when they could. Mixt. D. (Strychnine, Acid, and Puttex Infusion), was usually given during convalescence.

For sickness, a dose of Liq. Iodi Fort, mij in an ounce of water, given hourly, usually controlled the sickness, except where it was associated with constipation, when Calomel was used.

In general the treatment was symptomatic.

The Management of Plague Epidemics.

The writer can add nothing in the least new on this subject, for as a rule the ignorance and prejudice of the low class native population most extensively affected, renders almost all efforts at systematic management ineffective.

The callousness which characterises many native subordinate medical assistants makes the sick afraid to go into plague camps, unless a European physician constantly supervises the care of the patients there; and most of the subordinates are so greatly afraid of themselves contracting the disease that they seldom nurse the sick at all satisfactorily.

The one measure that promises satisfactory results, i.e., the entire evacuation of a place immediately on epizootic infection first appearing, has never been attainable in the writer's experience. Evacuation at a later stage has usually been a panic measure, when as many of those leaving the place have gone into and infected surroundings or even distant villages, as have gone into the organised segregation camps where the outbreak might have been controlled and overcome.

The opening up or removal of the roofs of infected houses, and even the extensive application of disinfectants to the walls and floors, has not at all uniformly prevented/

prevented a recrudescence of the outbreak, when the people have returned again to those and neighbouring houses.

Prolonged desiccation of the houses, by means of large iron plates heated by charcoal or dung fires placed beneath them, did not, at Sehore, give any more decisive result than the more general measures mentioned above.

The one measure which can be relied upon to stem the tide of a plague epidemic, i.e., the inoculation with Haffkine's prophylactic vaccine of a large proportion of the population, say 50% to 60%, at a very early stage in the outbreak, is also very difficult to put into operation in an Indian village or town community. But its effectiveness in protecting the male community when they are almost all inoculated, was shown very clearly in the case incidence among females when the infection reached the villages of Sonasauri and Mothuja. As previously noted, the immunity of the inoculated Christian community is indicative of the beneficent result that might be attained were the general population inoculated equally thoroughly.

PROPHYLAXIS.

Evacuation has already been referred to under management, and the writer's experience is in complete agreement with the views expressed in Captain Glen Liston's pamphlet, "The Cause and Prevention of the Spread of Plague in India", p.30 et seq.

Extermination of Rats.

A priori, this seems a hopeless measure among a population composed largely of Hindus, with whom the preservation of all forms of animal life is a matter of religious belief, which is held most tenaciously and extensively practiced. And again, energetic measures are needed to destroy the very large proportion of rats necessary to modify the epidemicity of plague, and the indifference and lethargy, with which the stolid Hindu faces almost all epidemics, does not promise much success in the application of such a measure for averting the outbreak of plague, especially when the work has to be done when the disease is quiescent.

Again, the writer must record the similarity of his experience with attempts to destroy rats, and its use as a prophylactic measure with Captain Glen Liston's views - p.28 et seq.

Inspection of In-comers or Visitors.

There is a method, applicable to comparaticely small and isolated places, that depends for its efficiency upon the thoroughness with which it is worked.

The writer has been a member of the Sohagpur Municipal/

Municipal Committee since 1910, and was able to direct and ensure the thorough application of the method through three epidemic seasons, when plague had infected most of the neighbouring towns and many villages.

The method is the one of inspecting all visitors (or returning inhabitants) from plague-infected places. The Railway Station and main roads have to be watched, and the names and addresses of those coming from infected places are noted. If there is any suspicion of plague symptoms about the people, they are at once taken to a segregation camp and watched up to ten days, and detained there if need arises. The other incomers are medically inspected (and usually the temperature observed) daily for ten days.

Public notification in the streets, to the accompaniment of a drum, is made of the penalties incurred by citizens who smuggle in visitors, or who hide and do not immediately report to the authorities any plague case in their houses. Though there have been, during the three years under review, about six occasions on which imported cases of plague have been dealt with in Sohagpur, and a number have died in the segregation camp or plague huts, there has been not a single case of indigenous plague and no epizootic in Sohagpur during that time.

This method has been singularly and completely successful in the favourable conditions of Pachmarhi (a/

(a hill-station 32 miles from the railway at the end of a blind road), which is the Summer head-quarters of the Central Provinces Government.

But, as the subordinate official is so very susceptible to the influence of a very small bribe, this method has most generally failed, and it can be recommended only for a small community, and where really effective supervision, and an effective deterrent against defection on the part of the staff employed, can be ensured.

Inoculation with Haffkine's Vaccine.

The writer has used, in all the cases of inoculation he has personally performed (more than 1,000 ~~xxxxxxx~~), the vaccine prepared at and supplied by (under order of the Inspector General of Civil Hospitals for the Central Provinces and Central India) the Bombay Bacteriological Laboratory, Government House, Parel, Bombay, where by the kindness of Colonel Bannerman, I.M.S., the Director, he has had the pleasure of observing the whole process of preparation and capsulation, etc. The accompanying booklet on "The Preparation and use of Anti-plague Vaccine" has in general been the writer's guide in performing the inoculations.

Dosage - The dosage suggested has been closely followed, with a slight degree of variation in consideration of the body weight of the patient.

The Operation of Inoculation. The writer has for/

for the past four years invariably sterilised the place intended for the puncture solely by two applications of Liq. Iodi Fort., and, after an application of the same nature, subsequent to the puncture, had dried, a small portion of Flexile Collodion. He has usually wiped the needle with a piece of cotton-wool soaked in 1-20 carbolic lotion before the puncture was made, finding that otherwise a small portion of the oil or vaseline used for sterilisation was left at the site of puncture and interfered with its sealing.

Direction of inserting the needle. Finding that in a certain proportion of the earlier cases there was some œdema about the elbow joint, causing stiffness and perhaps a little pain, he has ceased to insert the needle in a downward direction towards the elbow, and now inserts it in an upward direction, and among 400 cases thus treated he has had no complaint of affection of the elbow joint. (Note. Site of puncture - The outer side of the middle of the left upper arm.)

Reaction. In no case has there been more than mild fever, usually from 100° to 102°F. lasting for about 24 to 36 hours, and never more than moderate local tenderness and œdema with injection of the tissues around the place where the dose was injected. The writer has dosed himself on four occasions, and twice he had rather prolonged local discomfort, attributable to using the inoculated arm freely in inoculating others too soon after his own inoculation.

There/

There has been no case of suppuration, though in a few cases a degree of induration, somewhat like a gumma, has remained for a few weeks.

After the first period of opposition, probably due largely to nervousness or fear of the results of inoculation, have passed, it has usually been easy to persuade a large number of those with whom one could come into personal contact to submit to inoculation.

Much can be, and in some cases has been, done by European Government officials in pushing inoculation, e.g.:-

1. In penalising in any legitimate way, as by withholding hut allowances, etc., those who refuse to be inoculated (this also applies to the promotion of evacuation when an epizootic begins).
2. Allowing those who have certificates of inoculation to travel about freely without having to submit to measures of segregation or medical inspection. (This may not be theoretically sound as they <u>may</u> be infection carriers - but the small risk is worth taking for the greater benefit.)
3. The giving of a monetary reward to those who will be inoculated.

The writer has found that the issue of Certificates of inoculation (usually not granted until ten days have elapsed) have been a great inducement to many people to submit to inoculation. The certificates give/

give the name, caste, and address of the person inoculated, together with the date of inoculation and some kind of identification mark, such as a scar or personal peculiarity, is described. These certificates usually exempt the holder from restrictions of movement, and from being detained for segregation or repeated medical inspection on going into uninfected districts.

From the experience of the 1,000 cases and what he has seen of inoculation as practised by others, the writer is firmly convinced of the efficacy of inoculation as a very powerful, in fact as the best, personal or individual safeguard.

Again, so far as he has seen its effect in small village communities where a large proportion of the people, say between 50 and 60% have been inoculated, the case incidence, the case mortality, and the duration of the epidemic are very much reduced.

With these notes the writer forwards, as well as the booklet "The Preparation and Use of Anti-plague Vaccine", six pamphlets intended to diffuse information about plague and the means of escaping and combating it:-

1. The Cause and Prevention of the Spread of Plague in India, by Captain W. Glen Liston, M.D.,D.P.H., I.M.S.
   This is a most admirable production for educated and intelligent readers. It is sold at two annas = 2d.

2. The History of the Plague, and how to stop its Ravages, by Dr. J. Murdock. Annas two.

3. The Plague and how to guard against it. Christian Literature Society. ¼ anna = ½d.

4./

4. Bubonic Plague, by Dr. D. N. P. Datta.

2, 3 and 4 are now out of date.

5. Vernacular Pamphlet "Plague and How to Escape it, by Dr. V. Ramchand Bhatt.

6. Plague and How to Escape from it. Canadian Presbyterian Mission Press. (Also published in the vernacular.)

5 and 6 are sold in bulk and intended for free distribution.

The writer has seen that much can be done to disarm prejudice against inoculation and to popularise it, by the circulation of such literature as the pamphlets submitted. He thinks that the Government of India should incur the necessary expense and use considerable effort to circulate such literature in English, and more particularly in the vernaculars among the masses. Much can be, and has already been, accomplished by officers of the Indian Medical Service (European), and Medical Missionaries, coming into personal contact with the people, explaining the purpose and results of inoculation, and demonstrating how little discomfort it causes. In this way the practice is becoming more popular, and an increasing number of people is willing to be inoculated at the very commencement of outbreaks, when it affords the greatest personal and communal protection. A good knowledge of the vernaculars, and of the customs and prejudices (as well as of caste restrictions), is needed to do this propaganda work successfully.

The/

The writer thinks that it would probably be advantageous to train a staff of European inoculators - probably suitable men could be picked from retiring soldiers - with a tactful manner and patience with the natives, and having a good working knowledge of the vernacular and customs of the people. The actual method of inoculation, dosage, etc., could easily be taught. It would, of course, take time efficiently to train, to the required degree of proficiency in the vernacular, such a body of men, but I believe that, in the end, they would do vastly more than the present native subordinate staff (many of whom refuse to be inoculated and discredit the practice), to popularise and perform protective vaccination among the masses. They might travel about and reach the villages in caravans (as the cool season is favourable for this), as the recently introduced travelling dispensaries do which have been so successful in various parts of India. The terrible loss of life in the present series of epidemics calls for energetic and, if need be, costly measures for controlling and stamping out the infection.

The following notes, for which I am indebted to the kindness of Lieut-Colonel P. B. Haig, I.M.S., Agency Surgeon in Bhopal, indicate the general impressions resulting from his extensive experience in Sehore, and very closely correspond to the writer's impressions.

1./

1. Sehore Cantonment. The figures are reliable. The population is 7,400, but at least half the people left, so for average purposes, 4,000 should be taken as the population.

Number of cases 291

" " deaths 204

(Case mortality 70%)

Of the remaining 87 cases, some probably did die, as their friends removed some who were not traced.

Cases treated in Sehore Plague Hospital 105

Deaths 71

Recoveries . . . 34

(Case mortality 67%)

Cases among inoculated persons 17

(10 of these cases were attacked within ten days after inoculation, before immunity was established.)

Deaths among inoculated persons 8

(Case mortality 47%)

(Of these 6 died within ten days after being inoculated, so the disease had probably been contracted before inoculation.)

(This latter does not seem to the writer a sound argument - had it been 4 or 5 days it would have been more convincing.)

Plague among human beings was invariably preceded by mortality among rats - many squirrels (chipmunks - J.R.) also died.

Prevention and Treatment.

No compulsory measures were adopted. Before the epidemic/

epidemic persons coming from infected places were medically examined (and their temperature taken daily for ten days, J.R.). After the outbreak started, people were advised to leave their houses and live in huts, etc., in the fields.

All houses in infected areas were opened up, exposed to sun and wind, and cleaned up, disinfectants being used where practicable.

People were advised to wash and sun their clothing.

Inoculation was made available for all. In Bhopal state nearly 5,000 (total population probably over 150,000) persons were inoculated, but this was too small a percentage to affect the epidemic.

In Sehore Cantonment 2500 persons were inoculated. I think here that the epidemic was undoubtedly checked by this, as more than half of the people who remained were done.

Special Plague Hospitals were opened.

The type of the disease was entirely bubonic, and in the majority, the bubos appeared about equally in the inguinal, axillary, and cervical regions.

Ordinary surgical treatment was adopted for suppurating bubos. As regards general treatment - fresh air, diet, and stimulants, when needed, were relied on.

In many cases the bubo was complicated by the patient's friends having applied red hot stones or bricks/

bricks, or escharotic vegetable juices, which caused extensive sloughing of the skin.

Patients treated in the Hospital certainly have a better chance of recovery - but the principal factor is the severity of the infection.

No bad results occurred after inoculation. In a few cases in which the arm was used too early, a painful and persistent œdema occurred, but in no case did suppuration result.

I am a firm believer in the efficacy of inoculation for protecting individuals, and, if a sufficiently high percentage of a population were done, inoculation will check an epidemic. I think at least 60% should be done to effect the latter result.

(Signed) P. B. Haig.

Major E. H. Sharman, I.M.S., Medical Officer of the 99th (Native) Infantry, stationed at Sehore, has kindly supplied the following notes of an outbreak among his men. I put his notes on record because of their very great value in showing the degree of protection afforded by inoculation, and because there is a clear indication of the period and degree of the immunity conferred.

History of the Out-break of Plague in the 99th Infantry, Sehore, Central India, 1911.

(by Major E. H. Sharman)

No. of Cases. 49 cases among combatants and 10 among non-combatants occurred, with three deaths only, of which two were the only two uninoculated persons present in the Regiment.

History of the Out-break. Sehore is divided into three areas :- (1) The Cantonment, which is a very small area, including only the Regimental lines and two bungalows under military control, estimated population - 900. (2) The Agency limits, which forms the greater portion of the (British) station, and comprises the Civil Lines and Native Bazaars under the Political Agent at Sehore, estimated population - 7300. (3) The Qasba or Native City, which is under the Bhopal State Durbar, estimated population - 4,400.

A few plague cases were detected in the bazaars and/

and Native City, Sehore, from February to June. Plague became epidemic in both these places in July. The epidemic was worst in August and September, died down in October, and ended in November. A table is appended - A - showing the number of attacks and deaths in each of these three areas for each month throughout the year, which shows the total of 767 attacks and 474 deaths in a population of about 13,000. The exact figures of the percentage of the population in the Civil areas and Native City, who were inoculated against plague, are not available, but it is estimated that about 25% of the inhabitants living in the Agency limits, and about 5% of those in the Native City, were inoculated, as against 99.7% inoculated in the Military area. Assuming the above percentages to be correct, table B gives the ratio of attacks and deaths per thousand in these three areas.

Many of the Civil inhabitants moved out into camp during August, and a large proportion of the inhabitants camped out until about the end of October.

I think many more cases of plague than those recorded in the Civil areas, especially the Qasba (Native City) occurred, and that many cases who recovered were not detected. Plague broke out in a very severe form in Bhopal City, 24 miles away, in September, and continued up to November, as many as 100 cases a day being recorded at the height of the epidemic. In a population/

population estimated at 40,000, 4,563 attacks and 4,265 deaths were reported from September to the end of the year. The large proportion of deaths to attacks points to a probability that there were many cases unrecorded.

From Bhopal City plague spread to, and for a long time prevailed in, the surrounding villages in the State. The inhabitants now appreciate the value of early evacuation, and I have found villages, near Sehore, evacuated after one or two deaths, and even after dead rats and squirrels (chipmunks) have been noticed, and before the human population was attacked.

Outbreak in the 99th Infantry. A few cases of plague having been reported in the bazaars in March, inoculation against plague of all the men, followers and families, then present in Sehore, was carried out. British Officers of the Regiment and their families all volunteered for inoculation, thus setting a good example in the Regiment. When inoculation was commenced there were only 250 sepoys present, the remainder being absent on colonial leave, but as soon as men returned from leave they were all inoculated. The inoculation of the whole Regiment, including followers and families, was completed in July.

The only exceptions were Sub-Assistant Surgeon Sayid Yusuf and his wife, who declined to be inoculated. Both lived in the Regimental Hospital Compound (adjoining the Native City), and were attacked with plague in September/

September and both died. I understand that the Sub-Assistant Surgeon had been attending private cases of plague in the bazaar, and he possibly contracted the disease there. He died on September 5th, and his wife, after a prolonged illness, on October 5th. These were the first cases, and with the exception of some relatives of Officers' servants, who died in their compound during September, (and who were included in the Civil returns, as the bungalows are situated in the Civil area), no more cases occurred in the Regiment up to October 5th.

Situation of the Regimental Lines.

The Lines are situated in close proximity to the bazaars. There are many trees throughout the lines, and squirrels and rats are numerous. The sepoys' houses are of old pattern, small, badly-constructed, and with no light and ventilation, except through the doors. The construction and position of these old lines are such that any epidemic occurring in the bazaar, which is not under military control, is almost bound to spread to the Regiment. Also three guards have to be furnished to the Residency, Jail, and Treasury, and consequently the men cannot be kept entirely away from infected areas.

Plague-infected Rats and Squirrels.

Dead rats and squirrels were first noticed in the lines and adjacent houses about the end of August. Two or three were found daily throughout August and September/

September. They were covered with kerosene oil and burnt as soon as found. No connection between the location of the squirrels and rats found can be traced to the subsequent location of infection in the lines.

Incidence of cases of plague in the Lines.

After the cases of the Sub-Assistant Surgeon Sayid Yusuf and his wife in the Military Hospital Compound, and the relations of the Officers' servants, referred to above, early in September, no cases occurred until October 4th, the date of the first case in the Regimental Lines. A second case was admitted on October 12th. From October 12th to October 20th cases were admitted daily, one case on November 2nd, and the last case on November 5th. A chart - C - is appended, showing the number of daily attacks throughout the period. The maximum was reached on October 15th, on which day 11 cases were admitted. The percentage of attack among Hindus was 8.2, and among Mohamadans 5.3.

Type of Attacks.

Nearly all the attacks, being modified by inoculation, were very mild, and if the disease had not been epidemic, and careful inspection for enlarged glands, amongst those reporting sick with a raised temperature, had not been made, and other causes of illness excluded, several would have escaped detection. The symptoms and physical signs of most of the cases were as follows:-

There/

There was a rapid onset and a temperature of from 101° to 104°F. (most were 103° or 104° on admission). In about 48 hours, in many cases, the temperature became normal, but in others lasted for eight or ten days, reaching normal by lysis. All complained of feeling very ill, with pain all over the body, and, especially, of very severe headache. The eyes were suffused. The pulse was very rapid, 110 or 120. Respiration rate 28 to 36. All had enlarged glands, most of them being tender and painful. The pain and tenderness usually disappeared within a week, and the swelling gradually subsided. In most cases the glands became normal in size in ten or fourteen days. Enlarged femoral and inguinal glands were found in twelve cases; Femoral alone, in twenty; inguinal alone, in twenty-four; and axillary one and cervical one. Suppuration occurred in two cases only, among the inoculated. Complications were slight, a few had some bronchitis, and three old malaria cases had relapses of malaria during their convalescence.

Deaths.

The only two uninoculated cases died; and among the 57 inoculated cases, one follower only (a sweeper) died.

Summary/

Summary of Precautions taken and Orders issued to prevent the spread of Plague in the Regiment.

1. Anti-plague Inoculation of the whole Regiment, followers and families.

2. Re-inoculation of all after a period of six months from their primary inoculation.

3. Evacuation of Regimental Lines and removal of all, to a Camp situated on high open ground with no trees on it, was carried out on the occurrence of the second case in the Lines on October 12th.

4. Bounds. Bazaars and Native City were put out of bounds, and no unauthorised or uninoculated persons allowed into the camp. All men were ordered to be in camp before sunset.

5. Clothing. The men were ordered always to wear trousers, socks, and shoes or boots, when out of camp. All clothing, before being taken to the camp, was spread out and exposed to a hot mid-day sun for two hours.

6. Sunning. All tents were opened daily, and all clothing and bedding exposed to the hot sun for at least an hour.

7. Guards. The guards which had to be sent to the Jail, Treasury, and Residency were reduced as much as possible. All Guard-room floors were sprinkled daily with Carbolised Powder, and at 4 p.m. were washed down with Phenol before the men's bedding, which had been exposed/

exposed to the sun, was brought in.

8. Lines. The tiles were removed from the roofs of all houses by the civil labourers directly the Regiment had vacated them.

9. Inspection. All ranks were inspected daily on their return from parades, and any man observed to appear ill or having fever was carefully examined, and, if suspicious, was isolated.

10. Contacts, were segregated for ten days.

11. Fever. All cases of fever were at once transferred to the Regimental Hospital, where inspection and detention tents were pitched. Cases diagnosed as plague, were transferred to a Military Plague Hospital adjacent to the Civil Plague Hospital. Patients were kept in Hospital until their temperature had been normal for ten days, and their glands had subsided. They were then removed to a convalescent camp before returning to the Regiment.

12. Disinfection. Careful disinfection or destruction of infected clothing, bedding, etc., was carried out.

General Remarks.

At the time plague broke out in the Regiment, viz., October 5th, I think the disease among the civil population was of a less virulent form than it was earlier in the epidemic. The men in the Regiment who were attacked by plague were healthy strong men, who had been inoculated less than six months previously.

The/

The patients were at once put under treatment, and properly nursed and fed. Stimulants were given to most cases on admission, and continued until the pulse improved. The following mixture was given as a routine treatment.

℞

Tr. Cinchonae Co.	m xx
Ammon. carb.	gr.v
Liq.Strychn.Hydr.	m ij
Tr. Digitalis	m ij
Aquam ad	ʒi

The digitalis was omitted as soon as the pulse improved.

Glands were not punctured, and no microscopical examination (except that malaria was excluded by blood examination) was made.

The clinical symptoms of the cases were quite clear, and all other causes of raised temperature and other symptoms were carefully excluded. I also had the benefit of the long experience of Major (now Lieut-Colonel) P. B. Haig, I.M.S., Agency Surgeon, who was in charge of the Plague Hospital, and who saw with me any doubtful cases before admission.

The results show the enormous advantage of inoculation, as a preventative, and more especially how great is the protection afforded in the modification of the disease in those who are attacked. The statistics that I have seen in books and publications on plague, showing the proportion of recoveries to attacks in inoculated persons, have always been recorded among the civil population, and I think many of these attacks/

attacks among the inoculated are so mild and recovery is so rapid, that a considerable number of cases would never be recorded among Indians in Civil life. If these were all included, as they have been in this outbreak, the statistics of plague attacks among the inoculated would show a higher percentage of recoveries than has so far been recorded in civil communities.

No trouble was experienced in getting the sepoys' families and the followers to submit to inoculation and re-inoculation. All ranks were much impressed with the protection afforded by inoculation. Native Officers and men frequently remarked that, if the Regiment had not been protected by inoculation, about 50 of them would have been buried in Sehore this year.

Statement of Plague cases and deaths in Sehore Cantt. and Kusba from January to December 1911.

Serial No.	Months.	Sehore Cantt. under Military Control. Estimated Population - 900		Sehore Cantt. under Political Agent. Estimated Population - 7300.		Sehore Kusba under Bhopal durbar. Estimated Population - 4400.		Remarks.
		Attacks	Deaths	Attacks	Deaths	Attacks	Deaths	
1	January	"	"	"	"	"	"	
2	February	"	"	6	4	"	"	Plague declared in Chawni (cantt.) from 11.2.11
3	March	"	"	21	16	"	"	
4	April	"	"	22	20	"	"	
5	May	"	"	"	1	"	"	
6	June	"	"	4	3	"	"	
7	July	"	"	1	1	14	13	Plague declared in Kusba from 20.7.11.
8	August	"	"	20	8	148	83	
9	September	2	2	110	80	222	145	
10	October	55	1	82	55	28	18	
11	November	2	"	29	24	Not	received	
12	December	"	"	1	"	-"	-	
	Total	59	3	296	212	412	259	

Sehore,

15th March, 1912.

Chart B.

Table.

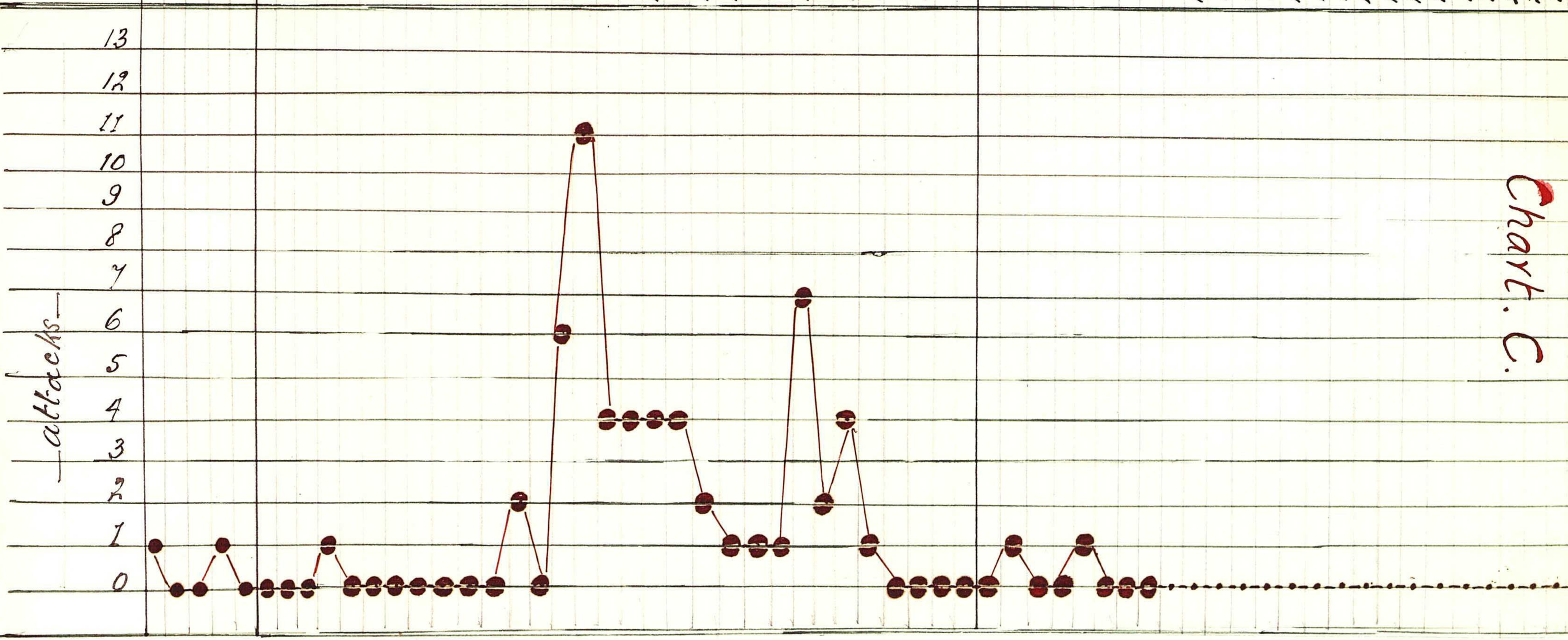
Particulars.	Sehore Cantt. 99th Infy.	Sehore cantt. under P.A.	Sehore Kusba.	Remarks.
Population	900	7300	4400	
Estimated percentage inoculated	99.7	25	5	
Attacks	59	296	412	
Deaths	3	212	259	
Ratio of attacks per 1000	65.55	40.54	93.63	
" " deaths " "	3.33	29.04	58.86	

Sehore C.I.

15.3.12.

PLAGUE CHART 99th INFANTRY FROM SEPTr TO NOVEMBER
1911.

Chart C.



Attacks in uninoculated 2.
Deaths " 2.
Attacks in inoculated 5%.
Deaths " 1.

69.

16.3.12.

Cases of Plague in 99th Infantry at Sehore C.I. in Epidemic of 1911.

Chart D.

Serial No.	Names	Ages	Duration of illness. days	Serial No.		Ages	Duration of illness. days
1	C. Syed Yousoof(Died)	27	5	31	Abdul Rahmon	29	14
2	Mrs Syed Yousoof(Died)	16	35	32	Shaik Ismail	33	34
3	Tilak Singh	22	48	33	Abdul Karim	18	14
4	Narsimaloo	30	40	34	Chunibal	27	18
5	Chotoo	24	34	35	Nandlal	20	14
6	Shaik Sulamon	19	15	36	Mir ali Naki	22	12
7	Maidya	22	13	37	Harkaran Singh	25	12
8	Charan Singh	30	14	38	Shaik aladin	37	12
9	Dulichand	19	22	39	Faseeuddin	18	11
10	Aladin khan	35	12	40	Ramasar Singh	24	16
11	Gafoor khan	33	11	41	Champath Singh	19	10
12	Dharam Singh	18	12	42	Jamna Singh	34	15
13	Chotu (Died)	30	2	43	Dhandu Singh	33	14
14	Gori	23	16	44	Jawaher Khan	34	17
15	Chatherpal Singh	29	37	45	Harnand	23	14
16	Prem Singh	36	17	46	Omichand	20	11
17	Nowrathan Singh	20	12	47	Dost Mohomed	29	13
18	Khana Singh	22	13	48	Balmokund	20	13
19	Sheopal Singh	24	12	49	Chota	28	14
20	Ramsahai Singh	23	11	50	Jogathpal Singh	19	13
21	Teetram	21	13	51	Kanniah	25	13
22	Sobram	23	12	52	Mathura Singh	39	16
23	Nowab Singh	20	16	53	Bhagath Singh	21	12
24	Lalchand	25	11	54	Shiveram	19	16
25	Brigbahadur Singh	23	15	55	Crulzar khan	37	15
26	Sohan Singh	24	17	56	Rambhagath	23	27
27	Ramsahai	35	20	57	Hubdar Singh	22	11
28	Nokhay Singh	21	15	58	Shenanandan	28	18
29	Gyabuksh Singh	24	11	59	Girdhari	30	17
30	Shaik Ramzan	34	10	60			

Summary of Notes on the Epidemicity and Prophylaxis of Plague.

1. The wide dissemination of Plague in India is attributable to the great facilities for and popularity of Railway travel.
2. A local outbreak is almost invariably traceable to an imported case, and it is always preceded by an epizootic (among rats and chipmunks).
3. The interval between the discovery of the epizootic (i.e. the finding of dead rats) is regularly from 10 to 14 days. c.f. The Etiology and Epidemiology of Plague, 1908, p.21 1.
4. There is a general recognition by the mass of the people, even villagers, of the close connection between rat mortality and human plague. There is increasing willingness to evacuate houses earlier.
5. The effective management of plague epidemics, owing to the lethargy and prejudices of the people, is possible only in small communities.
6. The mode of building and the close proximity to each other of Indian houses favour the maintenance of a large rat population, which is usually well fed owing to the very careless storage and handling of food stuffs, and the accumulation of rubbish in the houses.
7. Plague rarely attacks the young and old, while its incidence among the strong and healthy adult, male and female, is proverbial.

8./

8. The infection is usually and markedly most virulent at the beginning of an outbreak, and there is a low case mortality at the end.

9. The infection of plague is frequently spread when people flee from an infected locality taking their bedding with them.

10. It is most conspicuous how seldom those in attendance on cases of plague (out of the surroundings in which the disease was contracted) themselves contract the disease.

11. The epidemicity of plague seems to be favoured by prevalence of conditions of scarcity or famine. The breeding of rats is specially related to the hot season, when scarcity usually prevails, and there is always a relatively greater number of young and highly susceptible rats after a famine or scarcity.

13. A marked tendency of plague to recur in the same localities in successive outbreaks has been noticed.

14. Anti-plague inoculation with Haffkine's prophylactic confers a very high degree of protection and immunity upon inoculated persons. The writer has not known of the occurrence in the same epidemic season of a single case of plague among over 1,000 cases personally inoculated. The statistics of the outbreak in the 99th Native Infantry at Sehore show how high a degree of safety of life, i.e. how great/

great a reduction of mortality there is among those contracting plague even six months after being inoculated. Probably six months should be considered the outside period of the protection resulting from inoculation.

15. Only cases of Bubonic Plague have been met with in the epidemics occurring under the writer's observation in the Districts, in Central India, and the Central Provinces, referred to. The occurrence of carbuncles has never been observed in these areas.

16. The symptoms of the earlier cases have been marked and classical, but cases near the cessation of the outbreak may be so mild as to go undetected - hence possible innacuracy of mortality statistics.

17. With the exception of the incision of bubos that have progressed to suppuration, and the application of Ac. Carbolic Pur. and Sp. Vin. Rect. to them when evacuated, the treatment has been symptomatic, and chiefly directed to the avoidance of heart failure.

18. Immediate evacuation of dwellings*, and, after sterilisation of bedding, etc., the resort to camps can be relied upon to reduce an outbreak to trivial proportions. This, however, is seldom attainable, and there is commonly a severe exacerbation through people returning too soon to their homes.

* On the outbreak of an epizootic and the finding of dead rats, etc.

19/

19. Anti-plague inoculation is not only a great individual safeguard, but it can be relied upon greatly to minimise the ravages of an incipient epidemic, if a sufficiently large proportion of the population, say not less than 50% and better 60% or upwards, is inoculated.

20. The destruction of rats, on such a scale as to modify the epidemicity of plague, is not attainable in India because of the indifference of the people at non-epidemic seasons, when alone it is of value, and because of the Hindu's religious objection to the taking of animal life.

21. Small and comparatively isolated communities can be guarded against outbreaks of plague by prompt and thorough measures in dealing with imported cases - i.e. by the effective inspection and taking the temperature for ten days of visitors and returning inhabitants from infected places, and the rigorous isolation in a segregation camp for ten days of suspects and contacts, and the treatment in a plague camp or Hospital of all cases.

22. Too great stress cannot be laid upon the value of popularising anti-plague inoculation, a practice attended with no ascertained injury to health, and the one effective personal or individual and communal safeguard.

The methods available and effective for propaganda are:-

(a) Civil surgeons and Medical Missionaries coming into personal/

personal contact with the common people and explaining the objects and results of inoculation.

(b) The granting of certificates of inoculation which lighten the restrictions upon residence and travel of people belonging to infected localities.

(c) Legitimate pressure upon Government servants and employees to induce them to submit to inoculation - preferably in public.

(d) Monetary rewards to those who are inoculated.

(e) Widespread circulation of explanatory literature (e.g. specimens sent) giving details of the method and results, both in English and the vernaculars, to induce the educated classes to adopt and recommend the safeguard, and to remove the prejudice of the masses.

(f) The writer thinks that a properly trained staff of Subordinate European Inoculators, who would travel among the villages in the cool season, might do much to recommend and increase the adoption of the safeguard by the common people.