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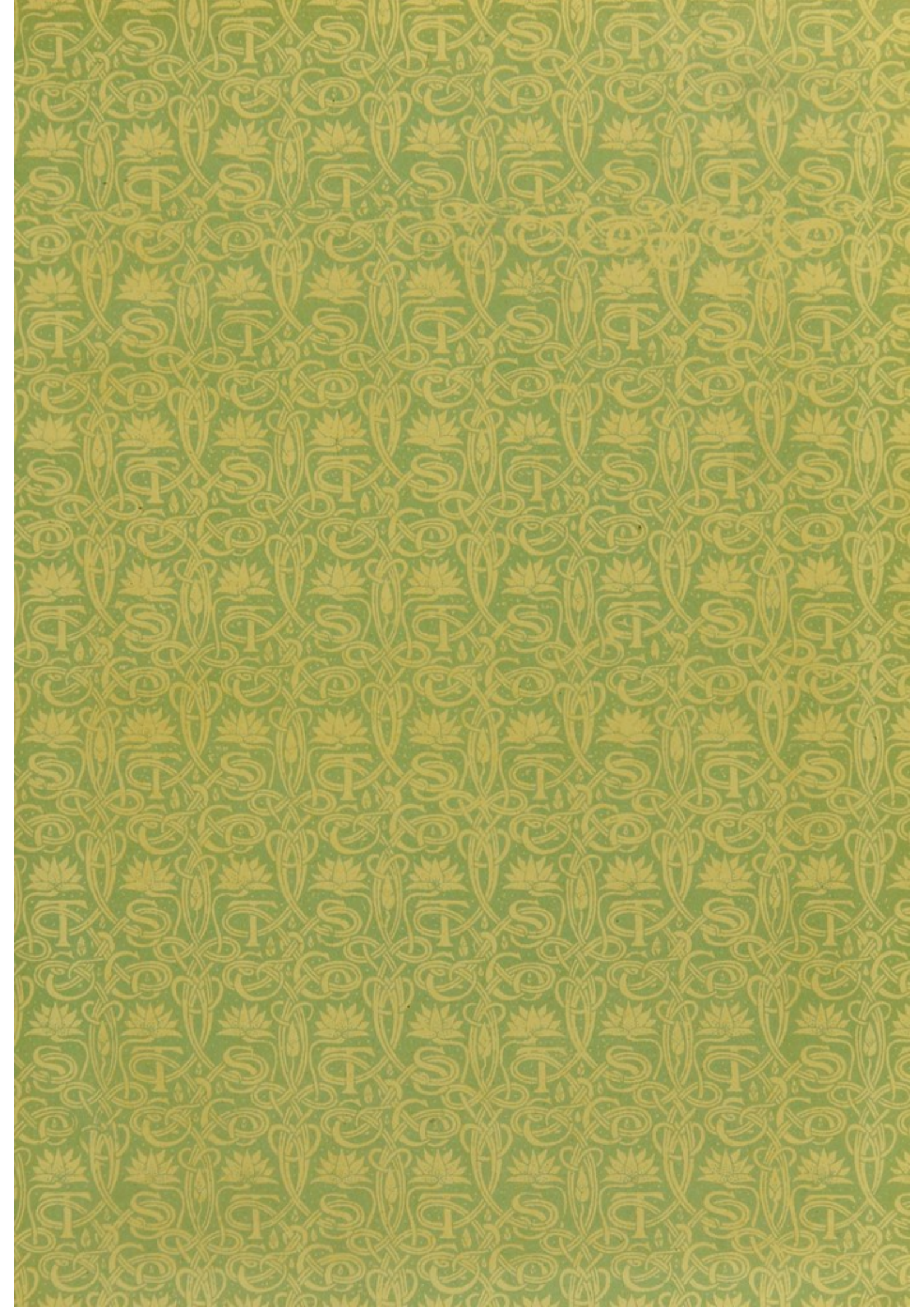
*Smallpox and Vaccination
in British India*



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SMALLPOX AND VACCINATION IN BRITISH INDIA

BY THE SAME AUTHOR

Malarial Fevers.—Third Edition (16th Thousand). Calcutta : Superintendent of Government Printing, India, 1908. Price One Rupee.

And with Capt. W. Glen Liston, I. M. S.

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[Second Edition in preparation.]

*Sir Patrick Manson, to whom I
owe so much.*

*S. P. James
9/2/10.*

SMALLPOX AND VACCINATION

IN

BRITISH INDIA

BY

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With 14 Diagrams

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PREFACE.

IN all the countries of Europe where vaccination has been extensively carried out an appeal to the figures of smallpox mortality has given in favour of the practice an answer as unequivocal as it is satisfactory, and it is obviously of great interest to ascertain whether a similar answer results from enquiry in a country like India where the difficulties attending the introduction and progress of vaccination have been enormously greater than in Europe. This is my excuse for having attempted to bring together in convenient form some facts and considerations which may assist those who desire to estimate the value of vaccination in India. The difficulties that I have in mind are often imperfectly understood by those who have no personal experience of this unique country, and since without a knowledge of them we cannot adequately appreciate the degree of success that has attended the work of vaccination it will not be out of place if I state some of them very briefly here.

(1.) The number of people in British India among whom vaccination operations are conducted is more than 230 millions and the extent of country over which they are scattered is more than a million square miles.

(2.) About 214 million of these people live in places where vaccination is optional.

(3.) As recently as 1901 no more than 5 or 6 per cent. of the inhabitants of India could read and write their own language.

(4.) The great majority of the people, while being exceedingly ignorant and childish, are so apathetic, and regard the dangers of future events so lightly, that even where general intelligence has advanced to an extent sufficient to enable them to realize that it is better to be vaccinated than to have smallpox, they

adopt the measure only when it is granted to them entirely free of cost and is brought almost to the doors of their houses.

(5.) It is characteristic of nearly all natives of India to be suspicious of any measure not sanctioned by the custom of ages—the mere fact that a measure is new suffices to condemn it in their eyes: in the early days also vaccination was opposed not only from disbelief in the efficacy of any “new” plan but because it was a measure introduced by the British Government.

(6.) From very early times there has existed in India the worship of a goddess of smallpox, and among certain castes it is still a rule to take no precautions whatever against the disease, a visitation of it in their households being regarded as a sign that they are favoured by the goddess.

(7.) For more than half a century after the introduction of vaccination nearly all the inhabitants in some parts of India were wedded to the practice of “smallpox inoculation,” and many thousands of Brahmin inoculators, having great influence with the people, were violent opponents of vaccination.

(8.) In the early years of vaccination the difficulties of providing a constant supply of good vaccine were almost insuperable, and even at the present day vaccination operations in most provinces can be carried out during the cold season only.

(9.) On account of the great expense it has never been possible to employ a skilled medical agency in the actual work of vaccinating, and for many years the only vaccinators who could be obtained were entirely illiterate, very ignorant, and wholly untrustworthy.

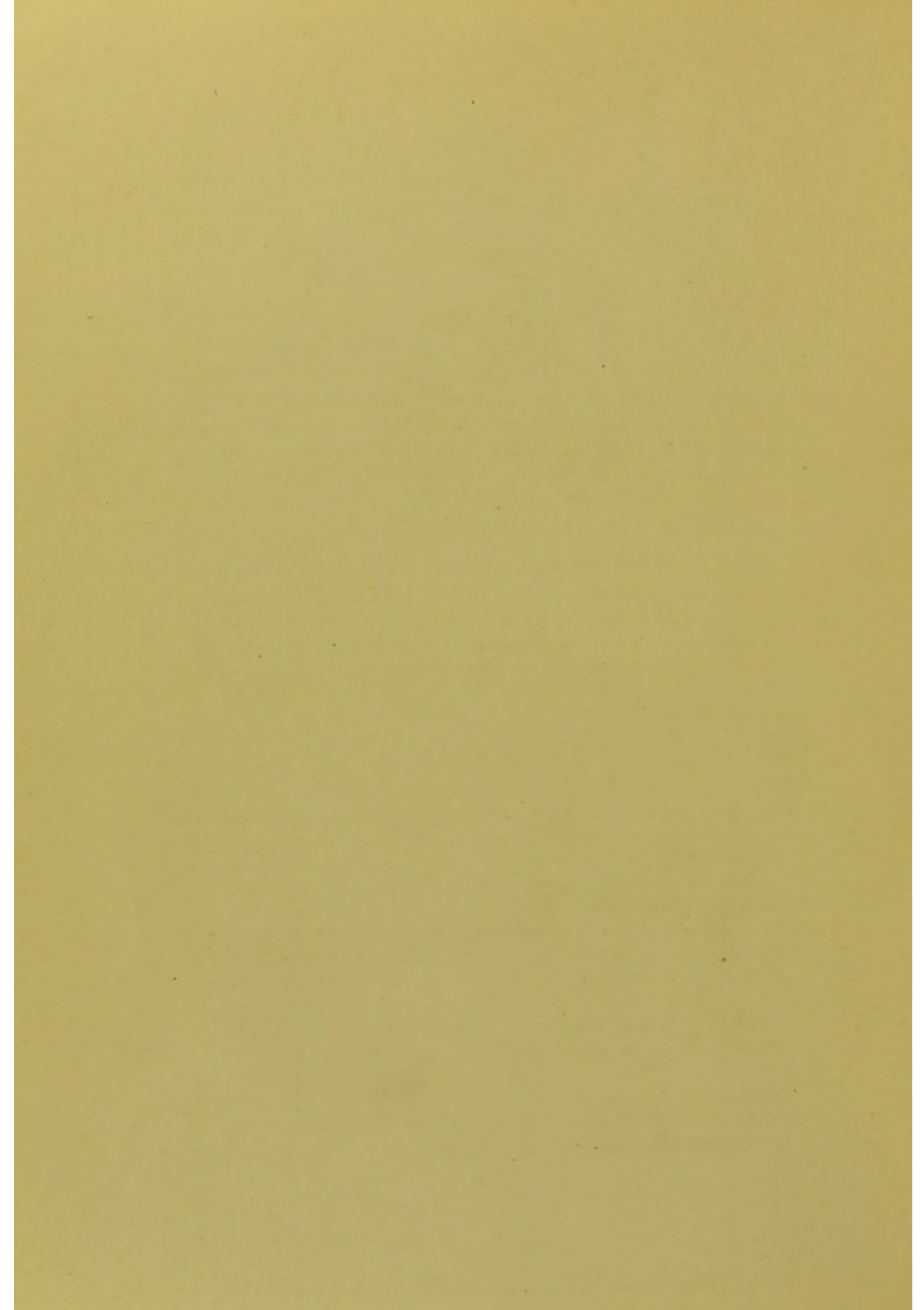
(10.) From time to time prejudices arise and rumours are spread which on account of the credulity and childish ignorance of the people result in very serious detriment to the progress of vaccination. A very early prejudice against vaccination arose because the vaccine disease came originally from the cow, an animal highly revered by Hindoos. One of the rumours causing

most difficulty in early years was to the effect that the object of vaccination was to set the "Government mark" upon people who would afterwards be sent as coolies to other British possessions, and another was that the Government mark was a means of obtaining a census of the people with a view to impose a new capitation tax ; but much more ridiculous rumours than these were current for many years. That such detriments to vaccination exist even to the present day was very evident on the appearance of plague in India, for at that time vaccination operations were of necessity much lessened and in some parts suspended on account of the fears of the people that vaccination was being used by Government either as a means of introducing plague among them or as a guise under which plague inoculation was being performed.

This list, which might be increased considerably, is sufficient to indicate the magnitude of the task of dealing with smallpox in India by a measure so essentially personal to the individual as is vaccination. It has been truly said that it is one thing to deal with epidemic disease among Europeans who are sufficiently educated to understand the object of measures taken for their own advantage and live surrounded by all the aids to such measures lent by modern sanitary appliances, but quite another to deal with it among orientals who oppose such measures in every way and generally live amid surroundings which could not be more favourable to the spread of epidemic disease if they had been specially devised to that end.* I would ask that this truth be kept in mind during the reading of my essay. For the rest its scope and object are sufficiently stated in the first chapter and in the concluding section of the last chapter. I need add only that I hope the subject has been dealt with in such a manner as to render it interesting to people of all classes.

S. P. J.

* Annual Report of the Sanitary Commissioner with the Government of India for 1904, page 91.



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CHAPTER I.

INTRODUCTORY.

SMALLPOX takes the first place among epidemic diseases in the tenacity and malignity with which it has pursued the human race over all the world, and the tale of the destructive ravages of this pestilence in early times and of the suffering which resulted from it fills the mind with horror. More than a thousand years ago it was a matter of common knowledge that an attack of the disease was an inevitable event in the life of everyone, and in all the centuries of which there is any record from that time until the discovery of vaccination, the same opinion as to the prevalence of smallpox was universal. And because, even in civilised countries during the 18th century, out of every five or six people attacked one died and a large proportion of the remainder were disfigured for life and often rendered blind or deaf, it is not surprising that the inevitable attack of smallpox was anticipated with anxious dread. Such pestilences as cholera and plague, terrible though they were, paled into insignificance in comparison with this ever-present scourge of the human race. Those who desire an adequate knowledge of the effect of the disease on mankind in early times should read Sir John Simon's celebrated essay on the "History and Practice of Vaccination," which, written in 1857, still remains the chief source from which later authors have culled their information. As regards the ravages of smallpox in early times in India—where at a low estimate it has been present for more than fifteen hundred years—there is very little information, but such as I have been able to collect is presented in the last chapter of this essay, and the figures given there enable us to conjecture how enormous must have been the mortality and disability during those dark centuries when the people relied

The importance of smallpox ; its destructive ravages in early times.

solely upon the temple-worship of a deity to protect themselves from the disease.

The first
great effort to
mitigate it;
smallpox
inoculation.

The first glimmer of hope in connexion with smallpox came from the knowledge that by receiving this loathsome disease of our own accord but by a special method—called *smallpox inoculation*,—we could, as it was said, “buy it cheaply,” that is, we could contract our inevitable attack of the disease in so mild a form that life was hardly endangered. In Eastern countries, and among them India, this wonderful endeavour in Preventive Medicine was in vogue for many years before it was introduced into Europe. The second chapter of this essay is concerned with the practice as it was carried out until comparatively recent times in India. Its aim was, by inducing smallpox purposely by inserting under the skin some smallpox matter of non-virulent type, to produce the disease in a mild form, and so to impart artificially the same security that one attack of the disease in its natural form is known to give against future attacks. The measure was a great advance, but there were two very strong objections to it, namely, that, however carefully it was carried out, a certain number of deaths resulted from the operation, and that, since smallpox set up by inoculation was as contagious as the disease contracted in the natural way, an inoculated person was dangerous to everyone with whom he came in contact. The second was almost an insuperable objection to the practice, because it implied that inoculation, unless it could be made universal, would tend to increase rather than diminish the prevalence of the pestilence; the practice, despite its advantages to the individual, was a serious evil to the community.

The second
great effort;
vaccination.

The hopes of the great benefits which this measure would confer upon mankind were doomed to disappointment, but fortunately for the human race it was to be supplanted by a method of protection, namely, *vaccination*, which has been described by Sir John Simon as “the greatest physical good ever given by science to the world.” The general employment of this method was due to the genius of an English surgeon

Jenner, who for this reason is justly honoured in history as one of the greatest benefactors of mankind.

The term vaccination means the intentional inoculation with the matter of *vaccinia* or cow-pox, and contrasting the results of smallpox inoculation with those of this newer method of protection we may say that while the former practice produces in the individual operated upon an attack of human smallpox which is dangerous not only to the inoculated person but also (from its contagiousness) to everyone around him, the latter practice produces a mild local disease which effectually protects the vaccinated individual against human smallpox and is, moreover, entirely without danger to him and (not being contagious) entirely without danger to others. Again, while smallpox inoculation tends—at any rate in crowded communities—to increase the prevalence of the disease, vaccination reduces the prevalence and mortality of smallpox in a remarkable manner. Obviously, therefore, vaccination is the better practice, and it is not surprising that from the time when the famous work of Jenner brought to every civilised country a knowledge and appreciation of “the greatest sanitary fact the world has ever known”* it has in those countries entirely supplanted the practice of smallpox inoculation.

Smallpox
inoculation
and vaccin-
ation
compared.

The third chapter of this essay contains a record of the introduction and progress of vaccination in India, and the fourth is occupied with the proof of the great benefits which the people of this country have already derived from the measure. To anyone who reads that chapter with discrimination it will be apparent that while the results already effected by vaccination in this country are such as justly to afford reason for enthusiasm and pride, much still remains to be done before we shall be within measurable distance of completing the emancipation of the people from the horrors of smallpox. A discriminating person will realise that, especially in a country like India, there

* Edwardes “Smallpox and Vaccination in Europe,” London, 1902. Immermann (Nothnagel's Encyclopedia of Practical Medicine) says: “Jenner's immortal service, the discovery of vaccination, is the greatest sanitary fact of all times.”

The danger
of forgetful-
ness.

The duty of
the public in
India.

is a great danger that the declining prevalence of an epidemic disease may bring about forgetfulness of the means by which such success has been attained. In one or two European countries such forgetfulness has led to serious neglect of vaccination, with the result that in those countries smallpox—at one time controlled—has again caused disastrous epidemics. To the individual all concern in the subject may seem to terminate with his own vaccination and perhaps with that of his relatives, but this is not so ; it is the duty—as it is the right—of all natives and Europeans in India to insist on the vaccination of everyone in the community and to oppose strenuously any measure which, being dictated by either ignorance or parsimony, may tend to lessen the efficiency with which arrangements to that end are carried out. The matter at issue is no trivial problem in modes of government or other politics of party or of state, but a problem of choosing between the life or death of individuals and of races. Let us hope that those in authority in India will continue to regard this as their guiding principle, lest they and the millions whom they serve may have cause to remember—too late—how indescribably dreadful a thing is the epidemic prevalence of a disease which, when uncontrolled, causes the wreck of nations in a manner more ruthless than the most terrible of wars.

CHAPTER II.

SMALLPOX INOCULATION.

IN a number of books and reports the practice of smallpox inoculation is said to have been carried on in India from "time immemorial" and to have been regarded by learned natives as of "incredible antiquity," but beyond such statements there is very little evidence regarding the origin of this measure of protection in India. We know, however, that by the beginning of the 18th century it was practised extensively over a very large area, and there is needed but little experience of native character and prejudices to make us sure that such a general acceptance of the measure was not brought about in a few years; very great difficulties must have attended the introduction of the practice and the progress towards its general employment must have been correspondingly slow.

It is generally stated that in olden times the practice was known to, and extensively employed by, all classes of the native inhabitants of India; whether this was so or not it is impossible at present to ascertain, and in any case it is more important to know that from the period of which we have trustworthy information, the custom has been sufficiently deep-rooted to form a serious obstacle to the introduction of vaccination in only a few of the provinces into which India is now divided, namely, Bengal, Assam, Burma, the North-West Frontier Province and some of the Native States. Writing in 1804 Shoolbred said that inoculation was not practised in Oudh, the Dooab, or at Allahabad, and that in Nepaul, Nagpore, Hyderabad, Mysore and Behar it was entirely unknown. In a long account of the state of vaccination in the Bombay Presidency, written by a Superintendent of Vaccination about 1835, there is no mention of the practice,

Its antiquity
in India.

Provinces
where the
practice
was most
prevalent.

although other difficulties in promoting vaccination are enumerated; and as regards the Madras Presidency, although it was stated by the Secretary to the Medical Board in 1841 that inoculation had been practised in various parts of the Presidency from "time immemorial," it was said also that the natives had no prejudices against vaccination and accepted it readily. There is evidence also that in Agra, Bareilly, and other parts of the area now known as the United Provinces, the practice was unknown in 1850, or at any rate was very rarely employed. But as late as 1899 inoculation was almost general in a number of Native States and, as is well known, the efforts to suppress it and to induce the people to accept vaccination in its stead have not been, even to the present day, entirely successful in the British territories of Burma, Assam, and the North-West Frontier Province.

The extent of
the practice
in those
provinces.

Except as regards Bengal, information of the proportion of the inhabitants who made it a rule to be inoculated is almost entirely wanting, but there is little doubt that in the province mentioned, except as regards certain castes who for reasons of religion took no precautions whatever against smallpox, the practice was almost universal until the middle of the 19th century. We are told that in 1850 there was at least one *ticcardar* or inoculator for every eight or ten groups of houses, and that in Calcutta town alone the names and addresses of 68 inoculators were known in that year. From 1848 to 1867 attempts were made by various civil surgeons to estimate the extent to which smallpox inoculation was practised in Bengal, and from an examination of more than 35,000 people in those years it appears that over 81 per cent. had been inoculated.

The operation
as carried out in
olden times.

Several accounts of the mode in which the operation was performed by the professional inoculators of comparatively olden times in India have been published, but as far as I am aware the first, and perhaps the best, was that by Holwell in 1767. The following is a part of his account: "Inoculation is performed in Hindoostan by a particular tribe of Brahmins. Dividing themselves into small parties of three or four each

they plan their travelling circuits in such wise as to arrive at the places of their respective destination some weeks before the usual return of the disease. They arrive commonly in the Bengal provinces early in February; although in some years they do not begin to inoculate before March, deferring it until they consider the state of the season and acquire information of the state of the distemper. The inhabitants of Bengal, knowing the usual time when the inoculating Brahmins annually return, observe strictly the regimen enjoined, whether they determine to be inoculated or not; this preparation consists only in abstaining for a month from fish, milk, *ghee*. When the Brahmins begin to inoculate, they pass from house to house and operate at the door, refusing to inoculate any who have not, on a strict scrutiny, duly observed the preparatory course enjoined them. It is no uncommon thing for them to ask the parents how many pocks they choose the children should have. Vanity, we should think, urged a question on a matter seemingly so uncertain in the issue; but true it is, that they hardly ever exceed or are deficient in the number required. They inoculate indifferently on any part; but if left to their choice, they prefer the outside of the arm midway between the wrist and elbow, and the shoulders for the females. Previous to the operation the operator takes a piece of cloth in his hand (which becomes his perquisite if the family is opulent) and with it gives a dry friction upon the part intended for inoculation, for the space of eight or ten minutes; then, with a small instrument he wounds by many slight touches, about the size of a silver groat, just making the smallest appearance of blood. Then opening a linen double rag (which he always keeps in a cloth round his waist) he takes from thence a small pledget of cotton charged with the variolous matter, which he moistens with two or three drops of the Ganges water, and applies it to the wound, fixing it on with a slight bandage, and ordering it to remain on for six hours without being moved; then the bandage to be taken off, and the pledget to remain until it falls off itself. The cotton which he preserves in a double calico rag, is saturated with

matter from the inoculated pustules of the preceding year; for they never inoculate with fresh matter, nor with matter from the disease caught in the natural way, however distinct and mild the species. Early in the morning succeeding the operation four *collons* of cold water are ordered to be thrown over the patient from the head downwards, and to be repeated every morning and evening until the fever comes on, which usually is about the close of the sixth day from the inoculation; then to desist until the appearance of the eruption (about three days) and then to pursue the cold bathing, as before, through the course of the disease, and until the scabs of the pustules drop off. They are ordered to open all the pustules with a sharp pointed thorn as soon as they begin to change their colour, and whilst the matter continues in a fluid state. Confinement to the house is absolutely forbid, and the inoculated are ordered to be exposed to every air that blows; and the utmost indulgence they are allowed, when the fever comes on, is to be laid upon a mat at the door. But in fact the eruptive fever is generally so inconsiderable and trifling as very seldom to require this indulgence..... Their regimen is ordered to consist of all the refrigerating things the climate and season produce; These instructions being given, and an injunction laid on the patients to make a thanksgiving *poojah* or offering to the goddess on their recovery, the operator takes his fee, which from the poor is a *pun* of *cowries*, equal to about one penny sterling, and goes on to another door, down one side of the street and up on the other; and is thus employed from morning till night, inoculating sometimes eight or ten in a house.”*

It will be seen from this account that at the time to which Holwell referred the operation was carried out with great care, and there can be no doubt that in those comparatively olden times a high degree of knowledge in regard to the procedure necessary for success had been attained. In this connexion the

* Accounts of the operation as carried out in some Native States at the present day will be found in the District Gazetteers of the different States. (See, for example, Vol. VI of the Baluchistan District Gazetteer Series, Sarawan, page 219. The Times Press, Bombay, 1907.)

following additional details regarding the practice as carried out at that period are worthy of mention :—

Additional details.

(1) Infants at the breast were not inoculated, but children above one year of age were considered old enough for the operation.

(2) The rules to which in accordance with ancient custom everyone desiring inoculation had to conform were not only arduous in themselves but interfered greatly with daily work and with business generally. The restrictions included abstinence for a month prior to inoculation from milk, fish, and *ghee* and in addition for 21 days after the operation no member of an inoculated household was permitted to have intercourse with the outside world, and no person from another village was permitted to enter a house containing inoculated patients. Each time either of these rules was infringed the guilty person was regarded as “unclean,” and was required to bathe and to put on different clothes.

(3) The infectiousness of the disease set up by inoculation was freely acknowledged by the early professional inoculators and to this the elaborate code of rules to which the people in inoculated villages had to conform bears abundant testimony. Thus, no inoculation was allowed in a village unless nearly all the unprotected people were willing to have the operation performed; all the inoculations in a village were done on the same day; women who were pregnant and others who could not arrange to be inoculated on the date fixed had to leave the village until the danger of infection was past; the clothes of all inoculated persons were kept for 21 days and then washed on a fixed day separately from those of unprotected people; no barber was allowed to ply his trade in any house where inoculated persons resided; bathing in public tanks was not permitted until the eruption had disappeared.

(4) The fatality attending the operation—depending as it did very greatly on the skill and care of the operator—was probably very low at the period to which we are now referring.

This is evidenced in the extract from Holwell already quoted, and more recently by the observations of Bedford who saw 79 inoculations performed without a death resulting, and Wise who reported that in Chittagong the mortality attending the operation was only .5 per cent.

We see then that in olden times when all the rules just enumerated were strictly enforced, and when the operation was performed by the professional Brahmin inoculators only, the measure proved a real blessing to the inhabitants of certain parts of India. We must remember also in this connexion that the conditions of life in the parts of India where the operation was general were very favourable to the success of the measure. The great bulk of the inhabitants of Bengal, Assam and Burma lived in small villages or hamlets, each house being some distance from the next, and each village or hamlet a mile or more from neighbouring ones. Under such conditions, and with the strict rules of segregation in force, the danger of spreading the disease set up by inoculation was not great.

The disastrous changes in more recent times.

Unfortunately there is another side to the story.

With the increasing belief in the efficacy of the measure the demand for inoculators became greater than the supply and the price charged for the operation rose. In 1850 a usual fee was four annas and some rice for the operation on a boy and two annas and some rice for a girl ; other writers of the same period say that the lowest fee taken for puncturing was two or three rupees and the highest sixteen rupees and a shawl. As time went on, the work of inoculation was undertaken by Hindoos of low castes or trades who were not only exceedingly ignorant but had not the influence necessary to make the people conform to the rules for preventing the spread of the disease. The result was that about the middle of the 19th century many epidemics were definitely traced to the operations of inoculators. In 1831 Dr. Cameron stated : " It is now well ascertained that inoculation is the great means by which smallpox is kept in existence in Calcutta," and in 1844 the Superintendent of Vaccination reported that " smallpox is annually introduced into Calcutta by a set of inoculators,

numbering about 30, to the great endangerment of the public health." At this time the inoculators increased their gains largely by treating cases of smallpox, so that it was to their advantage when epidemics broke out. Indeed, it is said that when they reached a village where, in consequence of the absence of smallpox, the people were reluctant to be inoculated, it was not an unusual custom for them to throw pieces of cotton soaked in smallpox matter in places where children played, knowing that if they could set up an epidemic of smallpox the people would flock to them for inoculation. No one will be surprised to read that in the practice of the inoculators of this period the mortality attending the operation was often very high. Thus the Civil Surgeon of Serampore reported in 1850 that one inoculator admitted having operated during the season upon 400 individuals of whom 200 died. Other evidence collected by the Smallpox Committee* in 1850 was as follows:—

(1) On the authority of the Editor of a respectable Bengalee newspaper—the *Bhaskar*—there were inoculated in the district of Hooghly during 1850 nearly 1,000 boys and girls, of whom no fewer than 300 died.

(2) In the village of Caderpore there were 20 fatal cases among 100 inoculations of children.

(3) A native member of the Committee gave particulars of six fatal cases of smallpox induced by inoculation in the suburbs of Calcutta during 1850, and another native witness stated that he knew of 14 fatal cases during the same year.

It appears also that in these later times the practice of opening the pustules was often left to ignorant women, who in many instances collected matter from smallpox of the most virulent type and sold it to the no less ignorant and avaricious inoculators; and that, since no payment for inoculation was made unless fever and eruption resulted, it was a common practice among such inoculators to give a small quantity of smallpox matter internally when the cutaneous inoculation

* "Report of the Smallpox Commissioners appointed by Government for the purpose of enquiring by what means the extension of smallpox can be prevented or rendered less destructive." Printed at Calcutta, 1830.

was without result. Both these practices were calculated to raise the mortality exceedingly, and it is evident that instead of causing in the individual the mild disease upon the production of which the principle of inoculation has its foundation, these men often disseminated smallpox of a virulent type. The Smallpox Committee of 1850 also found that the removal of unprotected people from villages where inoculation was being done was certainly not the common or approved practice at that time, and the danger of this neglect will be apparent when it is remembered that children under one year old were not inoculated, that in every village there were some families whose religion forbade them to be either inoculated or vaccinated, and that according to an intelligent native authority there were always about one-fifth of the Hindoo population of towns and villages who, although they believe in inoculation, were prevented from having it done for various reasons. "This is generally the case with large families living in the same house, where the successive pregnancies among the wives of different brothers do not allow of inoculation among the children, who thus remain unprotected 10 or 12 years."

For all these reasons it would be a matter greatly to be wondered at if the practice of smallpox inoculation as carried out in the middle of the 19th century did not tend both to cause a great many deaths as a direct result of the operation, and to favour the spread of smallpox in all directions; and, indeed, it needs no argument to prove that, in the absence of precautions to prevent the spread of the disease, a practice by which a great number of people are purposely infected every year with smallpox must produce this result.

Disadvantages and dangers of the practice.

This brings us to a consideration of the most important matter relating to smallpox inoculation, namely, its disadvantages, and the reasons why in every civilised country where it was practised it was quickly abandoned on the discovery of vaccination.

Even under the most skilful management there are the following disadvantages pertaining to smallpox inoculation:—

- (1) Persons undergoing the operation have to subject themselves to a preparatory course of treatment and to various arduous restrictions for many days after the operation. Even in England, where it may be supposed great skill and care were used, the preparatory treatment lasted a month, and medical attendance was required for five or six weeks after the operation.
- (2) There is always a risk, which often is great, that the inoculated person may die as a result of the operation.
- (3) When the disease is produced in a severe form, all the suffering which attends an ordinary attack of smallpox has to be endured, and disfigurement and even lameness, deafness, or blindness may ensue.
- (4) The disease set up by inoculation, in however mild a form, is as contagious as ordinary smallpox, so that every unprotected person in the neighbourhood of an inoculated patient may catch the disease, and an epidemic of smallpox be started.
- (5) The operation, being apparently very easy to carry out, is one which in nearly all countries where it was introduced has been largely employed by quacks and other ignorant people as a means of making money. Such people take no care in regard to the kind of inoculating matter used or in regard to precautions against the infection of other people, and there is much evidence that under those circumstances the prevalence of and mortality from smallpox have often been greatly increased.

Summarizing this account of the practice of smallpox inoculation, we see that it consists of two distinct portions, one favourable to the practice, the other unfavourable. I believe this to be the correct point of view from which the history of inoculation in India should be approached. If the account is a true one, we should expect to find that during the first period of the history of the measure in Bengal, Assam, and Burma, it diminished

Summary.

Efforts to
suppress the
practice by
law.

considerably the total mortality from smallpox, but that after the middle of the 19th century it began to increase the mortality.

In France the practice of inoculation was prohibited by law as early as 1763, but in England it required the epoch-making discovery of Jenner and over 40 years' experience of the benefits of this discovery before a law prohibiting inoculation was passed. In India as early as 1804 an attempt was made at the desire of the Marquis of Wellesley to prohibit smallpox inoculation within the town of Calcutta. The observance of the rule was not, however, made compulsory by law and it gradually sank into neglect. It was not until 1865 that smallpox inoculation was prohibited by law (Act No. IV of 1865) in Calcutta and its suburbs, the Act being extended in the following year to villages in the neighbourhood of Calcutta and to several large stations in Bengal Proper. In 1869 the question of regulating inoculation in places where vaccination could not be thoroughly introduced was raised by Dr. Charles, his admirable paper being submitted by Government to Commissioners and District Officers for report. The weight of opinion was decidedly against giving official recognition to inoculation, and the impracticability of so regulating the practice as to render it harmless was clearly shown. The final resolution of Government in which any official recognition of inoculation was emphatically condemned was issued on the 13th of November, 1870. At the same time the question was raised of permitting inoculators to practise vaccination after having been instructed in the art, and a year or two later rules were drawn up under which licenses to practise vaccination were to be granted to ex-inoculators.

Vaccination, which possesses none of the disadvantages of inoculation and many advantages not possessed by that measure, has slowly taken the place of the older practice almost throughout the country, but it has been stated already that there are some areas even in British territory where inoculation is still carried on. Further mention of these will be made in the next chapter.

CHAPTER III.

BRIEF HISTORY OF VACCINATION IN INDIA.

THE history of the introduction of vaccination in India is full of interest. Dr. John Shoolbred in his admirable "Report on the Introduction and Progress of Vaccine Inoculation in Bengal," printed at the Honourable East India Company's Press in Calcutta in 1804, says: "The accounts of the *new inoculation* published in England soon reached this country and excited, as might have been expected, a very lively interest in all the members of the medical profession, who anticipated with anxiety and pleasure the acquisition of a discovery which promised an exemption from pain, misery, and premature death, to so large a portion of mankind. Impressed with these animating sentiments they expressed an earnest desire to obtain possession of the newly-discovered disease." Jenner had already anticipated this desire, for we read that at the end of 1799 he had caused copies of his works and a quantity of lymph to be put on board an East Indiaman, the *Queen*, but that the vessel being wrecked on the voyage neither books nor vaccine reached this country.* Other endeavours to transmit dried lymph to India followed, but as Shoolbred says: "It was soon known that the vaccine virus did not retain its infecting property long enough to permit its being transmitted in an active state to any part of India by sea." Jenner then urged that more effectual means be taken, and engaged that if twenty recruits who had not had smallpox were selected and he were allowed to appoint a surgeon to attend them, vaccine should be conveyed in the most perfect state to any of our settlements.† According to Seaton‡

An account
of the intro-
duction of
vaccination
in India.

1799.

* British Medical Journal, Jenner Centenary Number, May 23rd, 1896.

† Mr. Barclay, an apothecary in London, attempted to transmit the vaccine disease to India by this method, but without success. See Appendix to this chapter.

‡ "A Hand-book of Vaccination" by Edward C. Seaton, M.D. 1868.

this proposal was not accepted by the authorities, but in another account it is said that Jenner succeeded in securing the services of a number of people who volunteered to be vaccinated successively during the voyage from England to Ceylon and that by this plan cow-pox was transmitted to India.* I have not at present the means of ascertaining the truth of this account, but Shoolbred states definitely that the supply of vaccine to Ceylon came from Bombay, and in any case we know that the route by which the original vaccine which was to result in the supply of this material to Bombay, Surat, Hyderabad, Madras,† Bengal and many other parts, if not the whole, of India reached Bombay overland by way of Vienna, Constantinople, Bagdad, and Bussorah. Early in 1799 Jenner had sent to Dr. De Carro in Vienna a supply of threads soaked in vaccine obtained from Dr. Pearson, physician to St. George's Hospital in London, and from this stock De Carro got good results. In order to transmit the vaccine to Constantinople, De Carro obtained two pieces of glass, one of which had on its surface a hollow which was filled with lint saturated in lymph; a drop of oil was then put on the internal surface of the glasses, they were tied together and the edges sealed, the air being more efficiently excluded by dipping the glasses into wax until a solid ball had formed round them. Seaton says that the packet containing this lymph "was safely conveyed across European and Asiatic Turkey and over the whole line of deserts to Bagdad," and that on its arrival there the lymph was still liquid and the first vaccination with it succeeded. He continues thus: "A vaccinated child was then sent down to Bussorah and from its arm various vaccinations were there successfully performed. The lymph thus raised was continued in weekly successions and towards the end of May 1802 some of it was sent on by the *Recovery* to Bombay. With the lymph thus conveyed from 20 to 30 subjects were vaccinated, but only one of them

* British Medical Journal, Jenner, Centenary Number, May 23rd, 1896.

† The claim that Madras was the first place in India to receive a supply of vaccine (*vide* Indian Medical Gazette, August 1902, page 322, British Medical Journal, April 8th, 1905, page 807) cannot, I fear, be substantiated.

successfully." Shoolbred's account is more accurate and detailed, and despite the quaint and doubtless wholly unintentional obscurity of meaning in the reference to the doctors at Bombay, deserves to be quoted in full. It is as follows: "So early as March 1801 the Honorable Jonathan Duncan, Governor of Bombay, addressed a letter on this subject to the Right Honourable the Earl of Elgin, British Ambassador at Constantinople, begging that His Lordship would direct a supply of genuine vaccine matter to be forwarded as soon as possible by Bagdad and Bussora; where, the virus being renewed on fresh subjects, it might have the better chance of reaching Bombay in a state capable of communicating the infection.* It was not till the September following that Lord Elgin had an opportunity of complying with the request of Mr. Duncan; when, the disease being fully established at Constantinople and His Lordship having given so eminent a proof of his confidence in the safety and efficacy of the new practice as to have his own child vaccinated when only 7 days old, some matter was forwarded to Bombay. This first supply failed. By persevering however in forwarding frequent supplies of the virus on threads, the disease was at length fortunately produced by Dr. James Short at Bagdad, early in the year 1802. With matter renewed on Dr. Short's patients at Bagdad, Mr. Milne soon succeeded in producing it at Bussora; and finally after a long and patient perseverance, under the disappointment of innumerable failures, for which the medical gentlemen at Bombay deserve infinite praise, a successful inoculation was at length effected by Dr. Scott on the 14th of June 1802, on the arm of Anna Dusthall, a healthy child of three years old; a circumstance which it is of importance to state, because from this patient originally emanated the whole of the vaccine virus now in use in India."

1801.

1802.

By vaccinations with lymph from the arm of Anna Dusthall vaccine was soon produced in sufficient quantity for supplies to be sent to Poona, Surat, Hyderabad, Ceylon, Madras, and many

* See Appendix to this Chapter.

other places on the coast and in the Deccan. Attempts were frequently made to transmit dried lymph from many of these places to Bengal, but all failed, and it was not until Dr. James Anderson, Physician-General at Madras, undertook the task, that success was attained. On the 10th of October 1802, Dr. Anderson vaccinated from the arm of a native child at Madras, a boy John Cresswell, thirteen years of age, born of European parents at Port Jackson. This boy was at once embarked on board the ship *Hunter*, Captain Anderson, who from him vaccinated a female child on the 22nd of October, from her a Malay boy on the 2nd of November and from the Malay boy, on the 12th, Charles Norton, a healthy boy about 15 years of age, who arrived at Calcutta on the 17th November 1802 with a genuine pustule of the sixth day on each arm. "From the arm of Norton several children were immediately inoculated, among whom were two of Sir George H. Barlow, one of the late Colonel Dyer, one of Mr. Birch, one of Mr. Trail, and one of Mr. Binny; all of whom passing through the disease in the most satisfactory manner, the genuine vaccine infection may from this time be considered as established in Bengal." (Shoolbred).

Early
arrangements
for extending
the practice.

As soon as the difficulties of introducing the vaccine disease into India had been overcome, arrangements for extending the benefits of vaccination widely were made. In Bengal at the end of November 1802 the duty of preserving a constant supply of vaccine for the use of Calcutta and subordinate stations, of vaccinating the children of natives who might desire it and of instructing all Hindoo and Mahomedan doctors who might wish to practise vaccination was entrusted to Dr. William Russell, with the title of Superintendent-General of Vaccination. Under his direction all the European children in Calcutta and its neighbourhood were vaccinated and the benefits of the operation were extended to Cawnpore, Fatehgarh, Rungpore, and many other civil and military stations. In May 1803, by which time Dr. J. Shoolbred had taken over Dr. Russell's office, there were appointed at eight stations subordinate superintendents of vaccination under whom a certain number of civil surgeons were directed

to act in promoting the progress of the measure. According to Dr. Shoolbred there were performed up to the 31st December 1803 no fewer than 11,166 vaccinations in Calcutta and other parts of the Bengal Presidency; and during that year and the next the measure was extended to Prince of Wales's Island, to Sumatra, and to Bhuranpore and other cities of the Mahratta Empire. In 1816 the general duty of superintending vaccination in Bengal was taken over by the Medical Board, the work of the Superintendent-General being confined to Calcutta, from which place vaccine was distributed throughout the Presidency.

In the Madras and Bombay Presidencies the organisation was very similar,* the work of vaccination being entrusted to the supervision of civil surgeons who had a staff of native vaccinators under them; the civil surgeons worked under the authority of the superintending surgeons of Divisions, who in turn were directed by the Presidency Medical Board. In these two Presidencies the natives as a whole had even at this early period few prejudices against vaccination, but in Bengal the obstacles to be overcome were very great. In 1804 Dr. Shoolbred drew attention to the determined opposition of the whole tribe of Brahmin inoculators, to the stupidity and apathy of natives of all ranks and descriptions, and to the fact that although it was hoped the circumstance of the vaccine coming originally from the cow, an animal so highly revered by Hindoos, would have acted in favour of the measure, it had entirely the contrary effect. In addition it was found to be exceedingly difficult to maintain the supply of vaccine during the hot season. An important feature of the campaign in Bengal and other parts of India where the practice of smallpox inoculation prevailed, has always been the endeavour to convert the numerous *ticcadars* (inoculators) into vaccinators, and from one point of view this plan of conciliation rather than suppression has been

1803.

Some obstacles to progress, 1804.

Pensions to inoculators, 1805.

* Details of the early arrangements for advancing vaccination in Madras and of some of the difficulties encountered will be found in a letter by Lt.-Col. King, I.M.S., published in *The Indian Medical Gazette* for Oct. 1902, page 413. It has been said that the progress of vaccination in the Madras Presidency was promoted by a "pious fraud." Readers who are interested in the subject will find a discussion upon it in Baron's *Life of Jenner*, Vol. I, *The British Medical Journal*, April 15th, 1905, page 838, and *The Indian Medical Gazette*, June 1905, page 234.

attended with success. As early as February 1805 pensions for life were granted to certain Brahmin inoculators on condition of their having relinquished the practice of variolous for that of vaccine inoculation in the town and vicinity of Calcutta, and on the 23rd of April 1805 a statement was signed by 26 native inoculators declaring their full conviction of the power of vaccination to prevent smallpox, of its being attended with no danger, of its being a safe and efficacious substitute for smallpox inoculation, and that it ought therefore to be generally adopted, "a declaration which we make with the greater confidence as we are not aware of any circumstances which can render the adoption of this mild practice improper for any rank of Hindoos." During the early years of progress another means employed to advance vaccination was an order to all European and native revenue, judicial, and other civil authorities to promote the measure by every means in their power. Collectors of districts, *zamindars*, *talookdars*, *tahsildars*, and the headmen of villages were kept informed of the number of vaccinators employed and of the places where they were working, and were directed to inspect and check their registers of vaccination. Other means such as the gratuitous issue of rice to the poorer classes of natives who brought their children to be vaccinated, and the giving of small presents of money to those who allowed arm to arm vaccination from their children or the collecting of the vaccine "crusts" from their arms were also used.

Evidence of
gratitude to
Jenner, 1806.

Before continuing this brief history it is worthy of mention that the British public in India were among the first to show in substantial form their gratitude to the man who as a result of an enquiry lasting more than twenty-five years had given to the world such a wonderful means of saving life. In May 1806 a present of £4,000 was transmitted to Dr. Jenner from "the principal inhabitants of Calcutta and its dependencies as a testimonial of their gratitude for the benefits which this Settlement, in common with the rest of mankind, has derived from his inestimable discovery of a preventive of the smallpox." The example was quickly followed by presents of £2,000 from Bombay and £1,383 from Madras.

The next date of great importance in the history of the advancement of vaccination in India was 1827 in which year the “Bombay system of vaccination” was introduced. This system was due to the enlightened liberality of the Honourable Mountstuart Elphinstone, Governor-General of Bombay from 1819 to 1827. He arranged the vaccination work of the Presidency under four circles or divisions, to each of which he appointed a European Superintendent of Vaccination with an establishment of native vaccinators under him. The Superintendent was exempted from all local control, civil, military, or medical, and carried on his operations in whatever part of his district he thought proper, reporting monthly to the Medical Board at Bombay. He was furnished with a supply of medicines in order that he might give medical assistance to the natives and with six or eight peons to collect the inhabitants and procure supplies. The native vaccinators received fixed rates of pay ranging from Rs. 10 to Rs. 18 per month. The great merits of the system were that it brought vaccination to the doors of the people—too lazy, too poor, or too ignorant to seek for it—and that it ensured the examination by the European medical officer of every case operated upon. The absence of a close inspection of this nature was the great fault of the systems in other Presidencies, and, in addition, other systems laboured under the disadvantage of an absence of surgeons whose sole duty was the propagation of vaccination, an absence of travelling superintendents, and the grant to native vaccinators in lieu of an adequate fixed salary of a “capitation allowance” for every hundred persons vaccinated. According to Dr. Stewart,* this “head money”—as it was called—was found to be merely a premium on mendacity. In Bombay the European Superintendent spent his time touring through all the towns and villages where his establishment of vaccinators worked. On his arrival at a town or village he had all the vaccinated children brought to him and assured himself of the soundness of the operation; he saw

* Stewart. Report on Smallpox in Calcutta, 1833 to 1844, and Vaccination in Bengal, 1827 to 1844, by Duncan Stewart, M.D., Surgeon, E. I. Co.'s Service. Published at Calcutta, 1844.

the recently vaccinated cases, examining them in all stages of the vesicle, ascertaining the purity of the disease and of the lymph used in its propagation. He compared the native vaccinators' registers with his own records of vaccinated children seen, and in other ways verified their work.

This excellent system was followed in the Bombay Presidency alone for many years, but was ultimately taken as the model upon which the improved systems in most provinces were based.

1828. In the Bengal Presidency 30 vaccine stations had been established by 1828, but their cost per month was 260 rupees each, and it was found that their success did not correspond in any degree with the expense attending them. In Calcutta, Allahabad, and Agra, the cost per vaccination was about three rupees, in Furruckabad more than four rupees, in Benares five rupees eight annas, and in Delhi nearly nine and a half rupees. In December 1828, the Bengal Medical Board informed the Government that it was impossible to maintain an efficient lymph in the Upper Provinces during certain months, that Calcutta was the only place where such a lymph could be kept up throughout the year and that a *spurious disease* was propagated by the native vaccinators at certain periods of the year. That these opinions were justified and that the obstacles to the progress of vaccination in the Bengal Presidency were great was shown in Dr. W. Cameron's report of 1831, which was called for "in consequence of rumours which prevailed unfavourable to the practice of vaccination during the epidemic smallpox which ravaged the Western Provinces in 1829-30."

All these reasons led to the abolition in March 1830 of the office of Subordinate Superintendent of Vaccination in all except six stations, and in these the allowance was reduced to Rs. 160 per month, the immediate result being a decrease in the number of vaccinations from 61,910 in 1830 to 21,394 in 1831 and 15,119 in 1832.

From the first introduction of vaccination into India in 1802-03 to the end of 1836, a period of 34 years, the sum of over 3½ million rupees was spent from the revenues of the State in the

maintenance of vaccine establishments. Of this sum Rs. 1,670,861 was spent in the Bengal Presidency (including the North-Western Provinces), Rs. 1,328,635 in the Madras Presidency and Rs. 292,948 (from 1828 only) in the Bombay Presidency.

From the 1st of January 1835 a new scheme at a cost of Rs. 40,000 a year, by which 56 civil surgeons were again appointed superintendents of vaccination, was started in Bengal, but after a persevering trial for two years the attention of Government was drawn to its shortcomings.

In Calcutta an important advance had been made by Dr. Stewart in 1837 by the establishment of vaccine stations at the public dispensaries, where the native vaccinators were required to attend bringing with them for the inspection of the European surgeon, and for registration, the children vaccinated in the neighbourhood. From these children people attending at the dispensary were vaccinated under Dr. Stewart's supervision and they were easily induced to present themselves for inspection in the following week. Under this system the number of vaccinations in Calcutta increased considerably.

1837.

During 1838 the scheme of setting up dispensaries in other large towns of Bengal was matured and in 1839 institutions of this kind were established in twelve large towns in the Presidency. They were under the charge of the civil surgeons who were granted an allowance for managing them and for superintending vaccinations performed at them. An educated native sub-assistant surgeon was placed in immediate medical charge, and two or three subordinate assistants capable of performing vaccination were also attached to the establishment. Thus was commenced the "dispensary system of vaccination" which in somewhat modified form has continued to the present day.

The dispensary system, 1838.

The establishment of dispensaries, while being regarded as an additional means of introducing vaccination among the people of Bengal, was not at first considered a sufficient reason for altering the existing arrangements of the vaccination department,

1841. but in 1841 the Medical Board called for special reports from all local superintendents of vaccination relative to the quality of the lymph, the obstacles in the way of its diffusion, the efficiency of the establishments, the zeal of the vaccinators and the dependency to be placed on their reports. At the same time the Government of India entered into communication with the local Governments of Bombay and Madras in both of which Presidencies the reported popularity and progress of vaccination were in marked contrast to its unpopularity and decline in Bengal. The replies of the local superintendents of vaccination were almost unanimous in holding out little hope of popularizing vaccination in Bengal, and in concurring with this unfavourable opinion, the Medical Board stated that the only places where they would expect successful vaccination were Calcutta and some of the Hill provinces. As a result, the Government decided, on
1842. the 20th April 1842, to abolish the appointments of Superintendent of Vaccination at the stations of Moorshedabad, Dacca, and Patna.
1843. In 1843 the Court of Directors forwarded a despatch to the Government of India commenting on the unfavourable progress of vaccination in Bengal as compared with Madras, and advising the Government of India (1) to desist entirely from vaccination during the hot season in those places where numerous failures had hitherto occurred, (2) to consider whether the dispensaries might be made available in a greater degree for the promotion of vaccination, and (3) to desist wholly from prosecuting vaccination in the districts where repugnance to it was most strong. The abolition of the appointment of local superintendents already referred to was approved and further reductions in such other parts of the local establishments as were clearly inoperative or inefficient were suggested.
1850. The next event of importance in connexion with vaccination in Bengal was the appointment on the 12th of March 1850 of a special committee to enquire "by what means the extension of smallpox can be prevented or rendered less destructive." The

measures recommended by this Committee were briefly as follows :—

- (1) The prohibition of smallpox inoculation under penalties.
- (2) The appointment of a Vaccine Board or select body of Vaccine Commissioners authorized to contract for the vaccination of the poor with any duly qualified medical men, European or native, the persons so contracting being obliged to report their operations systematically to the superintending surgeons or other competent civil authority, the contract price being eight annas for each case successfully vaccinated.
- (3) The discontinuance of these contracts, and of vaccination by Government officers, during six months of the year, from 1st April to 30th September.
- (4) The appointment of several covenanted medical officers as at Bombay to travel through the country during the other six months of the year visiting all the vaccine depôts, encouraging and practising vaccination, examining strictly into the proceedings of the contracting vaccinators and reporting annually to Government.
- (5) The vaccination of all recruits in the army.
- (6) The grant of a moderate compensation to the *ticcadars* (smallpox inoculators) who by the proposed law would be deprived from earning a livelihood.
- (7) The bestowal of a small sum of money on every native mother who should bring her infant to one of the town dispensaries for vaccination, and should present the child again on the 6th or 8th day following for inspection, registration, and the supply of fresh lymph for the vaccination of others.

It does not appear that any specific action was taken upon these recommendations.

1853.

In 1853 the Medical Board of Bengal again drew the attention of medical officers to their obligations to advance the work of vaccination, especially in connexion with charitable dispensaries; and the Government native vaccinators, two in number at most civil stations, were placed at the dispensaries where such existed. They were to operate under the supervision of the Civil Surgeon, the Superintendent, and the Sub-Assistant Surgeon in charge of the dispensary, and were to resort on certain days of the week to different public places in the town and there to vaccinate in the presence of the medical officers. Careful registers were kept of their work and their pay was raised to Rs. 10 per month.

In Calcutta the following system (known as the "Calcutta system") was arranged in 1853. The town was divided into three districts, to each of which a Superintendent and staff of vaccinators were appointed. It was the duty of the Superintendent to go from house to house trying to overcome the objections of the people by persuasion and explanation, and by bringing vaccinators to their doors. Every vaccinated person was personally inspected by the Superintendent and the soundness and purity of the operation ascertained beyond doubt. The whole was superintended by the Superintendent-General.

1854.

The next important date in the history of vaccination in India is 1854 in which year the Government of India introduced the Bombay system of vaccination into the North-Western Provinces. Dr. Pearson, Superintendent of Vaccination in Rohilcund and Kumaon, had already been carrying on vaccination by this system for some years; he describes his arrangements thus: "To every *tehsil* in the North-West Provinces one vaccinator is attached; and in every city where there is a municipality, composed of enlightened commissioners, one, two or three municipal vaccinators are employed. To about every twelve vaccinators there is a native Superintendent or head vaccinator, and to every 50 or 60 vaccinators a European Superintendent (a medical officer). To give a clear idea of the practical method of the system of working I will detail a day's duties of

the European Superintendent. Having arrived at the *tehseel*, he proceeds to the village where the vaccinator had operated the previous seventh or eighth day; he then calls for the village record from the *putwaree*, *zemindar*, or *chowkidar*, and summons all the children whose names have been entered therein as vaccinated seven or eight days previously; the results are inspected and verified; faults pointed out; instruments examined; the vaccinator's capacities and character ascertained; and the people addressed. This round of duties goes on from day to day throughout the whole vaccine season. The native Superintendent is also perpetually on the move, employed on the same duties, and in this manner every vaccinator gets visited several times during the season. The check against falsification of returns, by repeated inspection of the vaccinator's diary and the return left in the village (which should correspond) is as complete as any check can be; and I have no hesitation in declaring that the system works well and honestly; and I make this declaration after an experience of twelve years."

It may be said, therefore, that by the year 1854 an efficient system of vaccination had been established throughout the Bombay Presidency, in Calcutta, and in the North-West Provinces of the Bengal Presidency. In the remainder of Bengal and throughout the Madras Presidency the absence of a close inspection of the work done by the native vaccinators rendered the systems adopted in those parts of India inferior.

A hill vaccine depôt was early established at Almorah by Dr. Pearson and there were other hill depôts at Subathu and Simla. These were kept supplied with vaccine from England in addition to the lymph collected locally.

In 1856 the Agra vaccination division was established under the superintendence of a European medical officer, and in 1858 Dr. Peskett was appointed superintendent of the Simla vaccine depôt as a distinct and separate duty.

In 1864 the Meerut, Benares, and Goruckpore circles of European superintendence were established in the North-West

Summary to
1854.

Vaccine
depôts in
the hills.

1856.

1858.

1864.

Provinces and Dr. Pearson was appointed Superintendent-General of vaccination in those provinces. In the same year a Superintendent-General was appointed for the Punjab, in which province the Bombay system of vaccination had by this time been introduced on the following plan. For the three circles of Simla, Dalhousie, and Murree, under which the work was divided, there were in all 17 native Superintendents, 112 vaccinators and one European Superintendent. The system allowed from three to four vaccinators to each district and a reserve for emergencies. The European Superintendent toured as much as possible, supervising the work of the native Superintendents and vaccinators, ascertaining the character of the vaccine used and supplying fresh virus.

The year 1864 is noteworthy also as being the one in which vaccination under a European Superintendent was introduced into the Central Provinces.

In 1865 the Allahabad and Jhansi circles of European superintendence were established.

Up to the end of 1864 there had occurred in the Madras Presidency very little change in the original system, and the supervision of the work of the native vaccinators was very inadequate. In a report of 1860-61 the Principal Inspector-General of Hospitals declared the system to be a failure, and in 1863 the Government of India ordered its revisal. In 1865 the Bombay system was introduced, the establishment being one General Superintendent, 11 Deputy Superintendents, 145 vaccinators and 25 peons. There were 11 small circles with a Deputy Superintendent to each and one native vaccinator to each *talook*. The system consisted in the Deputy Superintendent touring through the circle with his vaccinators, small parties going from village to village, doing the work thoroughly but slowly. The Superintendent-General visited each Deputy Superintendent in turn and thoroughly examined the work.

1865-1868.

From 1865 to 1868 great efforts were made to bring the level of vaccination in Bengal up to that existing in other Presi-

dencies. The Darjeeling circle of vaccination under a European Superintendent was started on the Bombay system during the cold season of 1866-67 and the Ranchee and Sonthal Pergunnahs circles during the cold season of 1867-68. Early in 1868 Dr. Charles' scheme for setting up a shield of protection round Calcutta by establishing a new vaccine circle, comprising the Presidency districts of the 24-Pergunnahs, Hooghly, Burdwan and Nuddea, under European superintendence, with an adequate staff of Deputy Superintendents and head and subordinate vaccinators, was sanctioned. In Calcutta and its suburbs smallpox inoculation was prohibited by law in 1865, and in villages in the neighbourhood of Calcutta and in several large stations in Bengal proper in 1866.* In order to augment the number of vaccinators in places where smallpox inoculation had been prohibited, municipalities were asked to provide funds for this purpose and readily did so. In the Bombay Presidency and North-West Provinces municipalities had for some time furnished a proportion of the vaccinators. In the parts of Bengal not included in one or other of the new vaccination circles the dispensary system remained, and was by no means satisfactory. Vaccinators from the dispensaries were sent into the interior of the districts to vaccinate, but there was no check upon their work, and great uncertainty prevailed as to the accuracy of their registers and as to whether or not they were dispersing a genuine protective vaccination. In November 1867, however, an advance was made by the grant of travelling and deputation allowances to civil surgeons for going out into their districts, visiting the vaccinators, and inspecting their work.

In 1867 a special vaccine department under European superintendence was established in Oudh.†

In 1868 a new era in Indian sanitation was inaugurated by the appointment of Provincial Sanitary Commissioners, and these officers eventually took charge of the vaccination work in all parts of India.

* Notification dated the 8th of June 1866.

† For many of the details from 1853 to 1868 I am indebted to Dr. Green's "Report on Vaccination Proceedings throughout the Government of Bengal," Calcutta, 1868.

1869. In 1869 orders were issued prescribing a uniform system for showing the extent of vaccination and the results in every part of the country where this measure was conducted; and from this year we enter upon the period when systematic reports on vaccination were submitted regularly every year to the different local Governments. As these reports are easily accessible, it will not be necessary to do more than complete this history by mentioning very briefly the most important events in the progress of the measure.

1875. By 1875 vaccination had been included among the duties of the Sanitary Department in the Madras and Bombay Presidencies, the Central Provinces, Berar, Oudh, and British Burma. In Bengal Proper and Assam, however, the work was still carried out under the orders of the Surgeon-General, and in the North-West Provinces and the Punjab there were separate Superintendents-General of Vaccination directly responsible to the local Governments.

1877. The following statement shows the staff for carrying on vaccination in 1877-78:—

	SPECIAL VACCINATION ESTABLISHMENT.					DISPENSARY VACCINATION.
	Superintendents-General.	Superintendents.	Deputy Superintendents.	Native Superintendents.	Vaccinators.	Number of Vaccinators attached to dispensaries.
Bengal Proper	1	6	10	11	640	192
North-West Provinces and Oudh	1	2	7	40	587	...
Punjab	1	1	1	29	121	152
Central Provinces and Berar ..	2	18	2	23	222	24
British Burma	1	15	...	2	31	.....
Assam ... ..	...	...	...	...	...	18
Madras Presidency	1	1	...	38	675	2
Bombay Presidency	1	7	...	35	408	.....

At this period dispensary vaccination had been altogether abolished in the North-West Provinces and Oudh; it was still

an important part of the systems adopted in Bengal, the Punjab, and the Central Provinces, and it was the only system in practice in Assam. It had never been practised in Bombay. It has been mentioned already that the enlistment of smallpox inoculators as vaccinators was early attempted throughout India. In Bengal in 1874 rules were drawn up under which licenses to practise vaccination were to be granted to ex-inoculators and independent practitioners, and in the next year a grant of Rs. 6,000 was made to provide a staff of inspectors who should control the work done by ex-inoculators, as well as to maintain a certain number of apprentices while under instruction in the art of vaccinating. In Bengal Proper during 1878-79 there were no fewer than 975 ex-inoculators working as licensed vaccinators as compared with only 466 vaccinators paid by Government, and in 1879-80 by far the greater part of the work of vaccination was done by this "licensed agency" under paid supervision. In this year also the practice of attaching vaccinators paid by Government to dispensaries in Bengal was discontinued, the operations at these institutions being performed by municipal vaccinators or by hospital assistants.

1879.

Bombay has the merit of being the first town in India in which *compulsory vaccination* was introduced. This was in 1877. Kurrachee followed suit in 1879 and on the 9th of July 1880 the Act of the Government of India (No. XIII of 1880) to give power to prohibit inoculation and to make the vaccination of children compulsory in certain municipalities and cantonments received the assent of the Governor-General of India. Similar Acts were passed by local Governments. The chief sections of the Imperial Act were as follows :—

The Compul-
sory Vaccina-
tion Act of
1881.

Definition.—An Act to give power to prohibit inoculation and to make the vaccination of children compulsory, in certain municipalities and cantonments.

Its provi-
sions.

Section 3.—A majority in number of the persons present at a meeting of the Municipal Commissioners specially convened in this behalf may apply to the Local Government to extend this

Act to the whole or any part of a municipality, and thereupon the Local Government may, if it thinks fit, by notification published in the official Gazette, declare its intention to extend this Act in the manner proposed.

Section 6.—In any local area to which the provisions of this Act apply, inoculation shall be prohibited ; and no person who has undergone inoculation shall enter such area before the lapse of 40 days from the date of the operation, without a certificate from a medical practitioner, of such class as the Local Government may from time to time by written order authorize to grant such certificates, stating that such person is no longer likely to produce smallpox by contact or near approach.

Section 7.—Defines vaccination circles and provides for the appointment of vaccinators and superintendents of vaccination in such circles.

Section 8.—The Local Government may by written license authorize private vaccinators to perform vaccination in any vaccination circle.

Section 9.—When any unprotected child, having attained the age of six months, has resided for a period of one month during the vaccination season in any local area to which the provisions of this Act apply, and has not at the expiration of such period attained the age, if a boy of fourteen years, and if a girl, of eight years, the parent or guardian of such child shall take it, or cause it to be taken, to a vaccinator to be vaccinated, or send for a vaccinator to vaccinate it. Such vaccinator shall vaccinate the child and deliver to its parent or guardian a memorandum stating the date on which the vaccination has been performed and the date on which the child is to be inspected in order to ascertain the result of the operation, or shall, if he finds such child in a state unfit for vaccination, deliver to its parent or guardian a certificate under his hand to the effect that the child is in a state unfit for vaccination for the whole or part of the current vaccination season.

Sections 10 to 13 provide for inspection after vaccination, and detail the procedure to be adopted when vaccination is

successful, unsuccessful, or when the child is unfit for vaccination.

Section 15 provides for the kind of vaccine to be used.

Section 16.—No fee shall be charged by any vaccinator, except a private vaccinator, to the parent or guardian of any child for any of the duties imposed on such vaccinator by or under the provisions of this Act.

Section 17 prescribes the duties of Superintendents of Vaccination and prescribes that notices shall be sent to parents or guardians who neglect to comply with the Act.

Section 18 prescribes the procedure when a notice has not been complied with or when the order of a Magistrate has not been obeyed.

It prescribes also that the Magistrates appointed under this section shall be natives of India and not paid servants of the Government.

Section 22 provides for the punishment of offences under the Act.

The following statement shows for every fifth year the number of municipalities in each province to which the Compulsory Vaccination Acts have been extended.

The number of municipalities to which it has been extended.

	Total number of towns in the province.	Number of towns with compulsory vaccination of children.					
		1881	1886	1891	1896	1901	1906
Bengal	157	6	89	146	152	155	155
United Provinces ..	89	...	1	47	89	89	89
Punjab	144	...	...	3	13	22	26
Assam	46	3	12	36	43	45	45
North-West Frontier ...	11	...	...	...	1	2	6
Central Provinces and Berar ...	56	...	...	2	31	44	48
Madras	60	...	11	46	56	60	60
Lower Burma	44	...	4	20	35	40	43
Bombay	107	2	2	2	2	5	7
Coorg	5	..	4	5	5	5	5

"Compulsion" has played an exceedingly small part in the progress of vaccination in India.

Except in a few rural circles of Bengal vaccination has never been compulsory in the villages or other rural areas of any part of India, and when it is said that the *total population* of the places where the vaccination of children is at present compulsory amounts to less than 16 millions or only 7 per cent. of the population among whom vaccination operations are conducted, it will be apparent how small a part "compulsion" has played in the progress of vaccination in this country. The following figures for each province will serve to emphasise this important matter:—

	Total population of areas where vaccination of children is compulsory.	Population of areas where vaccination is optional.	Vaccination is compulsory among the children of the following proportions of the population.
Bengal	3,161,069	47,367,377	6·3 per cent.
Eastern Bengal and Assam ...	635,718	29,177,017	2·1 " "
United Provinces	3,358,755	44,333,027	7·0 " "
Punjab	1,061,558	19,047,132	5·2 " "
North-West Frontier ...	90,092	1,818,092	4·2 " "
Central Provinces and Berar ...	1,156,680	10,727,660	9·1 " "
Bombay	1,117,870	17,363,492	6·0 " "
Madras	4,250,049	33,959,387	11·1 " "
Burma	1,045,287	9,445,337	18·8 " "
Coorg	15,249	164,758	8·4 " "

This table affords a sufficient answer to the assertion—not infrequently made by those who have no experience of the benevolent methods by which India is governed—that vaccination has been forced upon the people of this country.*

1881.

By October 1881 the amalgamation of the Vaccination with the Sanitary Department had been carried out in all the provinces of India, and from that year steps were taken in several provinces

* A careful study of the full text of Sections 3 and 18 of the Act is also recommended in this connexion.

to instruct the existing staff in simple hygiene and to make future appointments as vaccinators dependent on the possession of an elementary knowledge of sanitation as well as of the art of vaccinating. Inspectors of Vaccination became Deputy Sanitary Commissioners and were called upon to attend to all sanitary matters, especially while on tour, instead of confining themselves, as formerly, to vaccination work.

In 1880-81 vaccination was still terribly backward in Assam. There was no special establishment and the work was carried on in certain selected areas by 17 vaccinators, a few medical subordinates attached to dispensaries and by 58 ex-inoculators or licensed vaccinators who received no pay from the State. It was said that some of the last class were not skilful in the art and that it was possible some of them used their licenses to carry on smallpox inoculation rather than vaccination.

A new feature in the North-West Provinces and the Madras 1882. Presidency was the employment in 1882-83 of female vaccinators to work in *zenanas*.

Bengal continued to be particularly unfortunate in the 1891. systems chosen and about 1891-92 the vaccination department in this province was again reorganised, the executive supervision of the work of vaccination being transferred to the District Civil Surgeons, the former posts of Deputy Superintendents and three of the six Superintendents being abolished. Under the new scheme every Civil Surgeon was held responsible for the protection of his district from smallpox. He used his own discretion as to the numbers of vaccinators it was necessary to employ and was allowed the assistance of an Inspector and Sub-Inspector to supervise the work of vaccinating. In 1892-93 the total number of inspecting officers under this scheme was 259 and of vaccinators 3,045.

In 1897-98 the working of the vaccination departments in 1897. Bombay, the United Provinces, the Punjab, and the Central Provinces was hindered and embarrassed by the conditions arising from the presence of famine or plague, or both, and in the next

year the unfounded dread that vaccination was being used as a cloak for anti-plague inoculation was very detrimental to progress. So great was the terror of this in Coorg that vaccination operations had to be suspended altogether from November to March.

In Assam in this year nearly 600 notices were issued under the Compulsory Vaccination Act and 25 prosecutions were instituted, but in only two instances were the defaulters punished.

1900.

In 1900 smallpox inoculation was still somewhat prevalent in Bengal, Assam, the North-West Frontier area of the Punjab and some tributary States of Bombay; and in Burma, Orissa and some of the Native States it was nearly general. An Amendment Act was passed in Burma requiring the vaccination of unprotected persons and providing for the compulsory vaccination of inmates of lodging-houses and coolie-barracks.

The influences of famine and plague were very detrimental to the progress of vaccination in 1900-01. "They produce a very low birth-rate and a very high death-rate, the ordinary avocations of the people are suspended, families are broken up, many people wander from home in search of work and relief, the vaccinating staff of all grades is largely occupied in carrying out relief and sanitary arrangements, and the congregation of people in relief camps in contact with destitute refugees from Native States where vaccination is very inadequately carried out sets up conditions favourable to the spread of smallpox."*

At the present time more than nine million vaccination operations are performed annually in British India. (See Chart No. 11 in Chapter IV.)

Short history
of the vaccine
supply in
India from
1802.

A short history of the vaccine supply in India will complete this necessarily brief and imperfect account. For about the first 30 years after the introduction of vaccination into India the vaccine used was from the same stock as had been propagated from subject to subject since 1802. In 1832, however, Dr. McPherson of Moorshedabad reported the discovery of some cases of genuine

* Annual Report of the Sanitary Commissioner with the Government of India for 1900, page 103.

cow-pox in cattle, and started from this source a new supply of vaccine. It is said that the superiority of this lymph was proved beyond doubt, that the natives appeared to place greater confidence in it and that it was distributed widely throughout the country and to Calcutta "where it was speedily mixed up with that previously in use."

In September 1839 the Superintendent-General of Vaccination in Calcutta received from the National Vaccine Institution in England "by the overland mail in 40 days" a supply of vaccine on points and glasses, and "four excellent vaccine crusts." From this source, but chiefly from the crusts, a new stock of lymph was set up which was used in Bengal to replace entirely the existing vaccine. For the next 50 years or more, supplies of vaccine were sent regularly from England to various parts of India, and as regards Bengal, the practice of obtaining a yearly supply from that country in order to supplement what was collected in India was not discontinued until 1892. Up to 1870 all vaccinations in India were done with humanized lymph either from arm to arm or with lymph carried on points, glasses, or in tubes, or from "vaccine crusts." As early as 1855 lymph in hermetically sealed tubes was in use in Madras; in 1859 it was taken into use in Calcutta and in 1860 in Upper India; a few years afterwards it was in general use throughout the country. Vaccination from crusts was also largely practised and during the season 1867-68 nearly 20,000 crusts were despatched to various places from the Kumaon dépôt alone. Animal vaccination was established in Bombay in 1870, and from this virus some successful experiments were made by Dr. Charles in Calcutta, but it was not until 1881-82 that the Local Government of Bengal (with a view to secure an efficient supply of animal lymph at the beginning of every vaccine season) sanctioned, as an experimental measure, the expenditure of Rs. 1,500 per annum to meet the cost of animal vaccination. Early in January 1883 animal vaccination was commenced in Calcutta and by the end of the year a continuous supply of lymph had been arranged for. In 1886-87 the results of animal vaccination were unfavourably reported upon owing

to imperfections of storage and adverse climatic conditions ; in 1890-91 a new depôt was started in the hills at Darjeeling.

In Bombay, animal lymph has been used to a considerable extent since 1870. In 1879-80, 588 heifers were inoculated with only 18 failures, in 1880-81, 470 heifers and in 1883-84, 935 heifers. In Karachi, however, animal vaccination had to be discontinued in the season of 1881-82 owing to the opposition of the Hindoo community.

In Berar, animal vaccination was started early and met with much success. Since June 1887 animal lymph has been the only kind used in this province.

In Madras, vaccination with animal lymph was successfully established in 1880-81 ; in 1891-92 it was used in 64 per cent. of the vaccinations and in 1894-95 in 97 per cent.

In Burma, efforts were made to establish animal vaccine depôts at Thayetmyo, Toungoo and Rangoon in 1882-83. They failed in the first two places, but a permanent depôt was successfully established in Rangoon. By 1891 calf lymph was being used in both Upper and Lower Burma with considerable success.

Up to 1884 no attempt had been made in the Punjab to raise animal lymph locally and all the lymph used was humanized, but in 1886-87 a notable feature in the history of vaccination in this province was the impulse given to animal vaccination by the use of buffalo calves in place of heifers—a change which removed many of the objections urged against animal vaccination by Hindoos when the calf, a sacred animal, was used as a vaccinifer. By 1891 vaccination with animal, mainly buffalo, lymph, was in general employment throughout the province and in the season of 1892-93 more than 93 per cent. of the total operations were performed with animal lymph. Another noteworthy feature in this province was the employment of donkey lymph from about 1890. The results were satisfactory, the lymph being used in places where high caste Hindoos refused to use buffalo lymph, but it was found that as Hindustan proper was approached, the Hindoos considered the donkey an unclean animal and refused to be vaccinated with lymph from it.

In the Central Provinces, animal vaccination was extensively employed from 1888-89, buffalo calves being used in a number of districts. By 1893-94 vaccination was being carried on direct from buffalo calves in all districts.

In Assam, calf lymph in tubes from England and Bombay was issued to all districts in 1882-83, but it was not until 1890 that an animal vaccine depôt for the province was started at Shillong.

In the United Provinces of Agra and Oudh, vaccination with animal lymph was in use in only nine towns in 1891-92 and as late as 1894-95 vaccination was carried almost entirely from arm to arm.

In Coorg in 1894-95 all the vaccinations were performed with calf lymph.

By 1898 the use of bovine lymph had largely taken the place of humanized lymph in all provinces ; in Madras, Burma, Assam, Berar and Coorg it was used exclusively or almost exclusively. Vaccinations were done either directly from calf to arm or with lymph preserved in tubes without admixture or mixed with glycerine, lanoline or vaseline. In 1899-1900 the use of humanized lymph in addition to bovine lymph was resorted to only in the Punjab, the Central Provinces, Burma, and the United Provinces.

In 1906-07 each province except the Central Provinces, the North-West Frontier Province, Ajmer-Merwara, and Coorg, maintained a central vaccine depôt for the manufacture of animal vaccine, and each Presidency town possessed a separate depôt from which all the lymph required in the town was supplied.

APPENDIX

TO

CHAPTER III.

An extract from the proceedings of the Government of Bombay.

BOMBAY CASTLE,
7th August, 1801.

Recorded the following Letter from the Medical Board—

HON'BLE SIR,

The late very happy discovery that the disease produced by inoculation from the Cow Pox, secures the human Body ever afterwards from the Small Pox, altho' of great importance in Europe would we imagine be of still more consequence in this country. The Small Pox from inoculation is certainly here a much more dangerous disease than in Europe for a greater proportion die of it and of those who escape great numbers suffer severely from it. We think that one-third of those who get the disease naturally are destroyed by it, at times indeed it appears under a much milder form but occasionally the mortality from it is still more deplorable. From what we have said it will be evident that a disease like the Cow Pox would be a greater blessing to this Country, and we have reason to believe that the Natives from their prejudices in favour of the cow would generally communicate it to their children, which will never be the case with regard to the Small Pox.

Several attempts have already been made to bring the Cow Pox to India, but without effect, for the matter on its arrival here has not been found to communicate the disease. We are under particular obligations on this subject to Mr. Barclay, Apothecary of London, who got unsolicited the Matter of Cow Pox and sent it to Portsmouth to Mr. Forbes, Surgeon of the Lord Hawkesbury, begging of him to inoculate with it during the passage and by that means to carry it to India in a recent State. Mr. Forbes on his part was not wanting in every attention, for soon after he received it he inoculated several persons on board of the Ship, but he was not able in a Single instance to produce the disease. The plan recommended by Mr. Barclay seems very judicious and if a sufficient Number of People, who never had the Small Pox were sent in a ship, we imagine it could hardly fail of success. Perhaps it might be proper to send some cows with the same intention.

It might also be desirable to have the matter of Cow Pox, sent from Constantinople to our Surgeon at Bagdad, who would inoculate with it; from thence it might be carried to the Surgeon of Bussorah and finally with a prospect of success to this place.

In order to encourage exertion it might be proper to offer some reward to the person who should first bring this disease to India.

The influence that the Cow Pox may produce on the happiness and the life of so great a Society of mankind is of so much importance that We cannot doubt but your Hon'ble Board will be ready to forward all our wishes for its introduction into India.

BOMBAY,

4th August,
1801.

We have the honour to be,

HON'BLE SIR,

Your most obedient humble servants,

WILLIAM MOIX, 1st Member,

H. SCOTT, 2nd Member.

Copy of the above Letter was on the 5th instant ordered to be sent as a Number in the Packet, to the Court of Directors and their assistance earnestly solicited for the secure transmission of the matter of the Vaccine Small Pox to this country in the manner suggested by the Medical Board, or any other that might appear still more efficacious and likely to succeed.

The President at the same time observed that he had already applied some months ago, *Viz.*, on the 20th of March last, to the Earl of Elgin, His Majesty's Ambassadors at the Port, to the purport above suggested by the Medical Board and that he would with pleasure repeat the solicitation for his Lordship's assistance on a subject so very interesting to humanity by the Packet under dispatch, and it was also directed that the Presidents at Bussorah and Bagdad should be written to the purport of the Medical Board's recommendation.

CHAPTER IV.

THE PROOF OF THE VALUE OF VACCINATION IN INDIA.

SECTION I.

The prevalence of smallpox before vaccination became general.

AMONG the many methods of testing the value of vaccination the best is a comparison of the smallpox mortality statistics during periods before and after the widespread employment of the measure. We know that in all countries where vaccination has extended considerably, a striking fall in the smallpox mortality has been produced, and it is our present object to ascertain whether a similar result has obtained in India. To render this method of test quite complete, it is necessary to possess an epidemiological record of the prevalence and mortality of smallpox during a number of years prior to the introduction of vaccination, but as regards the civil population of India the era of medical statistics did not commence until some years after the middle of the 19th century, and exact information regarding the prevalence of smallpox before that time is exceedingly scanty. We are aware, however, that for many centuries before the statistical era the disease ravaged the country with terrible severity. The existence nearly everywhere of ancient temples to the goddess of smallpox tells us that from the earliest times of which there is a record hardly any part of the country escaped the pestilence, and we have only to call to mind the chief characteristics of the disease, namely, that it seizes on almost all who for the first time come within its range, that it is eminently contagious from person to person, and that among unprotected natives 50 per cent. is a low estimate of the case-

mortality, to realise that in the words of Sir John Simon "its effects must have been comparable to that obliteration of vegetable life which ensues when the army of locusts, descending on pastures and vineyards, converts into the likeness of a desert what just before was all freshness and fertility." If further evidence be needed it is afforded by our knowledge of the antiquity and widespread employment of smallpox inoculation. It is necessary only to bear in mind two series of observations—on the one hand as regards the native of India, his poverty, his ignorance, his fatalistic beliefs resulting in an almost complete disregard for future perils, his unwillingness to take the simplest measures for self-preservation against epidemic disease and his procrastination when he agrees to do so, his active opposition to any measure involving personal pain or inconvenience; and on the other hand as regards smallpox inoculation, the arduous nature, the pain, the danger, the enforced isolation, and above all the expense,—to realise that the average inhabitant of this country would not have adopted it except that universal and bitter experience had taught him that the choice lay between this measure and almost certain death for himself and extermination for the race. We may conjecture, indeed, that when smallpox first appeared in India and found, as it would, the entire generation susceptible to attack, it must have extirpated—as is known to have occurred in St. Domingo, Mexico, Brazil, Quito, Siberia, Greenland and Iceland—whole races of men. At the risk of appearing to labour this point I take leave to transcribe some passages from an account of the ravages of smallpox among Indians of America, noting at the same time that in their habits and mode of living such tribes were fairly comparable with natives of India. The account (abbreviated) is as follows: "The disease first broke out in the village of Mandans, a few miles below the American fort Leavenworth, from which it spread in all directions with unexampled fury. The character of the disease was as appalling as the rapidity of the propagation. In vain were hospitals fitted up in Fort Union, and the whole stock of medicines exhausted. For many weeks together our workmen

did nothing but collect the dead bodies and bury them in large pits. The ravages of the disorder were the most frightful among the Mandans, where it first broke out. That once powerful tribe which, by accumulated disasters, had already been reduced to 1500 souls, was exterminated, with the exception of thirty persons. Their neighbours, the Ricarees, were out on a hunting excursion at the time of the breaking out of the disorder, so that it did not reach them until a month later; yet half the tribe was already destroyed on the 1st of October and the disease continued to spread. Very few of those who were attacked recovered their health; but when they saw all their relatives buried, and the pestilence still raging with unabated fury among the remainder of their countrymen, life became a burden to them, and they put an end to their wretched existence. The prairie all around is a vast field of death, covered with unburied corpses, and spreading for miles pestilence and infection. The Assiniboin, 9,000 in number, are, in the literal sense of the expression, nearly exterminated. They, as well as the Crows and Blackfeet, endeavoured to fly in all directions, but the disease everywhere pursued them. At last every feeling of mutual compassion and tenderness seems to have disappeared; everyone avoided the others. The accounts of the situation of the Blackfeet are awful. The inmates of above 1,000 of their homes are already swept away. The smallpox cast them down, the brave as well as the feeble, and those once seized by this infection never recovered. Thus, in the course of a few weeks their strength and their courage were broken and nothing was to be heard but the frightful wailings of death in their camp. No language can picture the scene of desolation which the country presents. In whatever direction we go we see nothing but melancholy wrecks of human life. The tents are still standing on every hill, but no rising smoke announces the presence of human beings, and no sounds but the croaking of the raven and the howling of the wolf interrupt the fearful silence." *

* Extracted from an appendix to Sir J. Simon's essay on the History and Practice of Vaccination. Those who consider that the account exaggerates the dread with which in pre-vaccination times smallpox was regarded by some Native races in India should read in conjunction with it Mr. Carnegy's account of the conduct of the Samaguting Nagas on the appearance of a case of smallpox in their village in 1877 (reproduced on page 68 of the

We may rest assured that an account of this nature would apply with equal truth to the ravages of smallpox in early times in India, and that its prevalence with terrible intensity for many years forced the apathetic natives of this country, doubtless reluctantly, to accept the arduous and expensive practice of smallpox inoculation as being one of the inevitable necessities of life. No epidemiological record, however complete, could afford more ample testimony to the devastation caused by smallpox than does our knowledge of the widespread employment of that measure of protection.

We are aware also that even after inoculation had been widely practised from, it is said, "time immemorial" smallpox still claimed an enormous toll of the inhabitants yearly. The disease still attacked rich and poor alike. Dr. Wise, Civil Surgeon of Dacca, found that in the history of the Tipperah family it was recorded that between the 15th and 18th centuries out of sixteen Maharajahs five died from smallpox; and Holwell writing in 1767 about the prevalence of smallpox in Bengal—which may be regarded as the home of inoculation in India—says: "Every seventh year with scarcely any exception the smallpox rages epidemically in these provinces during the months of March, April and May, and sometimes until the annual returning rains about the middle of June put a stop to its fury. On these periodical returns (to four of which I have been a witness) the disease proves universally of the most malignant confluent kind, from which few either of the natives or Europeans escaped that took the distemper in the natural way, commonly dying on the first, second, or third day of the eruption."

A century later the tale is in nearly all respects the same, and at this period we enter upon the era of statistics—for some years scanty and very imperfect but still very valuable because we know that their error lay not in an overstatement but in an enormous understatement of the mortality, equally from smallpox

Gazetteer of the Naga Hills. Assam District Gazetteer, Vol. IX, Calcutta, 1905) and the account of an epidemic of smallpox in the unvaccinated island of Minicoy (off the Malabar Coast) during the last few weeks of 1904. In that epidemic although the inhabitants forced all patients to proceed immediately to another islet, one-eighth of the population died,

as from all other causes. In the early years of death registration in India considerably more than 50 per cent. of the deaths that occurred were not registered at all, and therefore it is obvious that the recorded ratios of smallpox mortality for those years are much lower than they would be if all the smallpox deaths that occurred had been registered. If we use those ratios in our test of the benefits of vaccination, we are intentionally employing figures which may be very unfavourable for our purpose, but if, after using them, we still find a marked decline of smallpox mortality in later years, the proof of a real diminution in smallpox is all the more striking. For our present purposes also it is fortunate that the signs attending a fatal case of smallpox are so distinct that no mistake in diagnosis would be likely to be made even by a village *chowkidar*—especially as the disease is one with which every villager in India is only too familiar. In point of medical knowledge the agency by which the causes of death are recorded in India is the same now as it was 38 or more years ago, and as regards smallpox we may place the same reliance upon the diagnosis in 1868 as we do in 1908, and may say that for all practical purposes the diagnosis was, and is, sufficiently accurate. For our present object therefore we need have no reluctance in using as many of these early statistics as we can find, and indeed we do so at our peril, because if they prove to be much lower than in later years it will be open to anyone to say that in spite of vaccination the statistics show an increase in smallpox mortality.

In London in the 18th century the yearly death-rate from smallpox was on an average 4,000 per million. Here are some ratios for certain years of the 19th century in Calcutta.

1833	...	..	11,796	per	million.
1838	...	...	6,976	..	..
1844	...	...	13,537	..	..
1849	...	...	7,981	..	..
1850	..	...	10,721	..	..
1857	...	...	8,237	..	..
1865	...	...	12,925	..	..

In London smallpox caused about 12 per cent. of the total deaths in the 18th century. In Calcutta from the 1st of January to the 31st of December 1849 it caused nearly 13 per cent. of all the deaths and from the 1st of January to the 31st of May 1850 it caused nearly 47 per cent. Of 57 *adult* patients treated in the smallpox hospital in Calcutta in 1850 no fewer than 40 died; only one of these patients had been vaccinated and one inoculated. In other large Indian towns the disease in the middle of the 19th century was not less fatal. There were terrible epidemics of it in Delhi in 1842, 1846, and 1849, and DeRenzy says that in 1865 there died from small-pox in Lahore 7,000 people in the short space of two months: if this rate of dying had continued throughout the year, one third of the population of that large city would have been destroyed by smallpox alone. In Bombay as early as 1788 an effort was made by Mr. Farmer to abate the pestilence by inoculation,* but in 1801 the Medical Board wrote that at least one-third of those who contracted the disease naturally were destroyed by it and that at times the mortality from it was still more deplorable.

In some other TOWNS of India the following death-rates from smallpox were recorded in the early years of the statistical era:—

Province.	Town.	Year.	Smallpox death-rate per million.
Berar ...	{ Lakunwada ...	... 1872	13,100
	{ Sheagaum ...	... 1873	14,700
Madras ...	{ Cannanore ...	... 1873	10,600
	{ Cochin ...	... 1873	32,700
Central Provinces ...	{ Narsingpur ...	... 1874	11,290
	{ Mandūla ...	... 1874	12,150
	{ Armori ...	... 1874	11,000
	{ Murwara ...	... 1875	12,130

* In Calcutta inoculation was practised among certain classes of Europeans as early as 1785 and it is said that in 1787 Government erected a hospital for inoculation at Dum Dum. (See a paper by Lieut.-Col. D. G. Crawford, I.M.S., in the *Indian Medical Gazette*, January 1903, page 3.)

Province.	Town.	Year.	Smallpox death-rate per million.
North-West Frontier ...	Nammal ...	... 1871	28,540
	Bhakkar ...	... 1871	17,280
	Dera Ismail Khan ...	... 1871	11,290
Punjab ...	Khushab ...	... 1871	23,740
	Lawab ...	... 1871	17,490
	Pakpattan ...	... 1872	20,540
	Ferozepur ...	... 1875	15,730
	Saliwal ...	... 1871	15,390
	Bhadurgarh ...	... 1873	15,470
	Palwal ...	... 1872	12,020
	Multan ...	... 1871	10,180

In DISTRICTS (with populations considerably larger than those of most counties of England) some of the smallpox death-rates in early years of registration were as follows :—

Province.	District.	Year.	Smallpox death-rate per million.
Punjab ...	Gurgaon ...	... 1869	10,340
	Montgomery ...	... 1869	11,790
	Amritsar ...	... 1869	7,050
	Lahore ...	... 1869	7,180
Central Provinces ...	Sagar ...	... 1869	10,800
	Damoh ...	... 1869	12,800
	Narsingpur ...	... 1875	16,960
	Murwara ...	... 1875	12,620
Madras	Ganjam ...	... 1866	5,400
Berar	Akolah ...	... 1873	6,000

For PROVINCES (where the inhabitants, many millions in number, are scattered over areas which in general are from twice to thrice as great as that of England) we may select the following rates, noting at the same time that the smallpox death-rate for the whole of England in the 18th century was estimated to be on an average 3,000 per million.

North-Western Provinces	...	...	1869	...	3,067	per million.
			1873	...	3,155	„ „
			1874	...	3,030	„ „
United Provinces of Agra & Oudh	...	...	1878	...	3,991	„ „
Madras Presidency	...	...	1878	...	3,023	„ „
Berar	...	...	1869	...	3,068	„ „
			1872	...	3,830	„ „
			1873	...	3,810	„ „
Punjab	...	...	1869	...	3,048	„ „
Central Provinces	...	...	1869	...	3,465	„ „
			1874	...	2,382	„ „
			1875	...	2,730	„ „
			1879	...	3,440	„ „

Lastly, considering INDIA as a whole, it may be noted that in 1869, over the comparatively limited area in which death registration was attempted, nearly 200,000 deaths from smallpox were recorded, and having regard to the known neglect of registration,* we are justified in assuming that at least double that number actually occurred. Pringle,† writing in that year about the ravages of the disease in the North-Western Provinces, says: “In the Dooab, in the districts lying between the Ganges and Jumna, with a population of upwards of nine millions, I can state from the experience of the past four years that 95 per cent. of the population have been attacked with smallpox at some period of their lives.” He estimated the case-mortality at 80 per cent. in very young children and 60 per cent. in those a little older, and continued: “So fatal is smallpox among children that it has become quite a saying among the agricultural and even wealthier classes never to count children as permanent members of the family until they have been attacked with and recovered from smallpox.”

* The neglect was greatest in regard to deaths of infants and children—the classes in which most deaths from smallpox occurred.

† *Lancet*, January 9th, 1869, page 44.

Surgeon-General Pinkerton, who had been for six years Superintendent of Vaccination in Scinde and for seven years Superintendent-General of Vaccination for the Bombay Presidency, gave evidence before the Royal Commission on Vaccination to the effect that at the time he went to Scinde in 1863 nearly the whole population were marked with smallpox, and blindness and lameness resulting from that disease were very common. Stewart, writing in 1844, said that at the Park Street dispensary in Calcutta, out of 280 patients attending daily, 12 were suffering from affections resulting from smallpox, and according to Sir Ranald Martin, 75 per cent. of the blind in some parts of India during those early years of record owed their affliction to that disease.

The above will serve very imperfectly to convey an idea of the dreadful scourge with which the people of India were afflicted for many hundreds of years, and it is with relief that we turn from it and commence the task of ascertaining what vaccination has achieved in the arduous combat against the pestilence.

CHAPTER IV—*continued.*

SECTION II.

The smallpox mortality statistics of India.

It has been mentioned already that the knowledge which we desire regarding the efficacy of vaccination is best obtained by comparing the smallpox mortality statistics during periods after and before the widespread employment of the measure, and the present section of this chapter will be confined to that method of proof. Charts will be given which show for each province separately and for British India as a whole how many persons in each million of population have died annually from smallpox since the beginning of the statistical era ; and without classifying the statistics in so detailed a manner as to lay ourselves open to the criticism that we have arranged them to suit our own purposes, we shall (as is only just) consider them in regard to the extent and efficiency attending the progress of vaccination.

The first series of charts deals for each province separately with the method just described, and in the first place we take up those provinces where it was possible to establish comparatively early in the history of vaccination in India, efficient means for its general employment among all classes of people.

1. BOMBAY.

Population* in 1872 = 15,197,071 ; in 1901 = 18,481,362.

It has already been detailed in Chapter III, how among all the provinces of India, this Presidency led the way as regards an efficient organisation for vaccination by the establishment of the "Bombay system" in 1827. As a result of these excellent arrangements smallpox in this Presidency had already been reduced from a giant to a dwarf before the beginning of the statistical era, and in consequence the chart which faces this page does not exhibit such a marked decline of smallpox in later when compared with earlier periods as is exhibited by the charts of some other provinces where efficient systems of vaccination were not initiated so early. As in all the charts which follow, the comparison is not between periods of no vaccination as compared with periods of vaccination but between periods of "less" as compared with periods of "more" vaccination; and as regards this Presidency the period of "less" vaccination was really, on account of the excellent system in vogue, a period of very good vaccination.

Taking the chart as it stands, however, we may compare the smallpox mortality of the last 20 years with that of the preceding 20 years as follows :—

	1868 to 1887.	1888 to 1907.
Total smallpox deaths	168,910	88,245
Smallpox death-rate per million of population for the period	537·2	240·5

It has already been mentioned that the advent of plague in 1896 was very detrimental to vaccination. The number of vaccinations performed yearly fell abruptly and we are not surprised that the result should be manifest in the higher smallpox mortality rates from 1900. Practically speaking, vaccination is optional throughout the whole of this large Presidency (it is compulsory in only 7 towns), and when so terrible a disease as plague is epidemic, it is, as would be expected, exceedingly difficult to persuade the people to have their children vaccinated.

* Censuses were taken in India in 1872, 1881, 1891, and 1901. The death-rates shown on the charts for other than the census years have been worked out on the estimated population of those years.

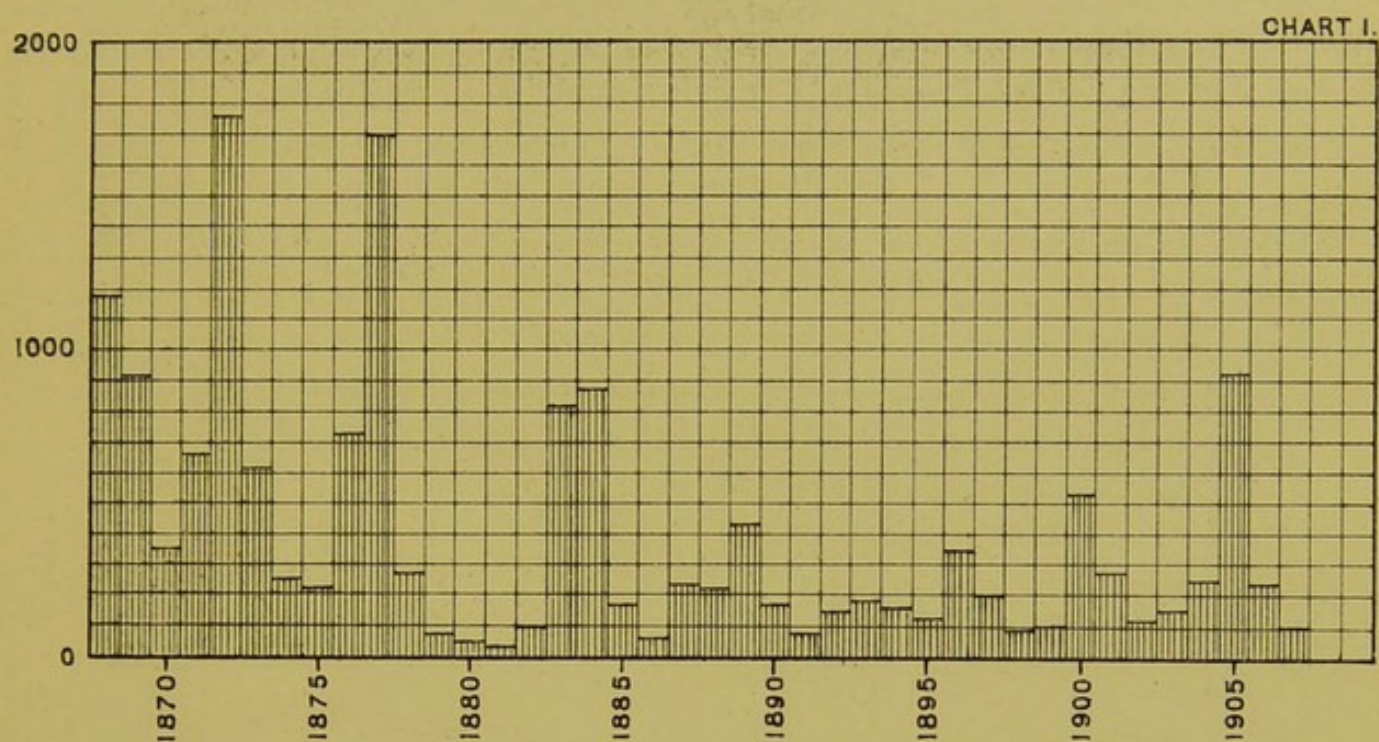


CHART No. I—The Bombay Presidency. Annual mortality from smallpox per million of population, 1868 to 1907.

2. UNITED PROVINCES OF AGRA AND OUDH.

Population in 1872 = 30,844,022* ; in 1901 = 47,691,782.

The North-Western Provinces (which now form the greater area of the United Provinces) were fortunate in being the second large area in India to receive the benefits of a thoroughly effective system of vaccination, the Bombay system being introduced in them some years prior to 1854. A similar benefit was not conferred upon Oudh until 1867.

The chart shows in graphic form how many persons in each million of population died annually from smallpox since 1868.

When we consider the figures of the 40 years according to decennial periods we get the following remarkable results:—

	1868 to 1877.	1878 to 1887.	1888 to 1897.	1898 to 1907.
Total smallpox deaths ...	*500,194	670,951	305,002	79,950
Smallpox death-rate per million of population for the period ...	1587·9	1535·6	662·1	168·5

* Up to 1876 the figures are for the province of Agra only.

CHART II.

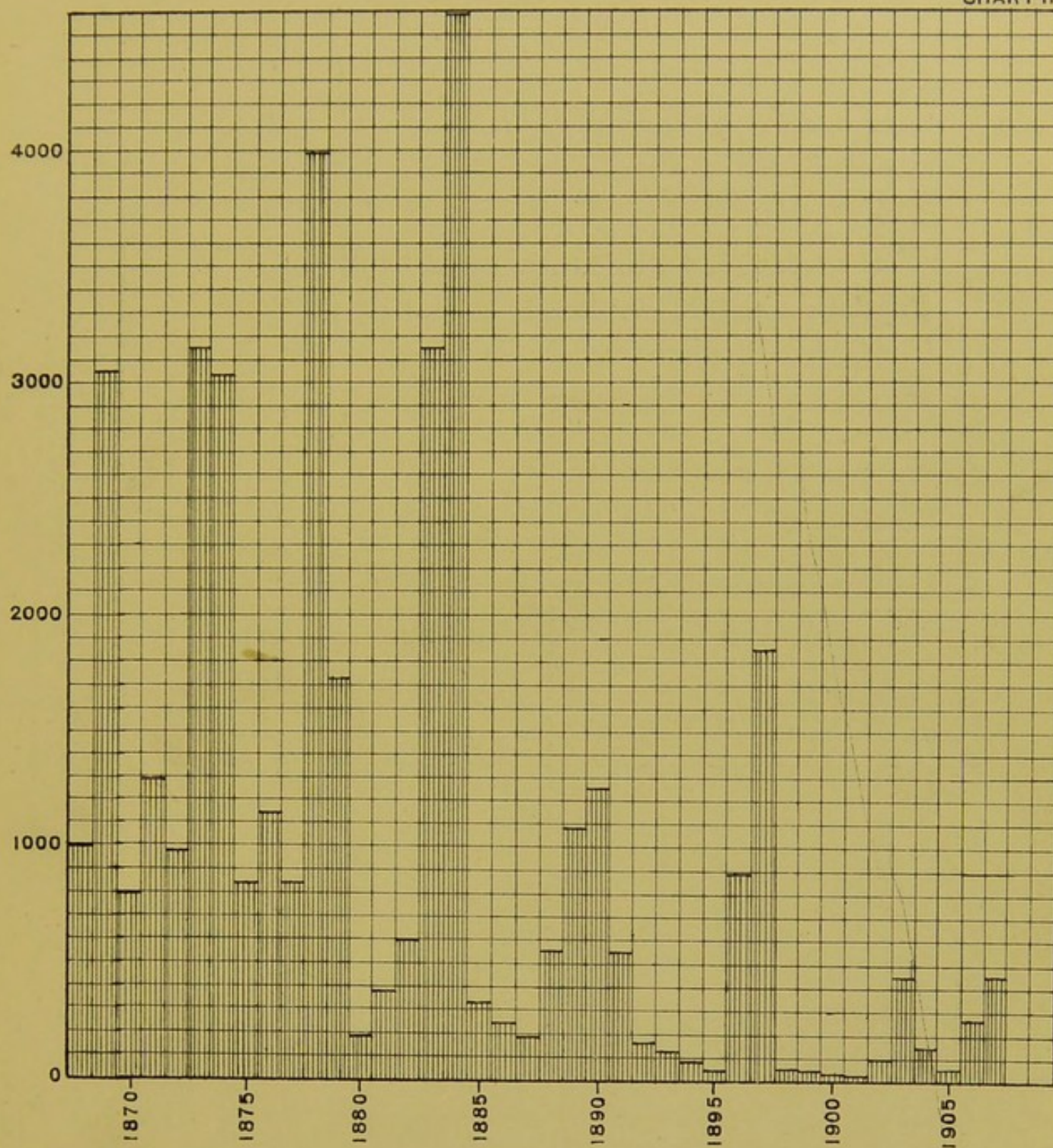


CHART No. II—United Provinces of Agra and Oudh. Annual mortality from smallpox per million of population, 1868 to 1907.

3. THE CENTRAL PROVINCES.

Population in 1872 = 7,266,373 ; in 1901 = 8,673,030.

The Central Provinces and the Punjab stand next as regards the date of establishment of a sound vaccination system, for in both these provinces the Bombay system of European supervision was introduced about 1864.

The smallpox mortality chart of the Central Provinces is for 40 years, and considering the statistics in two equal periods, we get the following results :—

	1868 to 1887.	1888 to 1907.
Total smallpox deaths	153,764	93,576
Smallpox death-rate per million of population for the period	1020·1	502·7

CHART III.

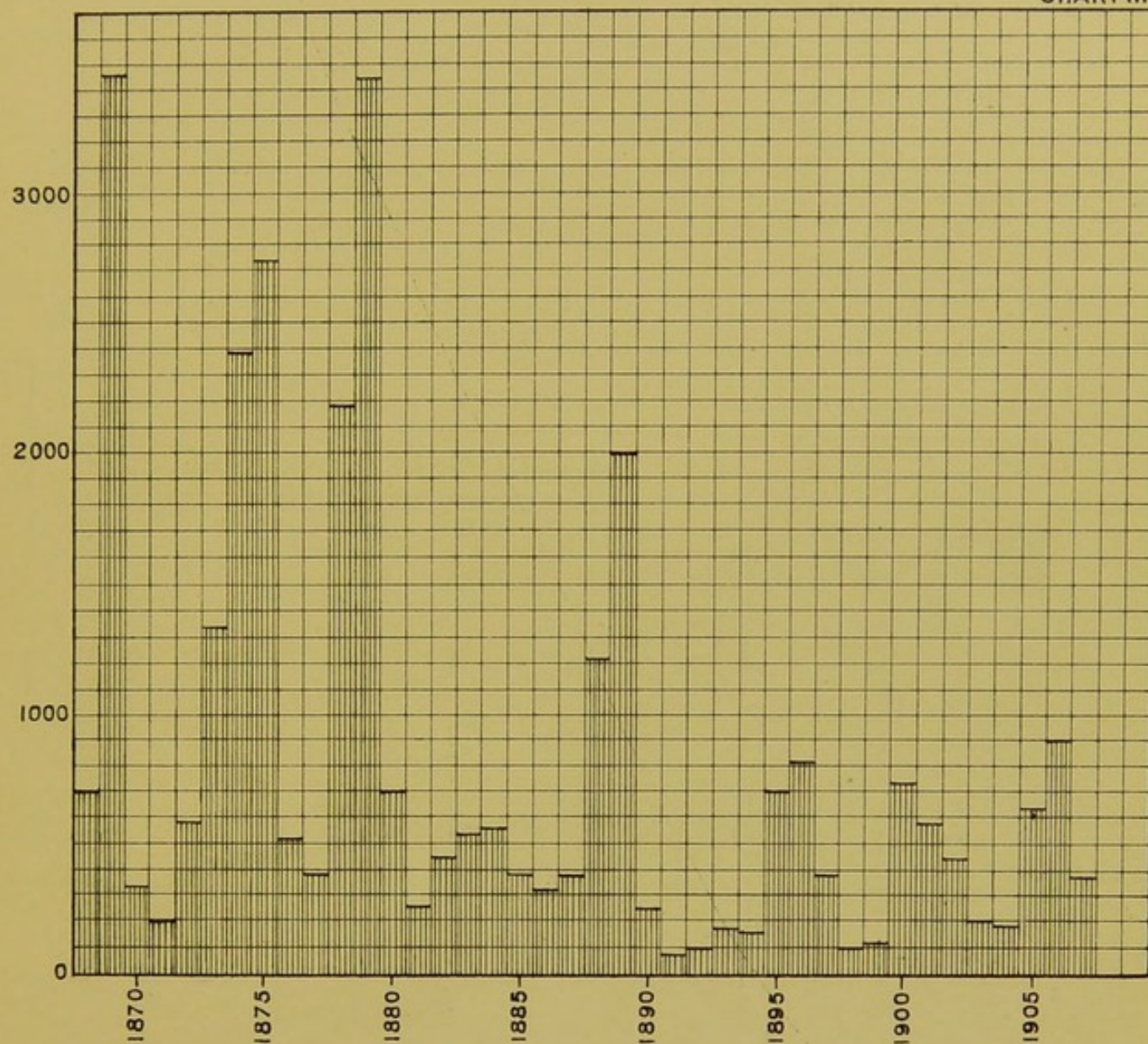


CHART No III—The Central Provinces. Annual mortality from smallpox per million of population, 1868 to 1907.

4. THE PUNJAB, EXCLUDING THE NORTH-WEST FRONTIER PROVINCE.

Population in 1872 = 15,785,698 ; in 1901 = 20,108,690.

	1868 to 1887.	1888 to 1907.
Smallpox deaths	354,440	195,304
Smallpox death-rate per million of population for the period	1099·3	520·7

CHART IV.



CHART No. IV—The Punjab. Annual mortality from smallpox per million of population, 1868 to 1907.

5. THE MADRAS PRESIDENCY.

Population in 1872 = 30,147,779 ; in 1901 = 37,315,611.

The introduction of a good vaccination system in this Presidency dates from 1865 when an organisation on the Bombay plan was formed.

The smallpox death-rates for the two equal periods of 20 years are as follows :—

	1868 to 1887.	1888 to 1907.
Smallpox deaths	656,336	450,945
Smallpox death-rate per million of population for the period	1163·9	673·0

CHART V.

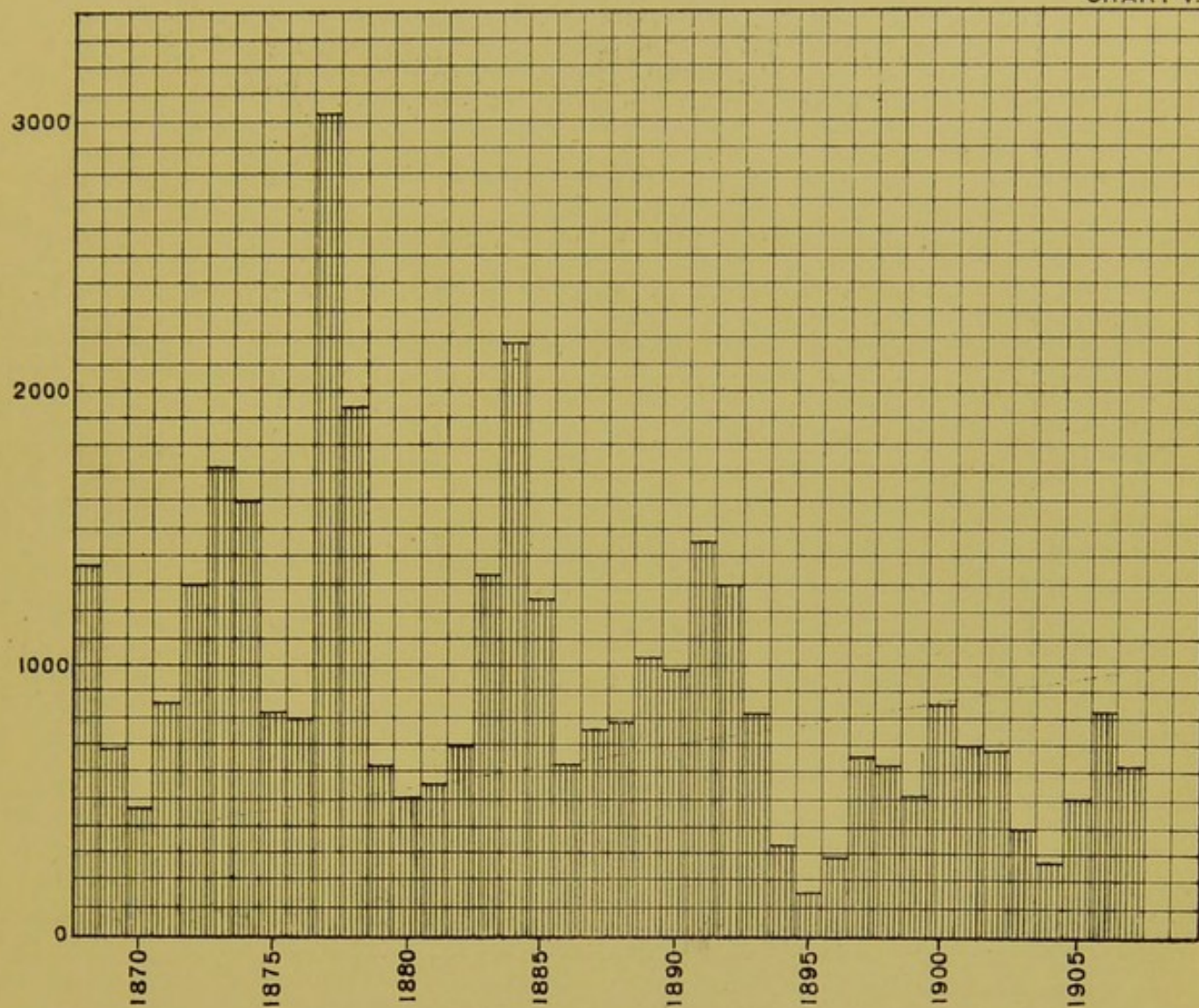


CHART No. V—The Madras Presidency. Annual mortality from smallpox per million of population, 1868 to 1907.

6. BERAR.

Population in 1872 = 2,184,945; in 1901 = 2,717,346.

Berar has always been noted among the provinces of India for the efficiency of its arrangements for vaccination, and the chart shows in a remarkable manner the good results which attend the labours of an efficient vaccination service. On account of the amalgamation of the province with the Central Provinces the smallpox mortality chart cannot be carried beyond 1904, after which year the statistics are included in the chart of the Central Provinces already given.

Taking the figures for the 36 years shown on the chart, we may compare the results of the last 18 with those of the first 18 years thus :—

	1869 to 1886.	1887 to 1901.
Total smallpox deaths	45,286	9,126
Smallpox death-rate per million of population for the period	1083·1	183·

CHART VI.

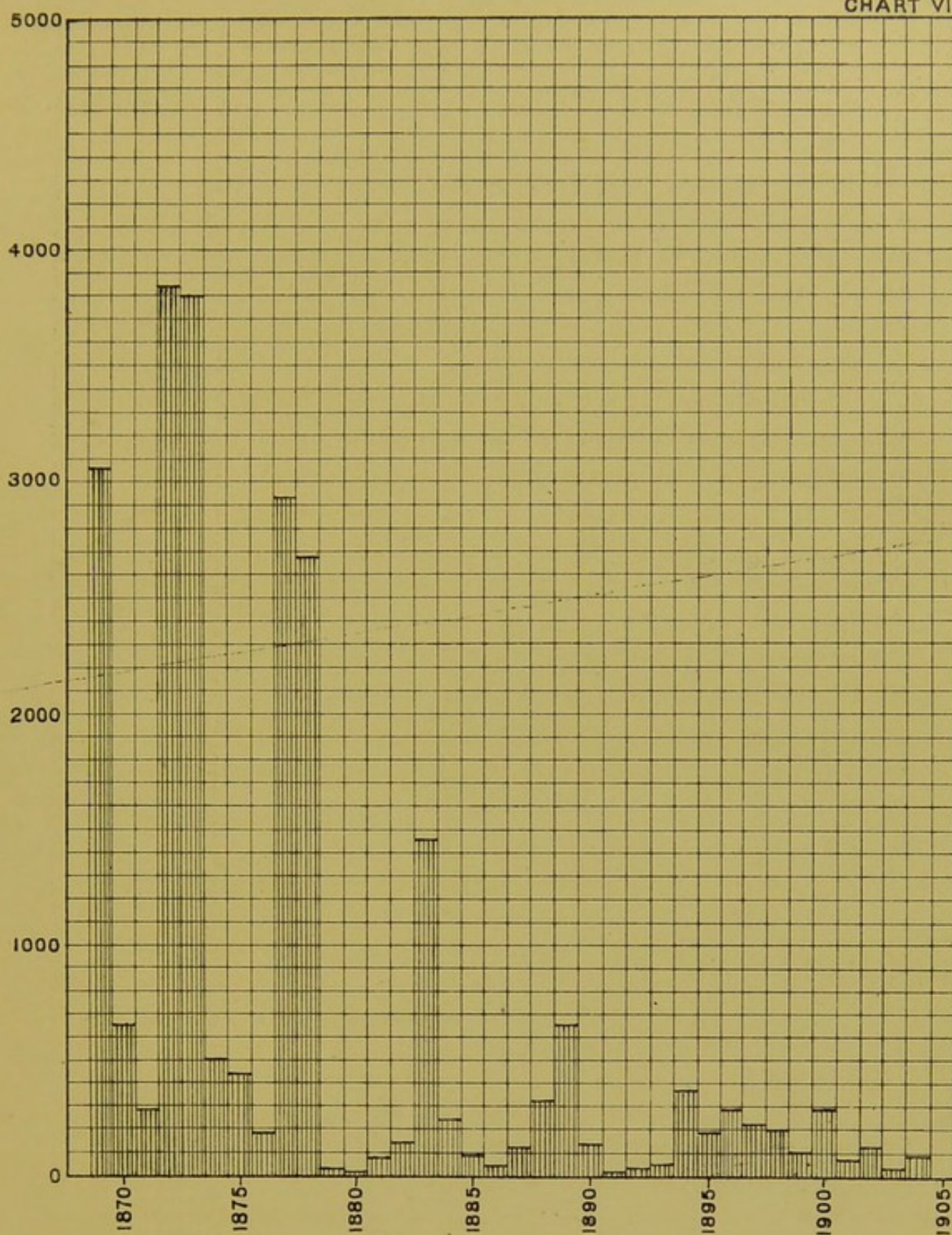


CHART No. VI—Berar. Annual mortality from smallpox per million of population, 1869 to 1904.

7. "WELL VACCINATED BRITISH INDIA."

The superiority of the Bombay system of vaccination lay in its provision for adequate supervision of the native vaccinators by European medical officers whose sole duty was the propagation of vaccination. It is certain that in India no system which omits this provision is good, and we have therefore rightly included in a separate class all the provinces which were fortunate enough to receive early the benefits of that system. Before turning to the less fortunate provinces, we are justified in combining the results of vaccination in those provinces and exhibiting them in graphic form under the heading "Well vaccinated British India."

The chart of smallpox mortality facing this page is the result. It relates to the portion of India represented by the provinces of Bombay, Madras, the Punjab, the Central Provinces, the United Provinces of Agra and Oudh, and Berar, that is to an area of about 573,000 square miles and to a population which, according to the census of 1901, numbered about $137\frac{1}{2}$ million people. The area is therefore nearly ten times as great as that of England and Wales and nearly three times as great as that of France or Germany; and the population is more than four times as great as that of England and Wales, more than $3\frac{1}{2}$ times as great as that of France, and more than twice as great as that of Germany.

The chart is self-explanatory of the remarkable benefits which the people of this vast area have derived from vaccination. We may take some figures from it and attempt to form an idea of the saving of life effected.

The chart is for 40 years, and taking the figures by decennial periods, we get the following results:—

	1868 to 1877.	1878 to 1887.	1888 to 1897.	1898 to 1907.
Smallpox deaths ...	1,308,737	1,242,797	747,590	478,843
Smallpox death-rate per million of population for the period. ..	1318·5	1073·1	596·1	361·5

Now we are aware that on account of the neglect to register smallpox deaths in 1868 to 1877 the death-rate for that period

CHART VII.

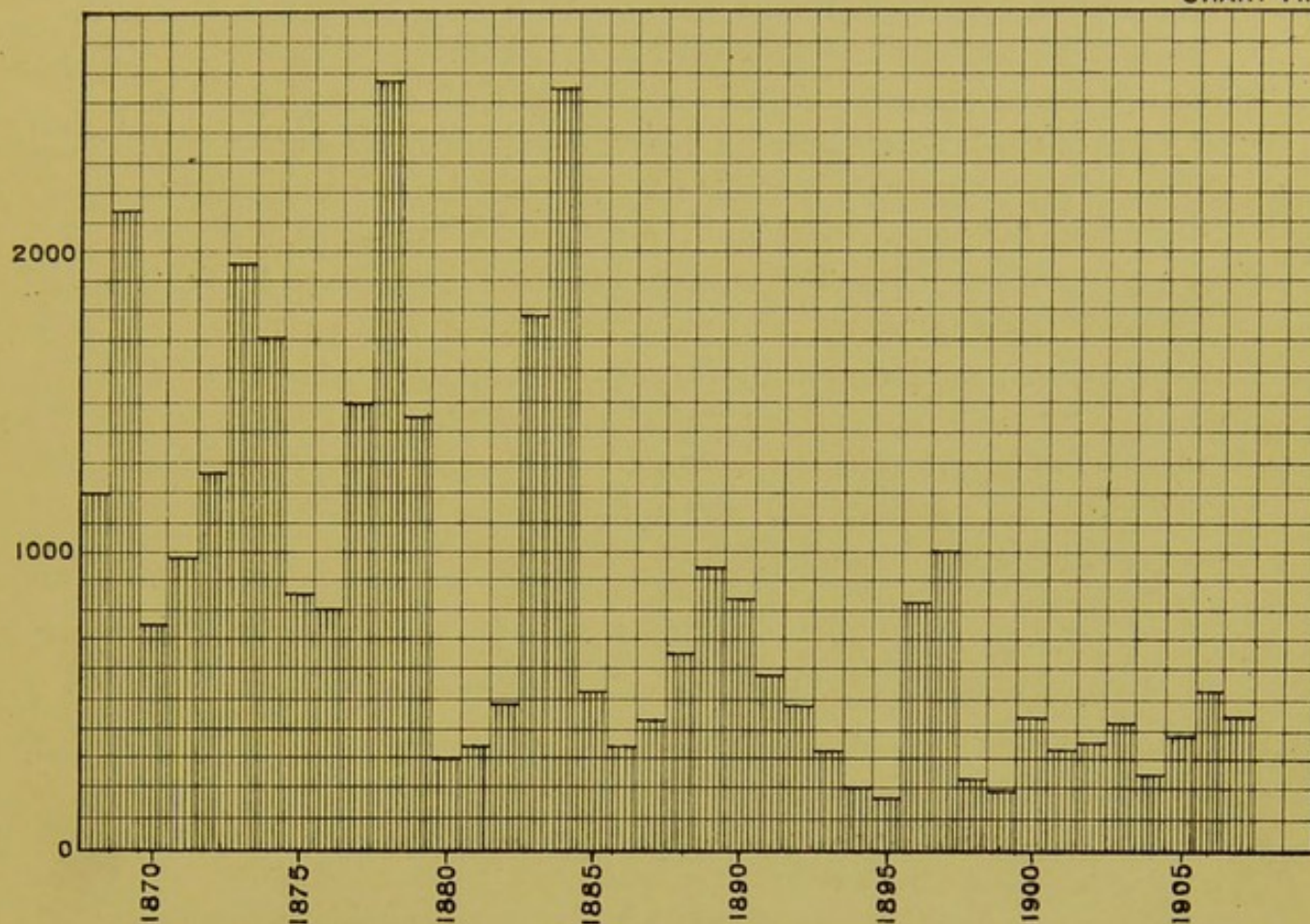


CHART No. VII—"Well Vaccinated British India." Annual mortality from smallpox per million of population, 1868 to 1907.

greatly understates the true death-rate from smallpox prevailing at that time, and we are aware also that in the absence of an efficient means of controlling smallpox the ravages of the disease in India in modern times would, on account of the much greater facilities for its spread, far exceed those of forty years ago. Let us, however, neglect these two factors and assume that the recorded death-rate of small-pox for 1868 to 1877 had continued through the subsequent periods down to 1907. On this assumption the number of deaths from smallpox in this part of India during the 40 years would have amounted to 6,235,802. Actually, however, they amounted to 3,777,967 and the difference, namely, 2,457,835 represents the number of lives *known* to have been saved by vaccination. How many millions more were saved by this measure may be dimly conjectured by those who, having considered the death-rates of 40 years ago enumerated in section I of this chapter, are able to appreciate the enormously increased opportunities for the spread of smallpox which during the last 40 years have occurred in India.

IN any attempt to prove the value of vaccination by an examination of the smallpox mortality in a country at different periods it is essential to take into account the extent and efficiency with which vaccination has been carried out during those periods. And although one would have preferred not to place the provinces of India in different classes as regards the merits of their arrangements for vaccination, I can imagine no other plan which could be adopted with justice to the cause of vaccination. In dividing the provinces under only two headings according as to whether a good system of vaccination was or was not early and widely introduced in them, I have adopted for obvious reasons the widest possible method of classification, but a more stringent classification based on the actual extent and efficiency of vaccination arrangements would have produced more striking results. The charts which we have now to consider are for the three remaining older provinces of India, namely, Bengal, Assam, and Burma, in

which, doubtless, on account of the much greater difficulties to be overcome (among which the almost general employment of smallpox inoculation by the people of these three provinces is all important), vaccination has always been much more backward than in any of the provinces already dealt with.

1. BENGAL.

Population in 1872 = 63,946,432 ; in 1901 = 74,428,193.

The history of the vicissitudes attending the various attempts to confer the benefits of vaccination upon the inhabitants of Bengal has been given in detail in Chapter III. The record is one of continual failure. In justice to the cause of vaccination it is essential to emphasise this unfortunate result and I propose to do so by the following two quotations.

In 1844 (that is more than 40 years after the introduction of vaccination in Bengal) Dr. Duncan Stewart, Superintendent-General of Vaccination, wrote as follows :—" The history of vaccination in Bengal presents a painful picture of the evil consequences resulting from the want of some settled principle in the organisation and of a consistent perseverance in the execution of any general scheme designed for the specific object contemplated. It exhibits at one time a hurtful struggle between efficiency and economy, at another a vain attempt at compromise between the prejudices of ignorance or superstition, and the views of an enlightened benevolence. The promotion of vaccination has never ceased to engage the consideration of successive Governors-General, of each new Medical Board and of all the Superintending Surgeons in Bengal ; a liberal ear too has ever been lent by the Court of Directors to recommendations emanating from the Supreme Government for the adoption of various measures calculated, as it was thought, to further the use of the remedy among the people ; but yet until the present hour, it has made no corresponding progress in public opinion, and its practical benefits are still almost entirely confined to the European sojourners and to their families and followers."

The second quotation is from the triennial report of vaccination in Bengal for the years 1905 to 1908, and before stating it we may recall the fact already mentioned in a previous chapter that the principal agency for performing vaccination in Bengal is that of "licensed vaccinators" who receive no pay from the State but obtain a living as best they can by charging the people a vaccination fee. The quotation referred to is as follows:—"In the absence of the compulsory law to enforce vaccination this Department has to depend chiefly on persuasive measures to advance the cause. But persuasion is of no avail with poor people who have not the wherewithal to pay for the bare necessities of life, and can ill afford to pay for vaccination, however beneficial it might be. The result is that the vaccinators, who are unpaid men, leave unprotected the areas that are least profitable, and carry on their work in places where they get their fees without difficulty and not unfrequently illegal gain in the shape of articles of food. The inspecting staff, who for the most part are promoted vaccinators, are not men of sufficient status and strength of character to be able to inspire confidence. They often share the spoils of the vaccinators and attempt to protect them, and it is only when some energetic Civil Surgeon, or Deputy Sanitary Commissioner brings to light their carelessness, neglect of duty, or malpractices, that these men are roused to some activity for fear of losing their appointments."

I cannot suppose that anyone after reading these extracts and the history of vaccination in Bengal, given in the previous chapter, will be surprised that the record of smallpox mortality in this province does not show a marked, or indeed any, decline of this disease. Knowing that by 1887 the Compulsory Vaccination Act had been extended to 129 of the 157 towns in the province, and that since 1892 it has been in force in nearly all the towns, it is to the statistics of those areas that one would turn first in the hope of finding a diminution of smallpox. For this reason the chart facing this page relates to the smallpox mortality in towns only. The absence and neglect of registration prevents the

CHART VIII.



CHART No. VIII—Towns of Bengal. Annual mortality from smallpox per million of population, 1875 to 1904.

statistics being given for earlier years than 1875 and the partition of the province renders it impossible to carry them beyond 1904. Doubtless the rates would have been much higher if no vaccination had been carried on, but beyond such conjectures as this there is little or no consolation to be obtained from an examination of the chart. It indicates clearly that however great may be the advances in other sanitary arrangements we cannot expect a decline of smallpox in the absence of an efficient vaccination service.

2. ASSAM.

Population in 1872 = 4,150,769; in 1901 = 6,126,343.

As recently as 1881 the province of Assam was without a special establishment for vaccination work, the total agency for this purpose consisting of 17 Government vaccinators, a few medical subordinates attached to dispensaries and 58 ex-inoculators or "licensed vaccinators" who were unpaid by the State and some of whom it was thought carried on smallpox inoculation instead of vaccination.

Very little progress has been made since that time. Smallpox inoculation is still carried on in some districts and as in many parts it is very difficult for a "licensed vaccinator" to make a living, only a very indifferent and untrustworthy class of man can be induced to take up this work for a livelihood.

Knowing the backward state of vaccination in the province it was scarcely to be expected that the smallpox mortality in rural areas would show a decline, and, therefore, the chart facing this page is for towns only. For the reasons given under the heading of Bengal the chart is for the years from 1877 to 1904. It is considerably more favourable to vaccination than a similar chart for rural areas would be, but even so it is far from showing an effectual control of smallpox. From our knowledge of the state of vaccination in the province we could expect no other result.



CHART No. IX.—Towns of Assam. Annual mortality from smallpox per million of population, 1877 to 1904.

3. LOWER BURMA.

Population in 1872 = 2,663,110 ; in 1901 = 5,546,265.

Probably vaccination has met with more opposition in Burma than in any other province of India. As in the neighbouring country of China, the great majority of the people are wedded to the practice of smallpox inoculation. The following extracts from the annual report on vaccination for 1908 will serve to illustrate some of the difficulties which have still to be overcome.

“ In the districts of Tharrawaddy, Pakokku and Amherst the population is antagonistic to vaccination ; in the Northern

Shan States there is active opposition and progress is likely to be very slow. " Inoculation is referred to as being the cause of mortality from smallpox in the Lower Chindwin district, where 93 cases with four deaths occurred due to this operation and in the Upper Chindwin district where 22 deaths followed on 141 operations. " " In Yamethin smallpox was propagated by inoculation. " " In the Kawa township of the Pegu district an inoculator holding a vaccinator's certificate openly practised inoculation, showing the certificate to the villagers as his authority to inoculate. He also produced a copy of an order passed by the Chief Court that inoculation was not illegal. " " Inoculation is still practised freely in non-municipal areas. " " In the absence of facilities for obtaining the services of vaccinators and also by reason of their distrust in the efficacy of vaccination the rural populations continue to resort to inoculation whenever they are threatened by an epidemic of smallpox. " " It has been found extremely difficult in Burma to obtain, for the emoluments offered, vaccinators who will take an interest in their work and apply themselves to overcoming the strong prejudices to the operation entertained by the people. " " In the Henzada district there has been a remarkable and continuous decrease in the number of vaccinations recorded during each of the three years under review. The civil surgeon reports that the records in the past have been quite unreliable, that the results reported by vaccinators were not inspected or checked in any way and that the number of operations performed was grossly exaggerated. He finds the people of the district opposed to vaccination and that the Headmen of villages will give no assistance to the vaccinators. " " Proposals for a general reorganisation of the Vaccination Department are at present under consideration."

No one after reading these extracts will expect an examination of the smallpox statistics of this province to show a marked decline.

For the same reasons as have been mentioned under the

headings of Bengal and Assam the chart facing this page contains the statistics of towns only. Considering the figures for the last 30 years in two equal periods we get the following results.

	1878 to 1891.	1892 to 1907.
Smallpox death-rate per million of population for the period ...	1249.6	854.6

It is satisfactory that vaccination has caused a decline of smallpox in the towns, but in rural areas the smallpox death-rate for 1892 to 1907 was higher than for 1878 to 1891, and the same is true if we consider the smallpox statistics of the province as a whole.

“ BRITISH INDIA AS A WHOLE.”

Finally under this method of proof of the value of vaccination I give a chart of smallpox mortality for British India as a whole. As well as the statistics of all the provinces already dealt with it includes those of Ajmer-Merwara, Coorg, and the North-West Frontier Province, for which statistics are available for a period too short to make it worth while dealing with them separately. Thus it includes the statistics of the whole of British territory in India, the area of which is more than one million square miles and the population nearly 232 millions.

To collect together into one table or chart the statistics of smallpox mortality relating to an area greater than the combined areas of Germany, France, Spain, Norway, Sweden, England, and Italy, and relating to a population which, excluding Russia and Austria-Hungary, nearly equals that of the whole of Europe, is to subject our method of proving the benefits of vaccination to an ordeal which most people would regard as absurd. It is to collect in one table the statistics of provinces where vaccination was introduced a hundred years ago along with those of provinces in which it was not introduced until 20 years ago ; it is to combine the statistics of provinces in which the registration of deaths was not attempted until ten years ago with those of provinces in which deaths have been registered since 1866 ; and it is to combine the

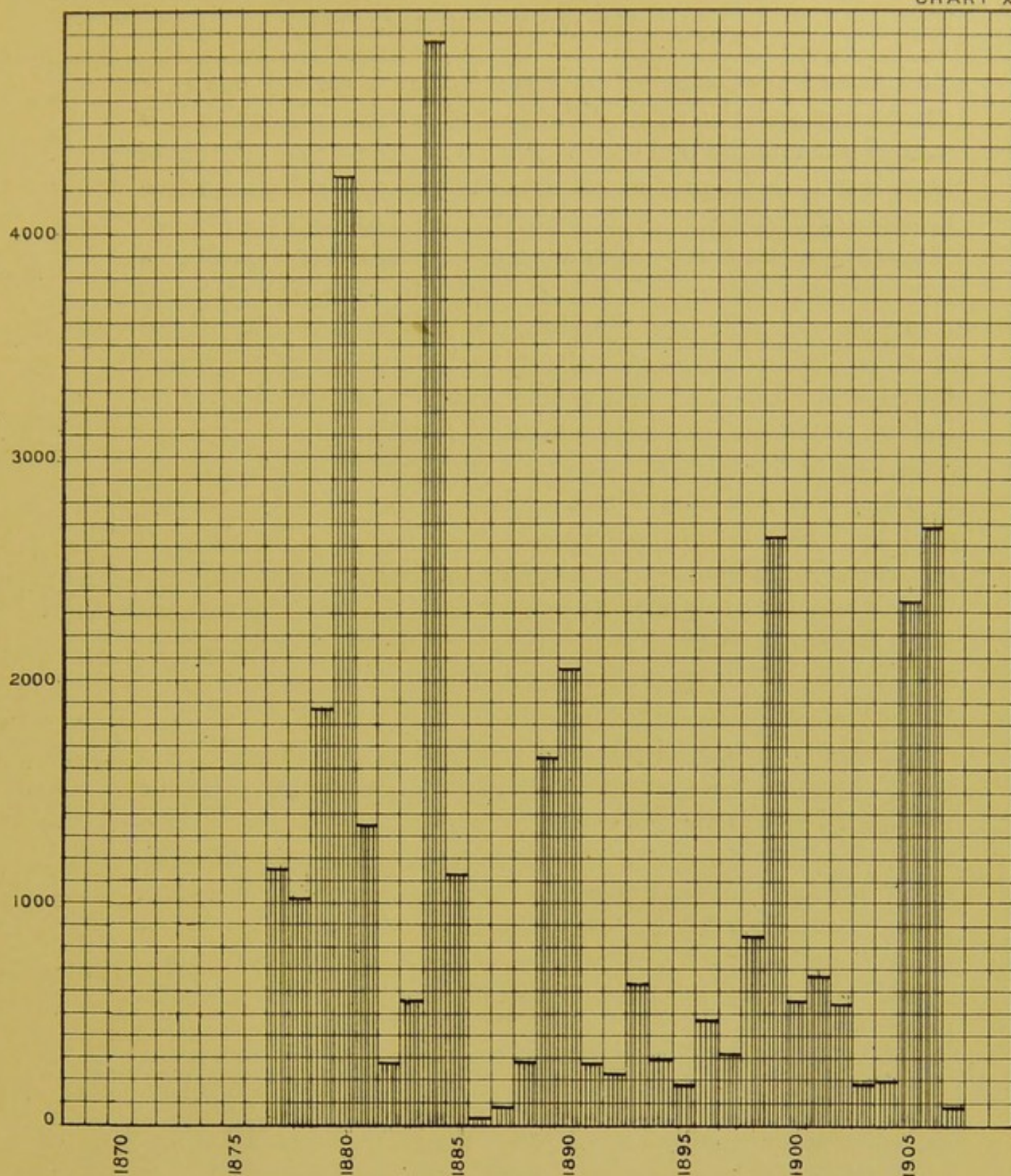


CHART No. X—Towns of Lower Burma. Annual mortality from smallpox per million of population, 1877 to 1907.

statistics of provinces in which vaccination is carried out very extensively and efficiently with those of provinces in which it is carried out scantily and badly. Such a heterogeneous mixture of facts is of little interest or value to one who really desires a true measure of the benefits that vaccination has conferred upon India, but unfortunately there are many people who regard with suspicion any attempt, however simple, to subdivide statistics into groups of similar and therefore comparable facts; they regard any such endeavour as an attempt to "juggle with the figures." It is for the benefit of such people that in this essay I have refrained almost entirely from a detailed classification of provinces according to the relative extent and success with which vaccination and registration have been carried out, and it is for their benefit that I now give the chart which faces this page. For purposes of comparison a diagram showing the total number of vaccination operations performed each year is given on a transparent sheet facing the chart; when this is placed over the chart the decline in the smallpox mortality coincident with the progress of vaccination operations is well seen.

It is the wonderful merit of vaccination that even with a chart of this nature the benefit which it has conferred upon the people of India is very evident. The chart begins when death registration was started in India and even when we neglect altogether the fact that for a number of years following the introduction of that measure quite half the smallpox deaths which occurred were not recorded at all, we get, when we consider the figures according to decennial periods, the following sufficiently remarkable results.

	1868 to 1877.	1878 to 1887.	1888 to 1897.	1898 to 1907.
Smallpox deaths	1,436,009	1,460,890	961,424	832,165
Smallpox death-rate per million of population for the period ...	1032·3	771·9	466·0	373·9

CHART XII.

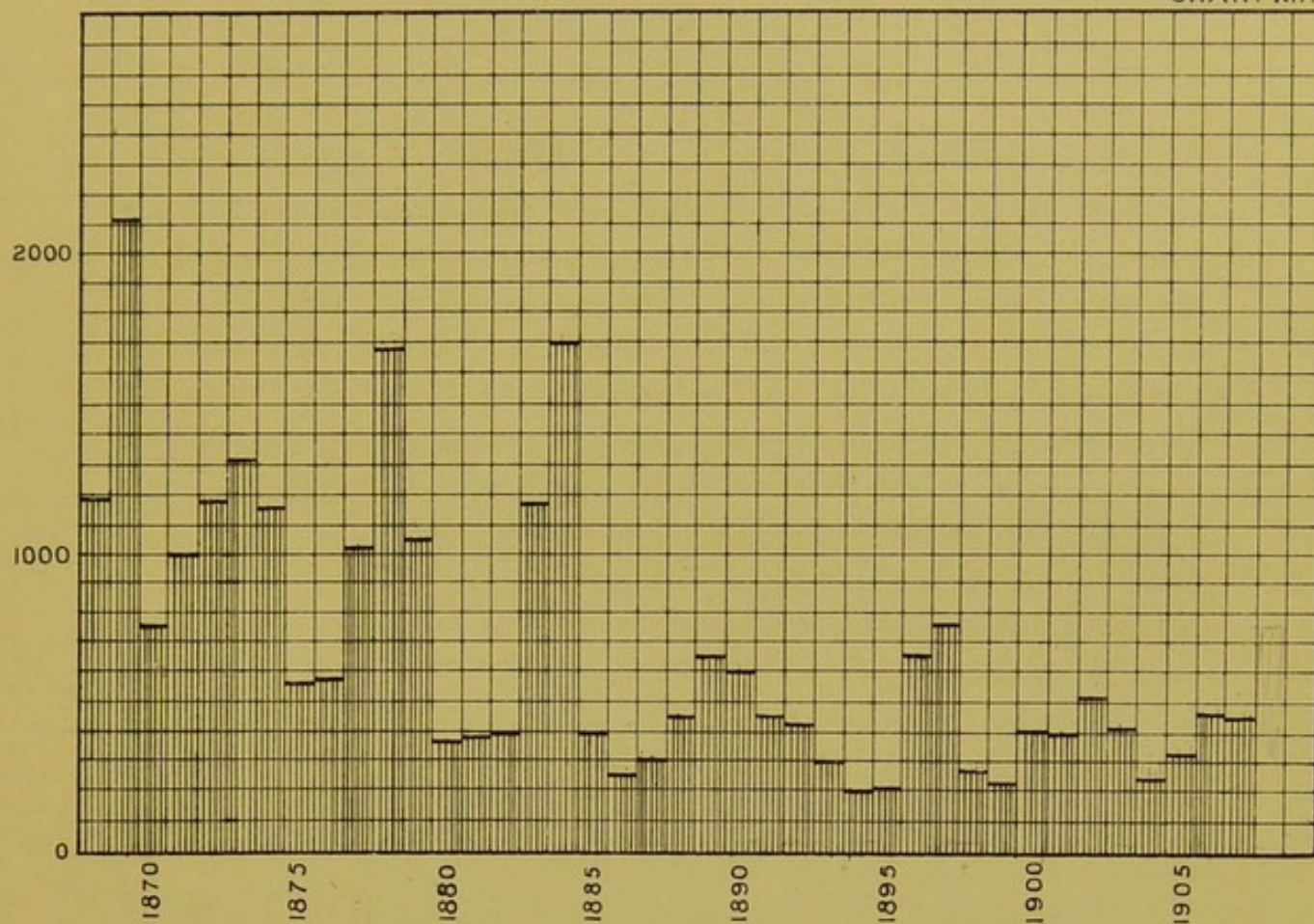


CHART No. XII—"British India as a whole." Annual mortality from smallpox per million of population, 1868 to 1907.

CHAPTER IV.—*continued.*

SECTION III.

(1) *The smallpox mortality statistics of India.*—continued.

To exhibit in graphic form the annual death-rates from smallpox for a series of years is only one of several methods by which the reduction of that disease which has occurred in India may be made clear. I will now deal with one of the other methods that is of especial value in a country like India where the population, except in the census years, is not accurately known and the registration of deaths, at all times much neglected, was far more so in the early years than in the later. This method is based upon a knowledge of the proportion which the recorded deaths from smallpox contribute to the total deaths recorded from all causes, its merits being that a knowledge of the population figures is not required and that the neglect to register deaths applies equally to smallpox and to every other disease. We know, of course, that the method when improperly used is liable to give fallacious results, but I am not aware that with the precautions which he shall adopt here any serious objection to it can be raised.*

In this plan an "epidemic" of smallpox is defined as one in which the deaths from this disease constitute a certain arbitrarily stated percentage of the total deaths, as, for example, 10 per cent. or 5 per cent., or 3 per cent., and when these percentages are worked out for each year it is seen how many "epidemics" occurred before

* An obvious objection is that during the last ten years the total mortality in India has been greatly increased on account of the presence of plague, so that even if smallpox had not declined, the proportion of smallpox deaths to total deaths would be less than before the appearance of plague. The answer to this objection is that the decline of smallpox mortality has been so great that even if all the deaths from plague are excluded from the figures of total mortality the results by this method of test remain the same.

a specified date and how many after that date. The date is usually fixed with reference to the year of institution of a compulsory Vaccination Act, but it has been already noted in Chapter III of this essay that a number of years passed before the compulsory Act applying to municipalities in India was extended to more than an insignificant number of towns, and that even if it had been brought into force immediately in all municipalities, it would have affected an exceedingly small proportion of the population. For this reason it is preferable to consider the statistics available for this country according to two equal periods. To do so will be to fix the date, as a rule, between 1887 and 1888. Our object is now to find out how many "epidemics" of smallpox occurred in the different provinces of India and in British India as whole before and after that time.

Considering the statistics of the provinces in the same order as in Section II of this chapter we get the following results.

I. BOMBAY.

In this Presidency defining an "epidemic" of smallpox as meaning such a prevalence of the disease that the deaths from it formed 3 or more per cent. of the deaths from all causes, the statistics show :—

For the 21 years from 1866 to 1886	10 "epidemics."
„ 21 „ „ 1887 to 1907	0 „

2. UNITED PROVINCES OF AGRA AND OUDH.

Defining an "epidemic" as such a prevalence that the deaths from smallpox formed 5 or more per cent. of the deaths from all causes the statistics show :—

For the 20 years from 1867 to 1886	10 "epidemics."
„ 21 „ „ 1887 to 1907	0 „

3. THE CENTRAL PROVINCES.

Defining an "epidemic" of smallpox as meaning such a prevalence of the disease that the deaths from it constituted 5 or more per cent. of the deaths from all causes, the statistics show:—

For the 20 years from 1868 to 1887	5 "epidemics."
„ 20 „ „ 1888 to 1907	0 „

4. THE PUNJAB.

Defining an "epidemic" of smallpox as meaning such a prevalence that the deaths from it constituted 5 or more per cent. of the deaths from all causes, the statistics show:—

For the 20 years from 1868 to 1887	7 "epidemics."
„ 20 „ „ 1888 to 1907	0 „

5. THE MADRAS PRESIDENCY.

Defining an "epidemic" as such a prevalence that the deaths from smallpox formed 6 per cent. or more of the deaths from all causes, the statistics show:—

For the 21 years from 1866 to 1886	8 "epidemics."
„ 21 „ „ 1887 to 1907	0 „

6. BERAR.

Defining an "epidemic" of smallpox as meaning such a prevalence of the disease that the deaths from it constitute 10 or more per cent. of the deaths from all causes, the statistics show:—

For the 19 years from 1869 to 1887	4 "epidemics."
„ 20 „ „ 1888 to 1907	0 „

If we reduce the percentage to 2·5 the results work out to 7 "epidemics" before 1887 and 0 afterwards.

From the actual figures of deaths from smallpox and from all causes for the six provinces above dealt with we obtain the statistics for the area that we have already named "Well Vaccinated British India," and working out the proportion which the smallpox mortality contributes to the total mortality we get, if we regard 5 or more per cent. as indicating an "epidemic," the

CHART XI.

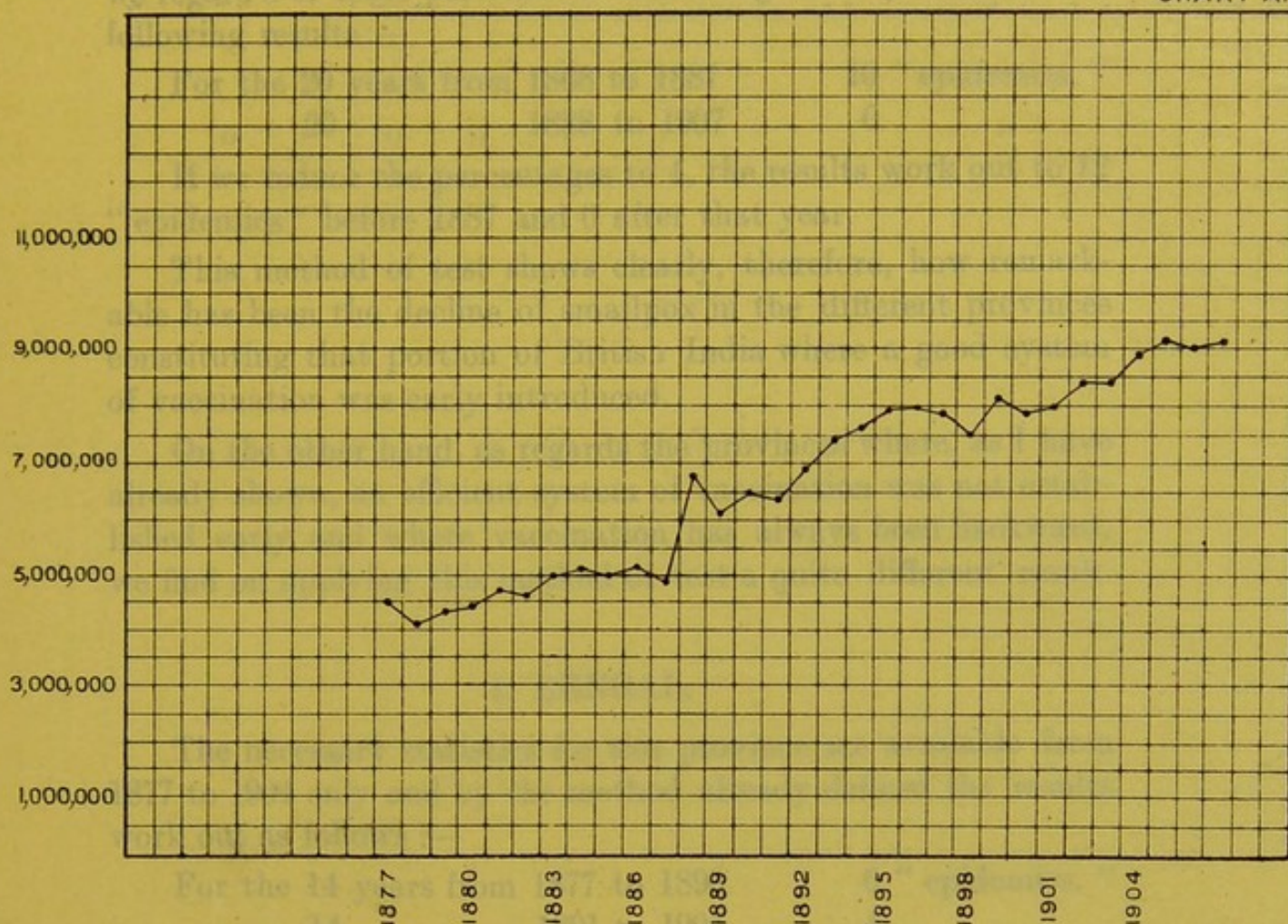


CHART No. XI—Total number of vaccinations performed in British India annually from 1877 to 1907.

As in Bengal, the statistics are available from 1877 to 1907, and considering them in two equal periods we get the following results:—

For the 14 years from 1877 to 1890

7 "epidemics"

" 14 " " 1891 to 1904

4 " "

3. THE CENTRAL PROVINCES.

Defining an "epidemic" as meaning such a prevalence of smallpox as to constitute 10 or 5 per cent. of the deaths from all causes, the statistics show:

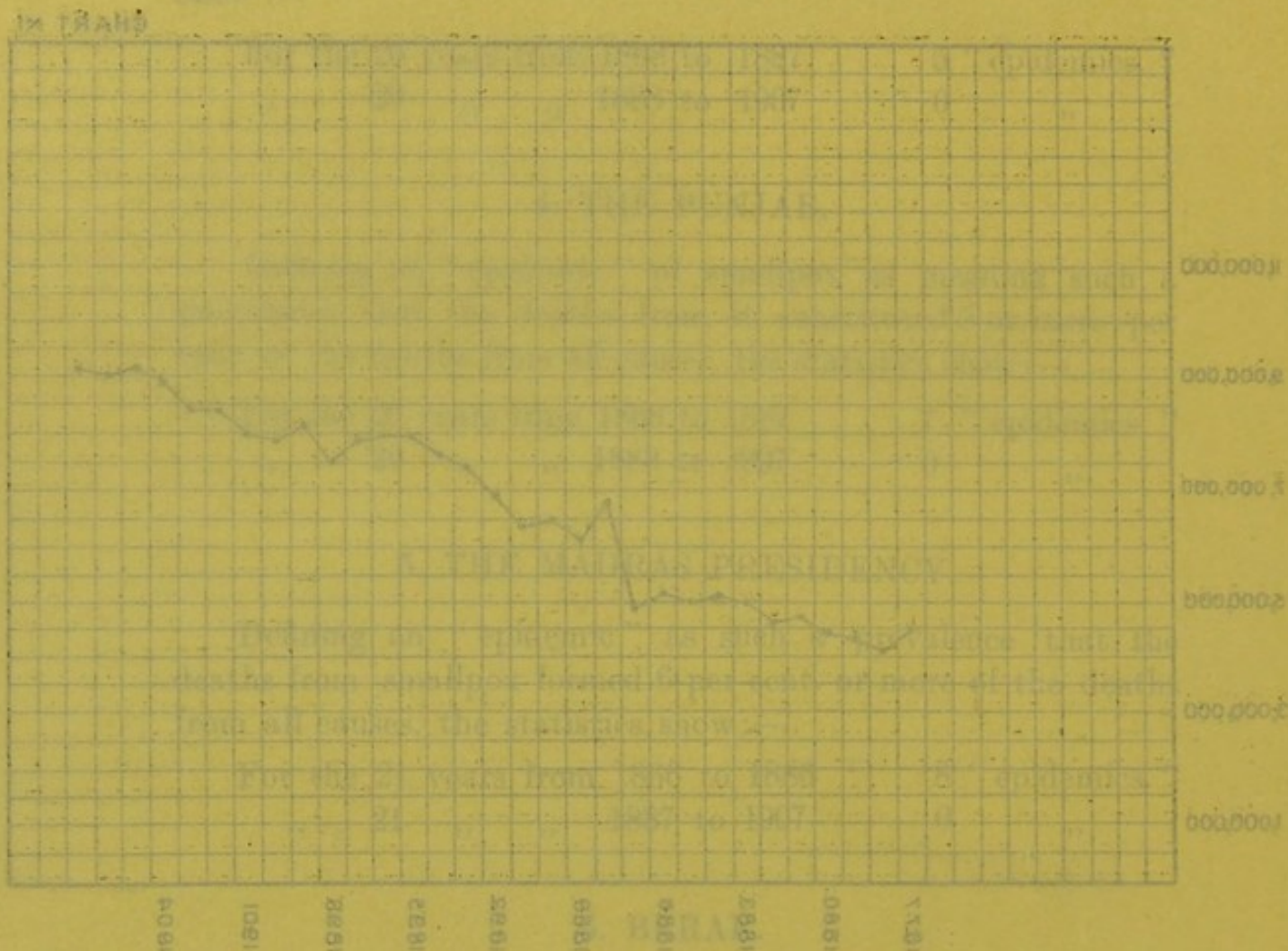


CHART XI—Total number of vaccinations performed in British India annually from 1881 to 1907.

For the 19 years from 1881 to 1887	4 " epidemics."
" 20 " " 1888 to 1907	0 " "

If we reduce the percentage to 2.5 the results work out to 7 " epidemics " before 1887 and 0 afterwards.

From the actual figures of deaths from smallpox and from all causes for the six provinces above dealt with we obtain the statistics for the area that we have already named "Well Vaccinated British India," and working out the proportion which the smallpox mortality contributes to the total mortality we get, if we regard 5 or more per cent. as indicating an "epidemic," the following results:—

For the 20 years from 1868 to 1887	10 "epidemics."
„ 20 „ „ 1888 to 1907	0 „

If we reduce the percentages to 4, the results work out to 12 "epidemics" before 1887 and 0 after that year.

This method of test shows clearly, therefore, how remarkable has been the decline of smallpox in the different provinces constituting that portion of British India where a good system of vaccination was early introduced.

On the other hand, as regards the provinces where, as I have already shown, an efficient system of vaccination was not established early and where vaccination has always been backward, we find on applying this method of test a quite different result.

I. BENGAL.

The necessary statistics for this province are available from 1877 to 1904 only and by the method already defined the results work out as follows:—

For the 14 years from 1877 to 1890	6 "epidemics."
„ 14 „ „ 1891 to 1904	4 „

2. ASSAM.

As in Bengal, the statistics are available from 1877 to 1904, and considering them in two equal periods we get the following results:—

For the 14 years from 1877 to 1890	7 "epidemics."
„ 14 „ „ 1891 to 1904	4 „
	6

3. LOWER BURMA.

Figures for this province are available from 1871 ; the results work out thus :—

For the 18 years from 1871 to 1888	8 “ epidemics. ”
„ 19 „ „ 1889 to 1907	7 „ „

I shall now complete this portion of the chapter by giving the results of this method of test for British India as a whole in the same manner as was done at the end of Section II of this chapter. The figures include those of Ajmer-Merwara, Coorg, and the Frontier Province, and represent that method of showing the decline of smallpox mortality in India which is least favourable to the cause of vaccination.

Defining a smallpox “ epidemic ” to mean such a prevalence of the disease that the deaths from it constitute 5 or more per cent. of the total deaths, the statistics show :—

For the 20 years from 1868 to 1887	9 “ epidemics. ”
„ 20 „ „ 1888 to 1907	0 „ „

(2) AN UNUSUAL METHOD OF TEST.

We have now proved that smallpox has been very greatly reduced in India, and knowing that whatever line of enquiry we choose to take up, this truth will emerge, it is interesting to seek for and apply unusual methods of test. I will deal very briefly with one of them. It rests upon our knowledge that smallpox in its natural unmodified form results very frequently in permanent blindness : indeed, there is much evidence that before the general adoption of vaccination it was the most frequent cause of that infirmity. Sir G. Blane (*Medico-Chirurg. Transactions*, Vol. X, p. 326) reported that in England during the last half of the 18th century fully two-thirds of the applicants for relief at the hospital for the Indigent Blind owed their loss of sight to smallpox, and according to Seaton it was stated in the Statistical Report on the health of the Navy for 1864 that in Japan almost

every blind beggar from whom enquiry was made said that his blindness was the result of that disease. It has been said also that in some parts of India before vaccination became general, 75 per cent. of the blind owed their affliction to an attack of smallpox, and similar statistics have been collected for other countries. In the report on the Indian census of 1872 there appeared a remark to the effect that the large number of blind persons was doubtless principally to be attributed to smallpox. Knowing these facts, it is obvious that if in such countries the prevalence and severity of smallpox are greatly lessened, the number of blind people should show a corresponding decline ; and, reversely, if in such countries we find a definite diminution in the statistics of blindness, we are justified in concluding that very probably there has occurred a diminution in the prevalence and severity of smallpox. The method is of the same kind as that which seeks to establish a decline of smallpox by noting a great diminution in the proportion of people with marks of pitting. The numbers of totally blind people in this country were carefully enumerated by ages at each of the censuses taken in 1881, 1891, and 1901, and I give here the figures relating to the provinces constituting that portion of India already defined as "Well Vaccinated British India."

Number of totally blind persons per million of population.

	Census of 1881.	Census of 1891.	Census of 1901.
Bombay	2,650	1,490	880
United Provinces ...	2,940	2,370	1,730
Central Provinces ...	2,570	1,720	1,720
Punjab	5,080	3,530	3,080
Madras	1,610	1,020	890
Berar	3,650	2,340	2,030
Well Vaccinated British India	2,880	2,020	1,610

It will be seen that this table affords evidence of a remarkable decline of blindness in those parts of India where good arrangements for efficient vaccination were early and widely introduced, and, therefore, we are justified in believing that it also affords evidence of a great decline in the prevalence and severity of smallpox in those areas. It is possible, of course, to attribute the diminution of blindness to other causes than a decrease of smallpox, but when it is said that the lessened prevalence of the infirmity has been very remarkable among children under ten years of age, it will be agreed, I think, that it is difficult to find a reason of equal importance. Moreover, it is noteworthy that in some provinces where vaccination has always been backward and where smallpox has not markedly declined, such a lessening of the terrible infirmity of blindness has not occurred. Thus in Assam at the 1881 census there were enumerated 630 blind people in every million of the population; at the 1891 census, 1,006 blind people per million, and at the 1901 census, 940 blind people per million; and for Burma the figures are: at the 1881 census, 1,570 per million; at the 1891 census, 1,970 per million, and at the 1901 census, 1,100 per million.

In British India as a whole 1,340 totally blind persons in every million of the population were enumerated in 1901 as compared with 2,330 per million in 1881. If the latter had been the rate in 1901, there would have been no fewer than 533,368 blind people in British India in that year. As a matter of fact, however, there were only 310,557 blind people. To have saved a very large number of people from the dreadful infirmity of total blindness and thus in all probability to have saved them from beggary is in itself one of the most noteworthy results brought about in chief part by the diminution of smallpox that has occurred in this country.

CHAPTER IV.—*Continued.*

SECTION IV.

The decline of smallpox is due to vaccination.

Hitherto we have been occupied in proving that coincident with a steadily increasing amount of vaccination in India there has occurred a remarkable decline of smallpox. No one, whether or not he has experience of this country, is likely to question the truth of the remarkable diminution in smallpox, and therefore the only problem now to be considered is the problem of the share that vaccination has had in causing the diminution. The facts before us are a steady increase of vaccination and, during the same period, a marked decline of smallpox, and the problem is to decide whether and to what extent the latter is the result of the former. Probably there is no country in the world more suitable for an enquiry of this nature than India and probably no country more likely to provide as the result of such an enquiry an entirely unequivocal answer to the effect that vaccination is wholly to praise for the reduction of smallpox. To go into the matter fully would occupy an unreasonable amount of space, but I will indicate as briefly as possible the methods of enquiry which, if adequately employed, would lead inevitably to the belief that vaccination is the essential cause.

(1) Considering our knowledge of the extent and efficiency of vaccination in British India as a whole, we find a general correspondence over a sufficient series of years between a vaccinated condition of the people and a diminished mortality from smallpox. It was not to be expected, of course, that as a result of vaccination the statistics of each year would show a lower smallpox mortality than in the previous year, or that the correspondence between the amount of vaccination and the

lessening of smallpox would be exact, or that epidemics of the disease would cease. All that was to be anticipated from the widespread, but by no means universal, practice of vaccination was the general correspondence just indicated, and this anticipation has been abundantly justified.

(2) By comparing the statistics of different areas we are able to show very clearly that the decline of smallpox is dependent upon the amount and efficiency of vaccination. An indication of this method has already been given in Section I of this chapter and we can institute the comparison in smaller areas with great exactness. Thus it is easy in this country to consider the smallpox statistics of two neighbouring areas exactly similar in all respects except that in the one area vaccination has been carried out thoroughly for many years, but in the other scarcely at all; and we see at once that although as regards population, mode of life, sanitary arrangements, houses, education, social condition, prosperity, and every other condition, such areas are entirely similar, smallpox continues its havoc in the non-vaccinated area while it has been almost extirpated from the vaccinated one. The existence in India of Native States where vaccination is exceedingly backward, bordering upon British territory where this measure is thoroughly carried out, and above all the existence in the middle of well vaccinated areas of places occupied by castes and races who refuse vaccination entirely, renders this method of enquiry very easy and the results in favour of the efficacy of vaccination very striking. Even at the present day it is apparent to the most casual traveller who steps over the border from British territory into some of the Native States that he is passing from an area where smallpox is rare into one where signs of the ravages of the disease confront him at every step; and enquiry proves to him that vaccination is the only measure which satisfactorily accounts for this great difference.* In this country we can

* In the tributary Native State of Daspalla in Orissa the average death-rate from smallpox during the ten years from 1893 to 1902 was 15,000 per million. The total number

carry enquiries of this nature through the whole series from provinces with a population of 60 million inhabitants down to villages with a population of a few hundred, and even beyond this to single streets and houses. The result is invariably the same—well vaccinated areas show a remarkable decline in smallpox, while non-vaccinated areas or badly vaccinated areas show no such decline.

(3) We can take up in turn every cause other than vaccination that has ever been, or might be, suggested as accounting for the diminution, and endeavour to find out if it offers a satisfactory explanation. People who deny the efficacy of vaccination have shown great ingenuity in inventing reasons for the fall of smallpox, and as a consequence the enquiries by this method have been exceedingly numerous and complete in many countries. All such enquiries have led to the conclusion that except vaccination there is no cause that will account satisfactorily for the facts. As the method has been so well tried in other countries, and as we know that the conditions prevailing in different parts of a country so vast as India render such a mode of enquiry especially easy and satisfactory, it will be sufficient if we deal with it very briefly.

It has been suggested that in some countries and especially in England the diminution of smallpox was the result of a decrease of inoculation. Such an argument can be easily refuted as regards India because we know that the diminution of smallpox has been very great in provinces where inoculation was never practised widely, if at all.

It has been suggested that the diminution was due to some general unknown conditions which have been spoken of as "cosmic" or perhaps to a "natural decline of smallpox." Unless we are willing to allow that such theoretical "cosmic" influences were at work, or the "natural decline" occurred, only in the parts of India where vaccination was being carried on it is easy to show that these reasons will not account for the facts.

of successful vaccinations performed during the ten years was only about 2,200 or 4 per thousand of the population, and 86 per cent of these were performed during the last four years of the period.

It has been greatly urged that the decline was due to improved sanitary conditions. Apart altogether from the fact that the only "insanitary" condition which increases the prevalence of smallpox is overcrowding—which in the cities of India is much greater than it was 40 years ago—it must be obvious to all who are aware that sanitation is still in its infancy in India that a more sanitary condition of this country is a quite inadequate explanation of the decline of smallpox. This conclusion could be emphasized in many ways, of which I will select one. It is agreed universally that of all epidemic diseases cholera is most affected by improvements in sanitation, and no one will deny that if the sanitary improvements in India have been so great as to bring about the remarkable diminution that has occurred in smallpox, the reduction in cholera should be even greater. I place opposite this page a chart showing the death-rates recorded annually from cholera in India since 1875, from which it will be seen that if there has been a change in the death-rates from this disease during the last 30 years, the change is of the nature of an increase rather than of a diminution. On considering such a chart we realise that apart altogether from the factor of less neglectful registration of deaths (which of course applies equally to smallpox and makes the recorded diminution in that disease all the more striking) certain conditions have been at work in India tending to an increased prevalence of epidemic diseases which, like cholera, smallpox, and malaria, are carried directly or indirectly from person to person. In the first place there has been not only a large increase of population so that the density of the population has been increasing, but there has been a continually growing proportion of the population living in the towns and cities. Moreover, there has occurred a change in the conditions of life of natives in India which has probably been of far more importance than any other factor tending to increase the prevalence of epidemic diseases. This change is the enormous and continued extension of movement among the population and of communication within the country generally, as a result partly of the greatly increased facilities for such movement and communication and partly of

CHART XIII.

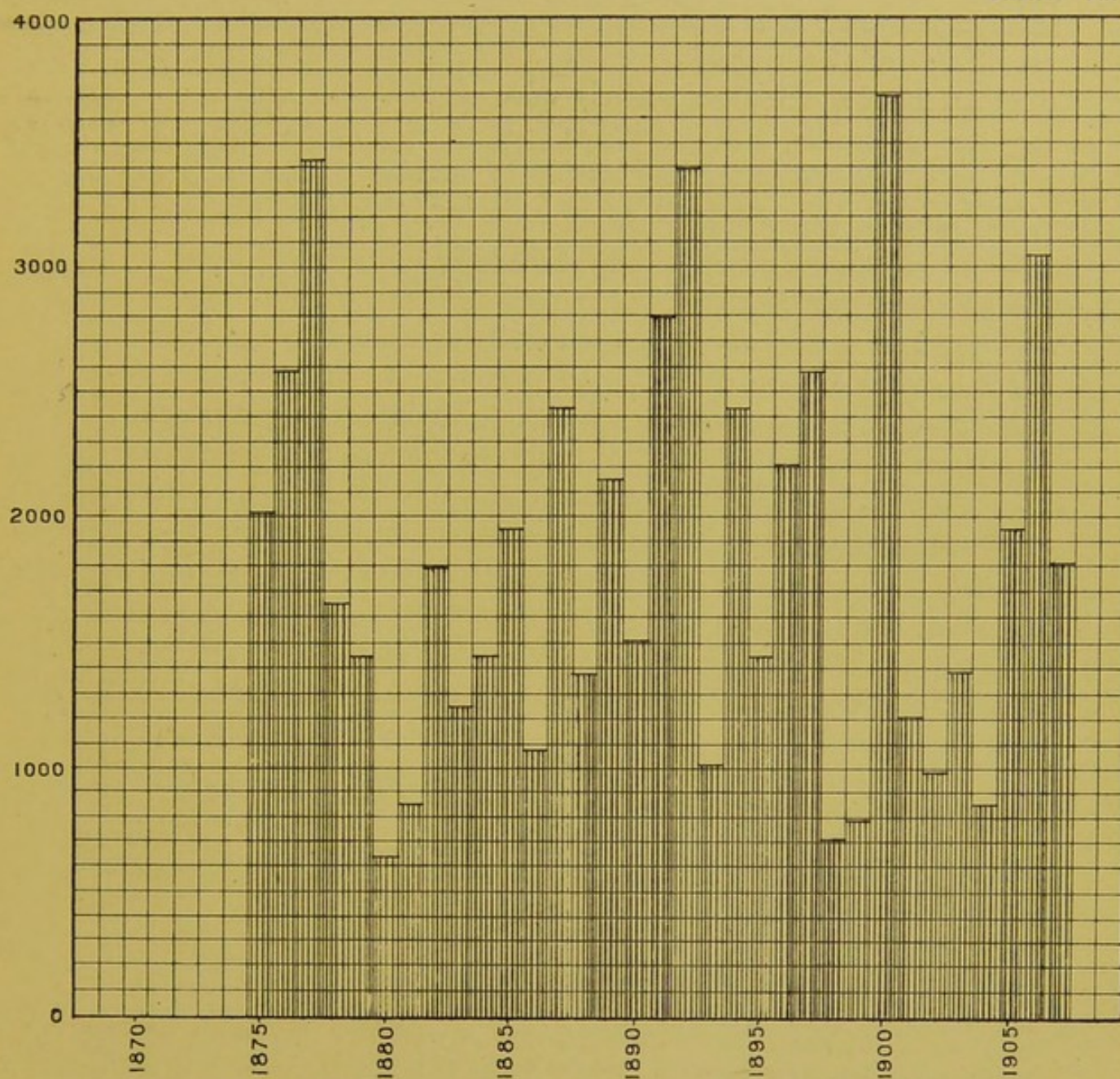


CHART No. XIII—Annual mortality from CHOLERA per million of population in British India, 1875 to 1907.

the great industrial awakening which has occurred in this country. That such conditions as these tend greatly to increase the prevalence of smallpox as of cholera and some other epidemic diseases there can be no doubt; and when we see that despite such improvements in sanitation as have occurred in India the prevalence of cholera has increased, we realise not only that the diminution of smallpox is entirely unconnected with such sanitary improvements, but that it has been effected in the face of a number of conditions tending largely to increase the prevalence of the disease. We are justified in believing, therefore, that the benefits of vaccination in this country are in reality far greater than a simple examination of the mortality indicates.*

(4) The spread of vaccination and the decline of smallpox do not stand as two disconnected phenomena without any tie joining them. The mass of experimental evidence offered since the introduction of the practice connects the two and points to the spread of vaccination as the cause of the decline. Such evidence may be considered under four headings as follows:—

(a) From the very earliest times it has been known that an attack of smallpox, however mild, protects the individual against subsequent attacks. Upon this observation rested the principle of smallpox inoculation, the object of which was, by using a virus much weakened in strength, to confer upon the individual a mild

* Although I have thought it necessary for our present purpose to refer to the statistics of cholera mortality, I trust that no one will consider that the chart affords reason to believe that sanitary measures in India are of little value. The chart is for British India as a whole, and therefore, like the smallpox chart for the same area, contains statistics which (if we desire to learn the truth regarding the efficacy of sanitary measures in reducing cholera and of vaccination in reducing smallpox) should not be lumped together. The increase of cholera which the chart shows is to be explained among other reasons partly by less neglect in the registration of deaths and partly by the fact that the increase of the disease in places where there has been no attempt at sanitary improvement, and where conditions already enumerated have tended greatly to favour its spread, swamps the remarkable decrease that has occurred in places where such an elementary sanitary improvement as the provision of a pure water-supply has been effected. The decrease of cholera in such places is a noteworthy achievement of sanitary effort in this country. Beyond what has been said in this essay it is wrong to draw any conclusion from an examination of the cholera statistics of India until they have been carefully analysed and separated so as to represent as nearly as possible the data relating to groups of similar facts. I hope to attempt such an analysis in a subsequent essay.

form of the disease which it was known would render him as safe from future attacks as if he had contracted the disease in the natural way. But the fault of this measure was that the virus used was not altered to such an extent as to prevent the disease which it caused being contagious. For the inoculated themselves it was an immense gain but for those with whom they came into contact it was a great evil. What was needed was a virus which while conferring upon the inoculated individual a protection equally great would do so by giving him the disease in a non-contagious form. This is exactly what is done by the operation of vaccination, for experiment has shown that vaccine matter is nothing more nor less than the matter of human smallpox so modified by passage through the cow that while the disease which it causes when inoculated on man confers upon him an efficient protection against an attack of smallpox, it is not contagious. "This new process of preventing smallpox is really only carrying people through smallpox in a modified form. *The vaccinated are safe against smallpox because they in fact have had it.* Their safety is of the same sort as if they had been inoculated under the old process, or had been infected by the natural disease. The trifling disorder which they suffer—these few tender vesicles on the arm, this slight feverishness that they show—is smallpox of the most mitigated kind; smallpox so modified by the intermediate animal organisation through which it has passed, that when thus re-introduced to the human body, it excites but insignificant disturbance, and no general exhalation of infective material." (Simon.)

It is obvious that such a measure *must* cause a decline in smallpox, because it reduces at one stroke not only the number of people who are capable of catching the disease but the number of people who are capable of spreading it. The prevalence of a disease in a place depends upon a number of people who are susceptible to it and upon the chances which exist for catching it, and it is obvious that if one simultaneously reduces both these factors (which means reducing all the factors upon which the prevalence depends) the disease must decline.

Smallpox inoculation, on the other hand, while it undoubtedly reduced the number of people susceptible to an attack of smallpox, materially increased the number of foci from which the disease was spread, and in all probability this nullified to a great extent the good effects of the measure. We cannot, of course, guarantee that a measure which minimizes the influence of only one factor upon which the prevalence of a disease depends will effect a reduction of the disease, and the less can we do so when we know that the employment of the measure increases the influence of factors favouring a prevalence.

(b) Experimental evidence has shown that vaccinated persons do not contract smallpox by way either of exposure to natural contagion or of inoculation. Both these methods of test have been tried extensively in India—the second as early as 1803. The first is a matter of everyday experience and evidence in regard to it is afforded by the records relating to the numerous body of European and native Government servants, police, postmen, the staff of smallpox hospitals, vaccinators, the members of Insurance Companies in which vaccination is insisted upon, the staff of many private firms in which the same measure is adopted, and the European and native armies in India. As the statistics relating to the troops present some features of interest, they are given in the form of a chart facing this page. Before remarking on the statistics it is to be noted that for the last 60 years or more it has been a regulation that every recruit who has not passed through smallpox, or does not bear satisfactory marks of vaccination, must be vaccinated by the Inspecting Medical Officer.* This regulation has been carried out with varying strictness at different periods and it is unfortunately true that “in our armies there is no such systematic national revaccination as in Germany, the proportion of failures in the operation of revaccination is large, and no exact information is published as to the actual number ultimately revaccinated with success.” (McVail). For the two reasons first mentioned our armies are

* I cannot find a definite order to this effect of a date earlier than the 21st of September 1858, but the practice was adopted before this.

CHART XIV.

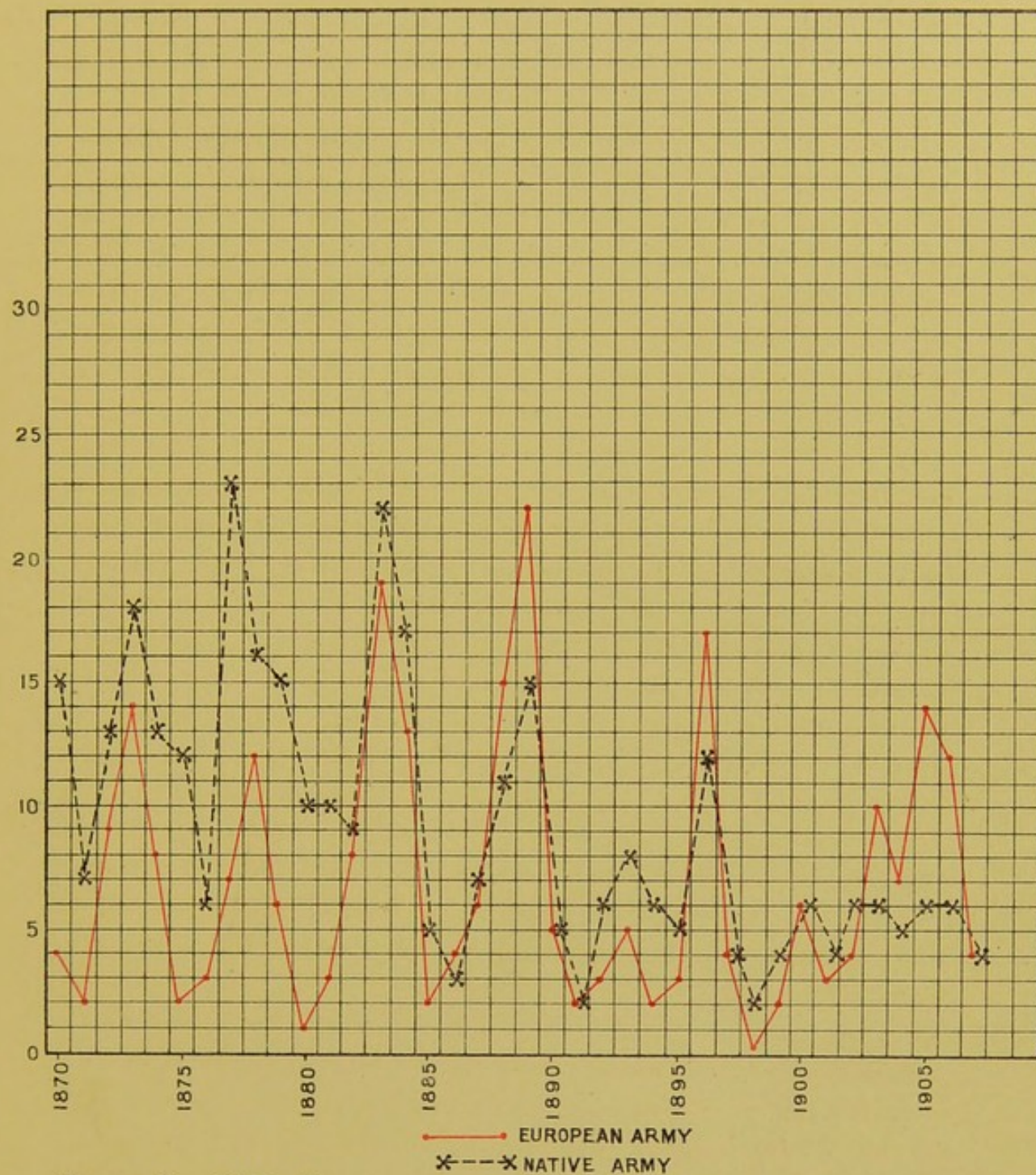


CHART No. XIV—European and Native Armies in India. ATTACKS of smallpox per 10,000 of strength, 1870 to 1907.



not absolutely immune from smallpox but the chart shows that in comparison with unvaccinated and badly vaccinated communities in India these bodies of men enjoy a very great immunity from attacks of the disease. The figures are for 38 years from 1870 to 1907 and we may show the results thus :—

	Strength on which the rates are worked.	Actual number of attacks of smallpox during the 38 years.	Attack rate per 10,000 for the period.
European army	2,408,019	1713	7.1
Native army	4,071,061	3479	8.5

The actual numbers of deaths during the period were 175 among European troops and 280 among Native troops, these figures giving death-rates of .72 and .68 per 10,000 respectively. As regards the statistics for earlier years we are told by Macpherson (*Indian Annals of Medical Science*, January 1852) that in the Bengal Presidency at a time when smallpox was very severely prevalent, only 103 cases occurred among 84,143 European troops during four years. Among men so constantly exposed to the infection of smallpox as are the European and Native troops in India these results are noteworthy.

Certain portions of the chart merit special attention. It will be seen that prior to 1886 it was a constant rule for the attack rate among Native troops to be higher than among European troops, but that from the year mentioned the position is very frequently reversed. There is no explanation which will account satisfactorily for this unexpected and very interesting change except the explanation that since 1885 vaccination and revaccination have been less carefully attended to among European than among Native troops. We are aware that among the general population of England there has been for many years a steadily increasing neglect of vaccination and that the class from which recruits for the European army are drawn is the class in which, when the law is not strictly enforced, such neglect is likely to be greatest. When people drawn from such a class

come to a country where they are frequently exposed to smallpox infection they begin to reap the consequences of the neglect. At the risk of appearing to labour this point I would especially direct attention to the portion of the chart for the five years from 1902 to 1906. It will be seen how badly the figures for European troops during those years compare with the figures for Native troops, and in explanation of it I give in the margin a table showing the number of European soldiers who at the yearly examinations in India from 1902 to 1906 were found to have no satisfactory marks or record indicating that they had been vaccinated. On comparison of these figures with the rising curve shown on the chart it will be obvious that it is unnecessary to search further for an explanation of the increased incidence of smallpox during those years among European soldiers in this country. I understand that at the end of 1906 measures were taken to prevent the recurrence of so unfortunate a neglect of vaccination in the European army of India. On the whole the chart shows clearly that if vaccination and re-vaccination were more thoroughly attended to in our armies, smallpox would be entirely absent from them, and it is exceedingly unfortunate that the authorities have not thought it essential to furnish so valuable an object lesson of the efficacy of vaccination.

We could better appreciate the immunity from smallpox enjoyed by re-vaccinated soldiers in India if we were able to compare their statistics with those of an unvaccinated community composed of people of the same race and of approximately the same ages living in similar conditions as regards liability to infection. There are no statistics for such a community, but there are statistics for a community in which, whatever may be the condition in regard to primary vaccination in infancy, successful re-vaccination in adult life is rare. I refer to the community composed of the wives of European

1902	...	...	2,463
1903	...	..	5,987
1904	...		6,529
1905	...	...	14,923
1906	...	...	20,649

soldiers in India. The conditions of life of these women keep them well protected from attacks of infectious disease and as a consequence they suffer from cholera and enteric fever to a much smaller extent than the soldiers. We should expect also that they would suffer much less from smallpox, especially if, as some people think, a more sanitary condition of living is the chief cause of a lessened incidence of that disease. But it will be seen from the table in the margin that it is an invariable rule for the incidence of smallpox among the women to be much higher than among the men. Chart XIV is not large enough to permit the rates for the women to be plotted upon it, but anyone who extends the chart to three times its present height and enters the rates upon it will see how striking is the difference. It can be accounted for only by our knowledge that the women, owing to the infrequency of successful re-vaccination among them,* are much less well protected from smallpox than are the men.

Relative incidence of smallpox among men and women of the European Army in India. Admission rates per 10,000 of strength.

	Men.	Women.
1898	0	13·0
1899	2·0	26·0
1900	6·0	52·0
1901	3·0	11·0
1902	4·0	23·0
1903	10·0	17·0
1904	7·0	22·0
1905	14·0	47·0
1906	12·0	38·0
1907	4·0	14·0
1908	8·0	97·0

(c) Again there is the evidence which shows that the fatality of smallpox among vaccinated people is much lower than among unvaccinated. Vaccination makes a great difference in the case-mortality, and in the earlier days of the measure the evidence in this regard—which forms the so-called “direct” proof of the value of vaccination—was a very important factor in leading the general public of civilised countries to adopt vaccination. Everyone could see not only that a vast majority of vaccinated persons escaped smallpox but that if a vaccinated person caught the disease he suffered comparatively little—“if it sometimes failed to prevent, at least it might be relied on to mitigate.” (Simon.) The remarkable figures in this connex-

* From the reports of medical officers it appears probable that women who possess marks of having been vaccinated in infancy are not re-vaccinated at all. See also paragraph 315 on page 81 of the Final Report of the Royal Commission on Vaccination, 1896.

ion collected by the Royal Commission on vaccination and published in their final report in 1896 have convinced all who desire the truth that vaccination has a great power to lessen the severity of an attack of smallpox, and in a large proportion of cases to prevent death. I am not aware that similar figures which can be relied upon have been collected on a large scale for India, but the following small ones which I have gathered together at some labour are trustworthy. They relate to the civil population of India and are for all ages.

	Number.	Deaths.	Case-mortality.
Vaccinated people attacked by smallpox }	1,118	97	8·6 per cent.
Unvaccinated people attacked by smallpox }	1,177	610	51·8 per cent.

The figures relating to the case-mortality of smallpox among European and Native troops in India are especially valuable. They relate of course to what must be described as a vaccinated and revaccinated community although we know that from time to time revaccination has been sadly neglected and that the deaths occur almost entirely among patients on whom this operation has not been successfully carried out.

Taking the figures for the last 37 years we get the following results :—

	Total cases.	Total deaths.	Case-mortality.
European troops	1,691	170	10·1 per cent.
Native troops	3,420	263	7·7 per cent.

We are aware that during the earlier years of this somewhat long period the prevention of disease among soldiers in India had not attained to such a high degree of perfection as at present and doubtless less care was exercised to ensure the successful vaccination of every soldier. This is evidenced by the fact that if we consider the figures of the last ten years we find that

among European troops there were only 29 deaths among 428 cases of smallpox—a fatality of 6·3 per cent.*—and among Native troops only 28 deaths among 618 cases—a fatality of 4·2 per cent. It must surely be a wonderful measure that in the adverse conditions of India can convert such a dreadful disease as smallpox into one that is, comparatively speaking, so seldom fatal. We can partially appreciate the benefits of vaccination in this respect by realising that during the last 37 years smallpox has been among Native troops only about one-third as fatal as pneumonia and among European troops only about one-third fatal as enteric fever. If we were to consider the figures according to the exact condition of the patients in regard to vaccination and revaccination at the time when they were attacked by smallpox the results would be even more striking.

(d). Finally, there is the well-known evidence relating to the remarkable change in the age incidence of small-pox mortality that has occurred in places where vaccination of infants and children has been widely employed. The following is the nature of the change. In pre-vaccination times nearly everyone was attacked by smallpox within a very few years of birth, and the adult population was composed almost entirely of people who had survived this attack. Therefore the proportion of the total small-pox mortality borne by deaths during infancy and childhood formed nearly the whole mortality. For example, in the town of Geneva between 1580 and 1760 among more than 25,000 deaths from small-pox nearly 98 per cent. were deaths of children under 10 years of age. Coincidentally with a steady increase in the employment of vaccination among infants and children there occurred a rapid decrease in the proportion of the total small-pox mortality borne by deaths among these classes of the population, and, after some years, an increase in the proportion of the total small-pox mortality borne by the deaths of adults. For India it is not possible to give many statistics illustrating this change in age-incidence because in this country the

* Among European soldiers, wives who, as we have seen, are rarely revaccinated the fatality during the same period was 15·7 per cent.

introduction of vaccination preceded by many years the introduction of statistical records of deaths by ages. Dr. Leith's admirable mortuary reports for the city of Bombay from 1848 to 1859, however, enable the following example to be given.

CHANGE IN THE AGE-INCIDENCE OF DEATHS FROM
SMALLPOX IN BOMBAY.

Deaths from smallpox at certain age periods to deaths from smallpox at all ages.

Years.	0 to 6.	2 to 6.	2 to 13.	20 and upwards.
1848-1852	79 per cent.	41 per cent.	50 per cent.	6 per cent.
1896-1900	56 " "	12 " "	19 " "	24 " "

The first point that requires notice in regard to this table is that in the period 1896 to 1900, as compared with the earlier period, the diminution in the share of small-pox mortality borne by deaths of infants and children up to 6 years of age is not very marked. This is because the period includes infants and children up to 2 years of age among whom in India, however strenuously vaccination is prosecuted, there will always be a large proportion unvaccinated. The next point is the remarkable diminution in the proportion of the total small-pox mortality borne by the deaths of children from 2 to 6 and from 2 to 13 years of age. These are the age periods which contain the largest proportion of persons sufficiently protected by vaccination. The third point is the increase in the proportion borne by the deaths of adults.

I should be going beyond the limit that I have laid down for myself in regard to this section if I were to detail the very simple explanation of these changes in the age-incidence of smallpox. It must suffice to say that no cause except vaccination has been, or can be, suggested which is adequate to explain them.

CHAPTER IV.—*Continued.*

SECTION V.

Conclusion.

I think that at this point we may safely leave the subject for the present. We have dealt with it in broad outline only, but I trust that the evidence presented has been sufficient in both quantity and kind to enable the reader to appreciate in some measure the great blessing that vaccination has conferred upon the almost countless multitudes forming the population of India. Doubtless there will be some who, holding it to be their duty to contest every [inch of progress made as a result of Jenner's wonderful discovery, will deny the value of the evidence, and will offer new suggestions to account for the remarkable defeat of smallpox in India. When made in good faith such denials and suggestions serve a useful purpose because as a result of the enquiries which they render necessary the truth about the value of vaccination becomes clear not only to those already acquainted with it but to a wide circle of people who have never sought it. Being satisfied that universal experience does not err, and knowing that India offers a good field for investigation regarding the efficacy of vaccination in preventing smallpox, we may rest assured that if any denial of such efficacy leads to a complete enquiry being made in this country, we shall possess as a result a vast amount of evidence showing the inestimable benefits of the measure in a land where many seeds are sown on barren soil. I trust it will not be thought that I have exceeded the limits of my task if I add also the hope that such an enquiry would result not only in a more thorough appreciation of the importance of the subject to the Empire, but in a disentangling of the multifarious plans for vaccination now practised in different parts of

India, so that by their co-ordination a system or systems of vaccination might be built up the adoption of which would effectually complete the work of suppressing smallpox in this country.

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