PAPERS ON

SMALL POX, VACCINATION, &c.

I.

Small Pox and Vaccination in India, and chiefly in the Bengal Presidency.

II.

On the Possibility of Stamping-out Small Pox, illustrated by three Modes of Procedure.

III.

On the Synchronism of Variola and Vaccinia, &c.

By ROBERT PRINGLE, M.D., Edin.

SURGEON H.M.'S BENGAL ARMY, AND SUPERINTENDENT OF VACCINATION, N.W. PROVINCES OF INDIA.

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SMALL-POX AND VACCINATION IN INDIA.*

THE importance of this subject, and the imperfect information which appears to have reached this country regarding it, as witnessed in India, and which I have noticed in the course of conversations during my short visit to England, have induced me to appear before the public, in the hope that I may be able, to a certain extent, to supply this deficiency, the cause for which, I am bound to say, lies at the doors of my professional brethren in India, and is not chargeable to those in this country. On the contrary, had any sufficiently reliable information on the subject, either of small-pox or vaccination in India, been available to the authors of the latest standard works on vaccination, the few inaccuracies which may be detected in their pages, on the subject as met with in India, would never have appeared. The only claim which I shall attempt to advance for this paper, is that the description of the facts which I shall hereafter relate has been acquired by personal observation and inquiry in the places where they were witnessed; and that any conclusions which I may arrive at and record, are the results of the experience gained during nearly thirteen years' continuous residence in India, which, with the exception of two years' military duty, have been passed among the agricultural classes of the community while in medical charge of civil stations, and since 1864 as a superintendent of vaccination in the North-west Provinces of India.

With these prefatory remarks I will enter on the statement of the subject, which, for facility of discussion, I have divided into two heads.

1st. Small-pox, as regards its prevalence, and the mortality resulting from it in India, and more particularly in the Bengal Presidency.

* Read at the Congress of the British Medical Association, at Oxford, in 1868.

2nd. The various prophylactic measures adopted to check the disease when it has appeared, and to prevent its spreading.

1st. *Small-pox as regards its prevalence, and the mortality resulting from it in India, and more particularly in the Bengal Presidency.*—I regret I have no long columns of statistics to support any conclusion I may arrive at: the manners and customs of the natives of India, and the means at the disposal of the Government there, were, until within the last few years, fatal to any system of statistics other than those connected with bodies of troops, and the diseases appearing among them. The remarks, therefore, which I am about to make, and which were gathered from personal inquiry and observation among the agricultural districts of Bengal and the North-west Provinces of India, will not, I trust, be deprived of too much of their value by the absence of such an important support as is yielded by statistics, and thus militate unduly against the interests of vaccination in India.

To those living in a country enjoying the benefits and blessings of vaccination, it is very difficult to convey any accurate idea of the universal prevalence of small-pox in India, in districts where inoculation is not practised; for vaccination, as yet, cannot be said to have left any visible impression on the countless thousands of Hindoostan. The following, however, may be of assistance to those unacquainted with India, in aiding them to form some estitmate of what a fatal scourge small-pox must be in the country alluded to.

In the Doab, or the districts lying between the Ganges and Jumnah, and south of the Sewalick Range, 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 small-pox at some period of their lives, and that in 60 per cent. the traces of the disease are seen in the face, while in the remaining 35 per cent. the cicatrices will be found, if the search be sufficiently carefully conducted. Nor need this be a matter of surprise. Anything more favourable for the propagation of small-pox, when it has once appeared, than the circumstances and conditions met with in a native village in India, it would be difficult to imagine, and should any one in the village escape from the disease in one year, the next, or the next, and so on, will place the case in a condition from which ultimate escape is almost hopeless. As regards the five per cent. unaccounted for above, I would merely add, though they do not show traces of the disease, that is no proof that they have escaped

entirely. The long period of incubation in small-pox, and the wandering habits of the natives of India in search of sacred shrines, will readily account for the facilities in the way of contagion and infection, and which end in making small-pox an annual visitant in an Indian village.

As regards the mortality from small-pox in India, I feel that, in the absence of statistics, I am treading on dangerous ground; and that what I shall now proceed to record might almost be beyond the reach of belief; but the incidents and facts which I shall relate, and which, I may repeat, are the result of personal inquiry and observation in villages where small-pox was either raging at the time or had lately visited, are but too well known to those who have studied the subject, and have witnessed an epidemic of small-pox in India. Instances are not wanting in other countries to show what a mortality accompanies small-pox where no prophylactic measures are employed to check its progress; and I would merely cite the case of the Island of Puynipet, as given in Sir James Simpson's pamphlet, entitled "Proposals to Stamp out Small-pox," published in 1868. From a single case of small-pox left on this island, 3,000, out of a population of 5,000, fell victims to the disease. I may mention here that the mortality from small-pox witnessed in India, and to which I shall now allude, has reference only to those parts of Hindoostan where inoculation is not practised.

If we take into consideration the period of the year—viz., the hot and rainy seasons, when small-pox generally rages as an epidemic—the circumstances in which it finds its victims, the utter absence of any treatment other than smearing the body with clarified butter and turmeric, together with the observance of some religious ceremony, consisting mainly in processions and offerings to the Deity, we shall be prepared for a high rate of mortality, but hardly for what seems really to be the case. Judging from my own experience, in villages which small-pox had lately visited, and from the observations of the villagers, who I may add were inclined to view vaccination unfavourably as a European or foreign innovation, and were therefore not likely, by increasing the mortality, to make out too strong a case for its introduction, as likely ultimately to interfere with their religious prejudices, I should consider the mortality to be as high as 80 per cent. in very young children, in those a little older, 60 per cent.; but, as far as I could learn, seldom, if ever, under 40 per cent.; and as this is only met with in the case of adults, it may be omitted from the calculation for the following reason. In the districts I allude to, it is rare to find an adult native suffering from primary

small-pox, or one who has been proof against this continuous contagion till he has reached that age—a further proof of the prevalence of the disease. So fatal is small-pox among children that the following has become quite "a saying" among the agricultural, and indeed wealthier classes; viz., never to count children as permanent members of the family, nor make arrangements to leave them money, &c., until they have been attacked with and recovered from small-pox. While visiting a village in the Himalayahs, even where inoculation is practised (but where it had been omitted for some years), with a view of vaccinating in it, I remarked what I can only call a gap in the population; viz., an almost entire absence of children between the ages of 8 and 12 years, and this though there appeared no want of younger and older subjects for vaccination. On asking the reason, I was told that the few children before me, between the ages I have given, were all that had escaped from an outbreak of small-pox, which had occurred some years previously.

2nd. *The various prophylactic measures adopted to check the disease when it has appeared, and prevent its spreading.*—This, which I consider the more important division of this paper, can be best discussed by subdividing it into two; viz.:—

A. The prophylactic measures employed by the natives of India, which may be summed up in Inoculation; and
B. Those had recourse to by the Government of India, and which are comprehended in their schemes of vaccination.

A. *The prophylactic measures adopted by the natives of India.*

With the exception of the districts in which inoculation is practised, viz., the Himalayan range generally, and some portions of Lower Bengal, the natives of India adopt no measures whatever, either to check the disease, or prevent its spreading; on the contrary, the numbers which collect at the religious ceremonies, conducted during these epidemics, with the view of appeasing the offended deity of small-pox, must have the effect of conveying the contagion to villages which have as yet escaped it. The natives of Hindoostan consider an outbreak of small-pox to be due to the displeasure of the female deity who presides over this scourge: hence the name for this disease, which, though it may, and does, vary with the dialects of the districts, is nevertheless that of the deity in that par-

ticular part of the country; for instance, "Thakooranee," or, the goddess, &c. I mention this circumstance, as it will help to account for the apathy with which the natives of India view this disease, and may explain the reason of their adopting no treatment for it, other than the benefits supposed to be derived from religious ceremonies, but submitting with a fatalism—always the more intense as it is a religious one—to its ravages. When I once hinted to a native, at a non-vaccinating period of the year, that he should not allow his child to play with others who were suffering from small-pox, his answer, which was most characteristic of the above, was, "Never mind, the child may as well take the disease now as a year or two hence; the sooner, perhaps, the better. If it recovers, which God only knows, I can calculate on its life."

I will now briefly allude to the practice of inoculation as met with in the Himalayahs, where it has been adopted since the most remote times, and whence it probably extended to Bengal, having been received primarily from Central Asia through one of the Himalayan passes. The following description is from personal observation and inquiry in villages where it was being employed, or had lately been practised; while that of which I was not an eye-witness was obtained from inoculators by profession, whom I had taught vaccination, and brought on the Government establishment as vaccinators.

There is no separate profession of inoculator; the practice is in the hands of the priests, and seems to be hereditary, and taken up by them as a means of adding not only to their income, but of enabling them to spend four or five months every year not unpleasantly, and at the expense of the villages in which they operate. On the first appearance of a case of small-pox in the Himalayas, imported probably from the plains, the inoculators hurry to the spot, and from ignorance, allowing the vesicular stage to pass, wait for the pustular, or generally for that of desiccation. During both these latter stages, the inoculators collect as much pus and as many crusts as they can, the former on cotton or wool, and the latter as they fall off; though, when in a hurry, by a small present they can easily remove them prematurely. Supplied with this variola virus, they hasten to their districts, and commence operations in a village as follows:—Having collected all the cases which have neither had small-pox, nor been inoculated, they operate by scratching, with an instrument composed of a bundle of *seven* needles tied together, at the base of the thumb in the right arm in males, and left in females; and having got a raw, bleeding surface, they bind on some of the

cotton or wool charged with variola pus with a *blue* thread; this they leave till an advanced stage of ulceration sets in, when it is removed. Should the supply of variola crusts be sufficient, they are powdered up with sugar and flour, and, with the addition of water, made into a ball, which is swallowed or eaten by each of the cases. To prevent the small-pox resulting from these operations spreading to the neighbouring villages, all the cases requiring inoculation are operated on in the same day if possible, as the period of quarantine, strictly enforced, is limited to a month after the last case inoculated. No means being used to prevent the contagion spreading, by disinfecting the clothes, &c., this quarantine of a month generally proves of little ultimate benefit. All communication with this village is closed, producing a complete stagnation of the little trade they enjoy, and often preventing the villagers obtaining their annual supply of salt, rice, &c., at cheap rates from the plains and the interior, as no passing merchant will open barter with a village under the flag, so to speak, of inoculation. During this month the inoculator lives at the expense of the villagers; and what with fees for the treatment of any serious case resulting from his operations, and the perquisites of feasts and religious ceremonies, his time is pleasantly and not unprofitably spent.

It is not often that an opportunity occurs of testing the relative merits of inoculation and vaccination when the two practices are carried on along side of each other; the following will therefore, I trust, not be without interest:—Having heard that a case of small-pox, imported from the plains, had appeared in a village in the Himalayahs, at an altitude at which vaccination could be successfully carried on in the hot season, and that the inoculator of the district had commenced his operations, as just described, I at once despatched vaccinators, and directed them to vaccinate all the cases requiring it in the immediate neighbourhood, with the double object of placing vaccination and inoculation on their trial, for the benefit of the natives, among whom I was anxious to introduce the former to the supercession of the latter, and of preventing the disease from spreading. I visited this village subsequently, before many of the inoculated cases had recovered, and pointed out to the natives who had assembled the vaccinated cases which had accompanied me, and showed them how I had arrived at the same result as they had hoped for, but at a very different cost. In the inoculated six deaths were allowed to have occurred out of sixty operated on, to say nothing of some serious cases of the disease which were before me; and the village had been debarred all communication

with the neighbouring ones for nearly a month. Among the vaccinated cases not an untoward circumstance had been witnessed, and not a case of small-pox, while no restriction whatever had been put upon the intercourse of this village with those near. The evidence was too strong in favour of vaccination, and the villagers agreed not to allow any more inoculation. The result of bringing this and some similar cases to the notice of the Government of India has been the issue of an order prohibiting inoculation in my division of the Himalayahs, or that portion between the Ganges and Jumnah.

B. The prophylactic measures had recourse to by the Government of India, and comprehended in their schemes of vaccination.

These might be summed up in two systems, viz.:—

1st. Vaccination carried on by the medical officers in charge of civil stations; and—
2nd. That conducted by a class of medical officers specially selected, and relieved from all military and civil duties, to enable them to devote their whole attention to the subject.

1st. *By Medical Officers in charge of Civil Stations.*—This system will require but a brief notice, as it is now abolished as such. The defects witnessed in it were guarded against in the second, and were mainly want of supervision, owing to the inability of the medical officers to leave their stations, and test the accuracy of their vaccinator's returns, his knowledge of his duties, or the character of his operations.

2nd. *By Medical Officers specially selected for Superintending Vaccination.*—This is the system now adopted throughout India generally, and may be divided into two kinds, viz., that employed in the Bombay Presidency, where there is no general superintendence other than that of the Deputy-Inspectors-General of hospitals of the division, which as far as I can learn is limited to the receipt of the returns; and that in practice in the Bengal Presidency, where there are Divisional Superintendents-General of Vaccination, whose chief duty is to supervise their superintendents of vaccination.

Being most conversant with the latter method, as carried on in the North-west Provinces, and known as Dr. Pearson's scheme, I will confine myself to a description of it, remarking

in passing that his has the merit of being the original one in its most important details. In these details it will challenge a comparison with any other in practice in India, while its late universal adoption in the Bengal Presidency may be considered a proof of its superiority. To Dr. Pearson undoubtedly belongs the entire credit and honour of having, after years of close attention to the subject, finally succeeded in establishing a voluntary system of vaccination, as nearly approaching perfection as its machinery, so to speak, will admit of, while it is absolutely such in that of being self-supporting. By this latter remark I mean that the vaccine vesicle once started, need never be lost, and this in a country where vaccination in the plains can be carried on beneficially for barely five out of the twelve months. How it is kept up during the remaining seven months, in quantities sufficient to admit of the vaccine vesicle being started afresh, in a thousand places at once if necessary, I will show hereafter. It must not be forgotten that Dr. Pearson's scheme was conducted to its successful issue in the face of an opposition from the priest-ridden and caste-prejudiced natives of the North-west Provinces of India, which, had it been advisable, would have called for a Vaccination Act, similar to that found necessary in this country. I say if advisable, for I do not think such necessary, being clearly of opinion that the best basis for a system of vaccination in India is a voluntary one; but then the scheme must be carried out systematically and carefully,—in short, in such a manner that its present and ultimate benefits will be self-evident to the natives, when I have no doubt of its voluntary universal adoption. Time must be allowed for this happy termination in the plains of India, but its extension on the present principles is all that is necessary, and if the publication of this paper leads to that good result I shall be amply rewarded. Liberal as the Government pecuniary grants have lately been, more money is needed to extend the scheme; and if millions laid out in works of irrigation will directly benefit the natives of India, thousands spent in vaccination will add to the population which will enjoy these benefits, by reducing in India the prevalence of small-pox, and the fearful mortality from it, of both of which I have attempted to convey some idea. The mortality returns of the North-west Provinces, which I have had an opportunity of perusing, give, for reasons obvious to any one who has studied the subject, but an imperfect estimate of the appalling mortality from small-pox, and I think it would be difficult to name any more fertile source of the allowed decrease in the population than is to be found in the prevalence of a disease acknowledged to be preventable.

The following are the main features of Dr. Pearson's scheme :—

1st.—Supervision by European medical officers specially qualified for the work.

2nd.—A carefully-trained staff of native vaccinators.

3rd.—Fixing the field of each vaccinator's operations within such limits as would admit of the benefit of systematic vaccination being made apparent in the district in which he works, whence the practice may be expected to spread on its own merits (the best foundation in a voluntary scheme like that under notice) to the surrounding districts.

4th.—A system of returns so compiled as in their execution not to interfere with a given amount of work to be done, but yet capable in themselves of detecting any attempt at falsification.

To illustrate the preceding, I will briefly describe the duties of a superintendent of vaccination in the North-west Provinces, who is always a European medical officer. During the vaccinating season the superintendent's sole duty is to be marching through his districts inspecting the operations of his native vaccinators, which he does in the following manner :—Having arrived at the head-quarters of a vaccinator, by means of the "Vaccinator's Diary" he can readily ascertain how the work is progressing. On examining this Diary he takes a day's work, and sends the vaccinator on to the village, and having noted at random others where he has operated, he can, on arriving at any of them, by means of the "Village Nominal Return," left with the head man of the village, call up the vaccinated cases. Thus the superintendent has an opportunity of testing the quality of the operations, and the accuracy of the recorded results, when, should there be any attempt at falsification, it is not only readily detected, but done in such a manner that the vaccinator stands convicted on his own written evidence, every record being in his own handwriting. The knowledge which the vaccinators have, that any attempt at falsifying returns will be soon found out, and the removal of any undue pressure as regards quantity in place of quality of operations being expected, has the best possible effect in keeping these returns correct. The vaccinator not being present during these random visits, the superintendent has ample opportunity of extracting from the villagers the estimate which they have formed of the vaccinator and his work ; an invaluable point in a voluntary system of vaccination, as on the bearing and conduct of these vaccinators rests much of the success of the scheme. As the superintendent pays these visits on horseback, he will probably arrive at the particular

village, if at any distance, as soon as the vaccinator, when, with the cases before the operator, he points out anything worthy of remark. At first sight it may appear that I have entered too minutely into what might seem trifling details, but among a suspicious and bigoted population it is only by attention to these minutiæ that the former is allayed and the latter overcome; and when this is attained, careful and systematic vaccination has a foundation that nothing will shake. If there is one point more than another which I strive to impress on my native vaccinators it is that one carelessly vaccinated case will produce an amount of injury to their reputation as vaccinators which fifty successful cases may not entirely remove; and that the records of their work which they leave in the villages will, if it is carelessly done, prove a powerful instrument against their future operations, by shaking the faith of the villagers in them personally and in their work generally. On the other hand, that they can wish for no better certificate of their skill as operators, and of the true benefits of vaccination, than the village return of a series of carefully vaccinated cases. To every ten or twelve of these native vaccinators is a native superintendent, who has been promoted for his zeal and good work. His duties consist chiefly in supervising the vaccinators while operating, aiding the superintendent in testing the accuracy of the returns, and quality of the work, and, should any opposition arise in a district or village, using his personal influence to overcome it by explaining the benefits which may be expected from the adoption of vaccination; and it is astonishing what patience and tact they display, and how rare it is that they are not rewarded with success. The duties of the superintendent-general are summed up in his title, while, speaking generally, his extensive knowledge of the subject, from the care and attention he has devoted to it, is of the greatest value to superintendents on joining the vaccine department, and not unfrequently to those who have been some years in it.

This, to do the subject justice, is as briefly as I can describe it, Dr. Pearson's scheme, though there are still many interesting details into which I have not time to enter. I trust, however, that I have said enough to show the authorities and my professional brethren in this country that a voluntary scheme of vaccination has to be gently handled in countries like India, if any ultimate benefit is to be derived from it.

I will now describe how the supply of vaccine lymph is kept up fresh and active in a country like India, where, owing to the heat of the plains of Hindoostan, the vaccine vesicle degenerates and operations have to be closed. For this

purpose I will take the system as I originated it in the tract of the Himalayan range of my division of superintendence; but must, in justice to Dr. Pearson, add that it was taken from that previously practised by him.

With the exception of the tracts of India which are directly affected by the sea breezes, and those above an altitude of 6,000 feet, the vaccine vesicle cannot be kept up in that country throughout the year, in the perfect state in which it should be, either to impart its full benefit to the case operated on, or be the means of extending it to others. In the Doab (or I may repeat the country lying between the Ganges and Jumnah, and south of the Sewalick range) the vaccine vesicle will not rise satisfactorily, as a rule, before the beginning of November, and deteriorates, becoming thus useless, towards the end of March, when all operations consequently cease. The vaccine lymph, however, before this degeneration sets in, can be taken in capillary tubes to the Himalayahs, where at first, at an altitude of 6,000 feet, it can be kept up in an active condition; but the altitude must be raised as the heat increases, till at 8,000 or 9,000 feet, it is beyond the reach of climatic changes, and is propagated with the greatest facility. To enable me to keep up a constant supply of vaccine lymph, I have divided my Himalayan tract into three districts, for reasons which I will give hereafter; and the operations are carried on as follows. Owing to the paucity of the inhabitants of these high altitudes, the operations, which are commenced in May, are limited at first to once a week; but, as November draws near, when a large supply of vaccine lymph is required for the commencement of the vaccinating season in the plains (where it has to be started *de novo*), they are increased to twice, and, if the number of cases will admit of it, to three times a week. After a sufficient number of *uninjured* vesicles have been left to impart full protection to the case, and enough lymph been taken to carry on vaccination in the village or neighbourhood, that which remains, and is superfluous (an increased number of applications being primarily made with this object), is stored in capillary tubes by the vaccinators who are specially instructed in this branch. At the close of the vaccinating season in the hills, this supply is sent to the plains by the ordinary post, in time to commence operations in November simultaneously, at forty or fifty centres in my division, and in sufficient quantities to meet all the demands made on my office for fresh vaccine lymph from the civil and military officers in my division. This method of propagating the vaccine vesicle is capable of being carried on indefinitely by the following simple expedient, and when once

a vaccinator has obtained a characteristic vaccine vesicle, he must be very ignorant of his duties if, with the population of the plains, he applies again for lymph during that season. The expedient alluded to is applicable only to the Himalayahs, owing, as said before, to the scantiness of the population, where in my division, for instance, if all the cases requiring vaccination were operated on successfully in one season, there would not be a sufficient supply in the next, to do aught else than merely keep up vaccination, without being able to store up an adequate supply for the plains' season. To obviate this I may repeat that I have divided my Himalayan district into three, and use one in a season, thus allowing fresh cases to collect in sufficient numbers during the next two or, if necessary, three years. It might be advanced against this that it unnecessarily exposes a population to the risks of small-pox: this, however, is fortunately not the case, as, owing to the very limited intercourse which these remote and high villages enjoy, with inoculation prohibited, small-pox will now but rarely enter them; and, should such a contingency occur, with the few cases amenable to it, the vaccinator, working in the villages below this high altitude, could rapidly protect them by vaccination. I may here mention that the results of my first season in one of these Himalayan districts were nearly 500 good crusts and 200 well-filled capillary tubes, a supply more than ample for my own wants or the requisitions for vaccine lymph on my office.

I may briefly allude here for the benefit of my professional brethren engaged in vaccination in this country to the manner in which the vaccine operations are conducted in the North-west Provinces of India. Owing to the objection the natives have to allowing their children to be taken from one village to another, "arm to arm" vaccination is not had recourse to, except in the village itself. The vaccine lymph is conveyed for short distances and time on ivory points; when both are longer in vaccine crusts; and when still longer, and the weather is becoming hotter, in capillary tubes. Without doubt the capillary tubes as supplied by Dr. Husband, of Edinburgh, when filled and closed by skilful hands, are vastly superior to any other method for conveying or storing lymph, and, with the single exception of arm-to-arm vaccination, the most satisfactory method of vaccinating; but, owing to the expense it would entail in the extensive operations of the North-west Provinces, too costly to be generally adopted, and fortunately vaccine lymph on ivory points, when fresh, and the weather is cool, is almost equally successful. I would merely add that the vaccine needle, a slight modification of Dr. Graham Weirs,

is the instrument employed in the vaccine operations of the North-west Provinces in preference to the lancet, and when skilfully applied with the light touch of a trained native vaccinator, most successful.

In a country where a Vaccination Act is in force, it is difficult to convey an idea of the opposition which has to be met and overcome before a voluntary system of vaccination, such as I have described, can be successfully carried on in a country like India. Every conceivable objection is started; but it was reserved for the priest-ridden and bigoted city of Benares to advance one which for ingenuity surpasses any I have ever heard. It was the following: some of the priests of this city (among whom are many deservedly respected for their learning), gave out that there was an old prophecy, that a black child would be born with white blood, who should rule India, and turn the English out, as they expressed it; and it was with a view to find out the advent of this child that the Government had given orders to scratch the arms of their children. The answer to this would be simply that the presence of blood during the operation, instead of being a proof of the vaccinator's skill, was the reverse; and that if in their neighbourhood any vaccinator was in the habit of doing so, his practice would soon be put a stop to. I could cite other objections; and absurd and untenable as they undoubtedly are, it is surprising what credence the ignorant and priest-led Hindoos attached to them, and how difficult it often is from their very absurdity to argue them out of their belief in them.

Years must elapse before the fearful scourge of small-pox can be said to be even much abated in the plains of India, since, as before, vaccination is still in its infancy among the almost countless thousands of Hindoostan; and though it has a satisfactory footing in some considerable tracts of country, yet I should be painting the picture in too bright colours if I did not add that there are yet places in which it is struggling for a bare existence, and many more where its benefits are even unheard of. Careful and systematic vaccination must, nevertheless, win the battle over prejudice and apathy in the end, and it is impossible to suppose that the benefits witnessed in some districts by its adoption, will fail to spread by rumour, at least to others less favoured. There are districts in the Himalayahs, such as those of Kumaon and Ghurwal, where Dr. Pearson has been at work for years, and where at last the benefits of vaccination have become self-evident to the natives, by the almost complete absence now of small-pox. No doubt these districts, by their limited population, and intercourse with the plains and each other, present conditions more favourable to this

happy result than the densely crowded villages of the plains, each one of which might be considered a thoroughfare when compared with those in the Himalayahs. Before long I trust my Himalayan district will be similarly freed from small-pox, and the natives spared from the possibility of the recurrence of an epidemic like that which produced what I have before described and termed a gap in the population.

In summing up the vast importance of this subject, I would beg to add that, after a continuous residence of nearly thirteen years in India, and having seen cholera in its most fatal haunts, during three years at Juggernauth, and the effects of famine, I have arrived at the conclusion that, though the former may count its victims by hundreds, and the latter in larger numbers, though at longer periods, yet both pale before the spectre of small-pox stalking yearly though densely crowded villages, and seizing its victims from the children born since its last visit, with a mortality which it is appalling to contemplate; and knowing this, as I do, I confess to feeling an earnest desire to do all that in me lies to check a scourge allowed to be preventable. I return in January to my duties; but if, during my short stay in this country, I have succeeded in enlisting on the side of vaccination one tithe of the sympathy and help which the subject demands, I feel I shall not have pleaded in vain for the infant population of Hindoostan.

ON THE POSSIBILITY OF STAMPING OUT SMALL-POX.*

ILLUSTRATED BY THREE MODES OF PROCEDURE.

BEFORE entering on the subject of this short paper, I would briefly allude to the circumstances under which the idea of it originated. Soon after my return from India, while calling on my former professor, and the President last year of the Health Section of the National Association for the Promotion of Social Science, Sir James Y. Simpson, Bart., my attention was drawn to his pamphlet, entitled, "Proposal to Stamp out Small-pox and other Contagious Diseases," and published in 1868. On carefully perusing it I was much struck with the absolute practicability of many of the measures therein recommended, and of the rules laid down, as witnessed in the instances which I shall presently describe, and which had occurred in my practice in India in 1863, and the subsequent years. As stated in the title of this paper, I have, for facility of illustration, and to exemplify the methods I would suggest more clearly, divided the subject into three heads, or more properly speaking, modes of procedure, viz.,—

1st. By isolation, with destruction if practicable, and purification invariably, of all materials or subjects likely to convey contagion or impart infection.

2nd. By careful and systematic vaccination at the period of the outbreak of small-pox.

3rd. By similar vaccination at any period prior to the outbreak.

1st. *By isolation, with destruction when practicable, and purification invariably, of all materials and subjects likely to convey contagion or impart infection.*—The instance illustrative of this

* A paper read before the Health Section of the National Association for the Promotion of Social Science, at its Congress in Birmingham in 1868.

method of procedure occurred under the following circumstances:—

While stationed at Morar in Gwalior, Central India, with the troop of Royal Horse Artillery of which I was in medical charge, in the beginning of the year 1863, some cases of small-pox appeared among the camp-followers of an officer, who had lately joined, and had just concluded his march from Saugor. On the cases being brought to my notice, I at once went to the principal medical officer of the division, and, after describing to him the method which I proposed to adopt, in the event of his approval, to prevent the disease spreading amongst the large European and native force stationed at Morar, and obtaining his sanction, I received, by order of the general commanding, a tent which had been previously condemned as unserviceable, and which I had pitched half a mile to the leeward of the last building in cantonments. Into this tent I removed all the cases of small-pox, seven in number. The only occupants of this tent, besides the patients, were the mother of one of the children and a native to wait on and cook food for the sick. This native was specially selected for this purpose owing to his having had, judging from the marks which remained, a very severe attack of small-pox some years before. I would not allow any of the inmates to leave the tent, and prohibited all communication with it; myself and the native doctor alone visiting the tent, treating the cases, and seeing that they had all their wants supplied. While discussing my project with the principal medical officer, I told him I would take all the responsibility and risk on myself, and would adopt all practicable measures to prevent myself being the means of conveying contagion or imparting infection to the patients in my hospital or to the community at large.

After this tent had been pitched, and the first cases isolated, two more occurred, one three and the other four weeks after the first appearance of the disease. These were at once sent to the small-pox tent and treated with the rest. These two cases occurred in the very centre of the cantonments; and I would beg to draw particular attention to the following:— On the first appearance of the disease in the papular, and hence non-infectious, stage in these cases, they were at once isolated. What the consequences might have been had the vesicular stage been reached or nearly completed, I am not prepared to say, but will allude to again hereafter, when comparing this outbreak with one that occurred in the next year, namely, 1864.

I had the satisfaction of seeing every case admitted into this tent discharged recovered. Before they left, however,

their clothes were taken from them and burnt, and after they had bathed they were supplied with new clothes. The tent was kept pitched for some time, to see if any more cases appeared, and none occurring, it also was burnt as it stood. Fortunately for me, I had selected an unserviceable tent, which, though condemned as such for Europeans, answered the purpose very well for which I wanted it, as months afterwards a charge was made against me for a tent burnt by my orders; though I must add that, on mentioning that it was considered unserviceable, and the *service* it had rendered, I was exempted from the cost of it. Thus, the last sources of the disease were removed, and the epidemic ceased. Here I think it will be allowed the disease was *stamped out*.

Let me, however, allude briefly to what was witnessed next year. During my absence on leave, small-pox appeared in the Morar cantonment in a similar manner to that just described; and on my return from leave there were cases of small-pox scattered over the station, and not one regiment could be said to have escaped. The Regimental Records of 1864 thus show a very different result as compared with those of 1863, in which year not a single case occurred in any European regiment; and of those isolated eight were among the camp followers, and one a trooper of a native cavalry regiment. Let me remark here, from personal experience and observation, that it is impossible in the plains of India to vaccinate successfully (owing to the heat of the weather and the deterioration of the vaccine vesicle) a European or native subject, for nearly seven out of the twelve months of the year; and as it is during these seven months that small-pox prevails as an epidemic, I leave it to those best capable of judging them as to the benefits conferred on the unavoidably unvaccinated European and native children, by confining the contagion of small-pox within the smallest possible limits, as was seen in 1863, or spreading it broadcast, as in 1864. The cause of the difference in the Regimental Records before alluded to was to be found in the absence of all measures of isolation, properly so called, in 1864, and in ordering out of cantonments all cases of small-pox which occurred in the regimental bazaars, in the persons of non-combatants, not being camp-followers. These Regimental Records of 1864 may and will show the results of this outbreak of small-pox in the regiments themselves; but who shall attempt to record the injury done to the surrounding population by the cases of small-pox ejected out of the cantonments and thrown broadcast in the district, at the hottest season of the year, when the disease assumes its most fatal type.

2nd. *By careful and systematic vaccination at the period of the outbreak of small-pox.*—The two instances illustrative of this method occurred in 1866, at a season of the year, and at an altitude above the sea, at which vaccination in India can alone be successfully carried out during the hot season. The circumstances of the first were the following:—While engaged in superintending vaccination in the Himalayahs I received a report that small-pox had appeared in a village at some distance, and the informant told me that unless I sent assistance promptly in the shape of vaccination, the native inoculators would commence operations. I at once despatched a vaccinator, and directed him to isolate the case; but as some time had been allowed to elapse before I was informed of it, it would perhaps have been inexpedient to remove the other occupants of the house. My orders were most carefully executed; and on my visiting the village I found that all the cases requiring vaccination—upwards of 120—had been successfully operated on, and the disease died out for want of cases amenable to its influence. My conjecture, however, regarding the inmates of the house in which the case lay proved to be correct, as I found two others of the family suffering from small-pox, contracted before my vaccinator had arrived. Here also I think it will be allowed that the disease was *stamped out.*

The other instance, as said before, occurred in the same year, but under slightly different circumstances. On hearing that small-pox had appeared in a district of the Himalayahs where vaccination could be carried on successfully at that season of the year, and that the native inoculators had commenced operations, I despatched vaccinators, and directed them to vaccinate all the cases requiring it in the immediate neighbourhood; with the double object of placing vaccination and inoculation on their trial for the benefit of the natives (among whom I was anxious to introduce the former, to the supercession of the latter), and of preventing the disease spreading. I visited the district myself, and found that my vaccinators had been most successful, not a single case of small-pox occurring where they had been at work; while from small-pox from inoculation alone, six deaths had been witnessed out of sixty operated on by the inoculators. I am happy to be able to add that the natives of the district decided in favour of vaccination, in preference to the time-honoured and priestly practice of inoculation. Here was a community protected from an amount of contagion and infection—as each inoculated case could impart both, similarly to one of ordinary small-pox —which it is difficult to over-estimate, and the disease more

than stamped out, namely, *debarred an entrance* among them.

3rd. *By similar, i.e., careful and systematic—vaccination at any period prior to the outbreak of small-pox.*—The particular instance which I will select to illustrate this method is comprised in the results of personal observation and experience during the years 1865, 1866, and 1867, and was witnessed in the Hill Sanitarium of Mussoorie, in the Himalayahs. In each of the three years under notice, small-pox had, in a few cases, with the disease contracted in the plains, made its entrance into Mussoorie. In two out of the three years it was limited to the cases themselves; and in the third it did certainly extend, through carelessness and apathy on the part of the natives, to a few men, but then died out. From personal observation, as I superintended the measures of isolation employed, I feel that this *stamping-out* was not due, except to a very limited extent, to isolation, but (excluding the native portion of the population whose immunity was traceable to inoculation in infancy) to the vaccination had recourse to in infancy amongst the European residents; and though I must add that my experience of vaccination in India, in those who have been vaccinated in infancy in Europe, is far short of what I would term careful and systematic vaccination, yet it is consoling, and I may add encouraging, to know that, imperfect as this vaccination is, and by late authors on the subject allowed to be, it is, nevertheless, when attended with not very stringent rules of isolation, capable in itself, under certain circumstances, of giving the death-warrant to an outbreak of small-pox. To elucidate the subject to those unacquainted with it as seen in India, I may, perhaps, mention that the population of hill sanitaria in the Himalayahs generally, differ as regards their susceptibility to the infection from small-pox from that of the plains for the following reasons, and which are in support of the theory of the possibility of *stamping out* small-pox:—The native population of these sanitaria is almost entirely composed of the hill tribes, who have been inoculated in infancy, and the few plains-men among them are adults, who have either suffered from small-pox during their stay in the plains, or seem to be proof against it in the most concentrated form of its contagion as met with in the towns and villages of the plains; while the European portion of the population has, as a rule, been protected by vaccination in infancy, or again protected by revaccination, if successful vaccination, after imperfect (and hence, in my opinion, useless) vaccination in infancy can be termed revaccination in adult age. In the plains of India, however, the susceptibility of the native portion of the

population, from the absence of any prophylactic measures whatever, reaches a height which must be witnessed to be believed; and if I can state, from personal observation, that nearly 95 per cent. of the native population of the plains of India will, if the search be sufficiently carefully conducted, show traces of the disease, I will leave it to be inferred what the mortality must be from such a prevalence. Nothing but the *most extensive vaccination* and most stringent isolation can ever make head against small-pox in the plains of India; and, with its vast population, and the present scheme of voluntary vaccination in its infancy, I fear the day is far distant when a disease which counts its victims by thousands annually can be curbed and finally *stamped out*. It is in these plains, and amongst the population that I have described, that the most numerous cases of small-pox are met with amongst the popularly considered vaccinated Europeans. The force of this wide-spread and ever-recurring contagion is irresistible; and vaccination has many a taunt unjustly showered on it by this contagion searching out the cases carelessly, and hence unprofitably, vaccinated in infancy. The picture of the Himalayahs, however, is a brighter one, as compared with the plains of India; and, with the experience acquired in the instances I have described, with the efficient staff of native vaccinators which I now possess, with inoculation prohibited, and the sympathies of the natives enlisted voluntarily on the side of vaccination; coupled with all this, a population more manageable, so to speak, as regards numbers and the means of communication, and hence the facility of spreading contagion more limited; with all this, I trust my district of the Himalayahs—viz., that lying between the Ganges and Jumnah, from their sources to where they enter the plains, and to which I return in January—will, before many years are passed, be freed from small-pox by the disease being debarred an entrance, and the natives able to look back on its ravages —an instance of which I will describe—as the visions of a horrid dream. With this instance I will conclude. While visiting a village in my Himalayan district, with the villagers assembled to watch the operation of vaccination, or "Belattie chapah"—foreign marking, as they term it—I noticed a complete gap in the population—viz., an almost entire absence of children between the ages of eight and twelve, though there appeared no want of younger and older subjects for vaccination. On asking the reason, I was told that the few children before me between these ages were all that had escaped from an outbreak of small-pox which occurred some years previously.

If proofs were wanting that it is possible to *stamp out* small-pox, I trust the instances which I have described will supply them; and I would merely add, in conclusion, that though these proofs may have been attained in certain portions only of the vast continent of India, and that by a system of voluntary vaccination, yet, if such is the case, Great Britain, with its Vaccination Act, its more limited population and extent of country, the means at the disposal of the authorities for carrying on vaccination, and, lastly, the vast advantages it possesses in civilisation and education, is without excuse for the prominence which small-pox acquires in the returns of the Registrar-General.

ON THE SYNCHRONISM OF VARIOLA AND VACCINIA.*

THE subject of this paper is one which has not unfrequently been brought before the notice of the Profession, and the only excuse I can advance for doing so now, is that it has fallen to my lot, during my service in India, to see several cases of this synchronism (a term I have used for want of a better), and the hope that their publication may throw some light on the subject.

I purpose discussing the subject under four heads. 1. The circumstances under which the cases occurred; 2. The means at my disposal for recording them; 3. A description of some of the cases, which will serve as examples of the rest; 4. The conclusions I have arrived at as the result of my experience on the subject, and acquired during the vaccinating seasons of 1864-65, 65-66, and 66-67.

1. *The circumstances under which the cases occurred.*—Small-pox, as a rule, but rarely appears as a severe epidemic in the cold season in the North-West Provinces of India—the period, I may mention, when vaccination can alone be carried on successfully and beneficially; and in the vaccinating seasons under notice, the disease raged in some of the districts of my superintendence in an epidemic form of a severe type. The severity of the epidemics in each season can be tolerably accurately calculated by the number of cases of this synchronism met with in the years recorded in the accompanying table.

When my attention was first called to the subject, by a native vaccinator reporting that small-pox had appeared in some of his cases which had been successfully operated on, and before the vaccine vesicle had completed all its stages, I at once visited the district where he was at work, and most carefully inspected the cases, a description of which and some others I will give hereafter.

2. *The means at my disposal for recording these cases.*—I am

* Read at the Congress of the British Medical Association, at Oxford, in 1868.

aware that, had the table appended to this been drawn up by the trained staff of a hospital, from cases occurring in the wards, it would have added a value to it to which I can hardly lay claim; but, nevertheless, I trust some weight will be allowed it, from the care I took in having the cases recorded according to a form, which, while insuring their accuracy as far as practicable, would yet be within the limited professional acquirements of my staff of native vaccinators. For this purpose, on the first appearance of this synchronism, I directed all the cases to be reported according to a form which I supplied to the vaccinators as under.

1. Number of cases reported by each vaccinator.
2. Name of vaccinator under whom the cases occurred.
3. Village and district.
4. Date of vaccine operation.
5. Result of vaccine operation.
6. Date of small-pox eruption.
7. Period in days which elapsed between vaccinal operation and the variola eruption.
8. Character of the small-pox, judging by the eruption, and recorded as "mild" or "severe."
9. Result, *i.e.* whether recovered or died.
10. Source of vaccine lymph employed in the case.

The only columns which will require any explanation are numbers 5 and 8. No. 5, viz., "Result of vaccine operation."—In several instances, where small-pox followed vaccination, the vaccine operation was unsuccessful; these cases, however, are, I need hardly add, not recorded in the accompanying table, which only exhibits those in which the vaccine operation was successfully performed. Column No. 8, viz., "Character of the small-pox, judging by the eruption, and recorded as 'mild' or 'severe.'" The reason for thus describing the type of the disease was the following, and it must be borne in mind that the means at my disposal for obtaining anything approaching to accurate information, were, so to speak, of a peculiar character, and require, therefore, similar treatment, if I may use the term. My staff of native vaccinators, though well instructed in vaccination, and, alas! too well acquainted with small-pox, from its prevalence in their own villages, could not, for the reason given before—viz., their want of a professional education—be expected to enter into the minute details of either disease, nor yet to record any slight deviation which might be witnessed. All, therefore, that I could expect from them was a description of the type of the variola, and furnished according to their own native terms, which is by an

approach to the number and proximity of the variola vesicles. Thus, when the numbers of these vesicles were few, and they distinct from each other, the case was recorded as "mild;" when more numerous and "packed," as they term it, it was entered as "severe."

3. *A description of some of the cases which will serve as examples of the rest.*—I could hardly be expected to personally inspect each of the 169 recorded cases, scattered as they were over a tract of country as large as England; what I therefore did was to visit as many as I possibly could, selecting them at random without the vaccinators having the slightest knowledge that, when they reported them, I should personally inspect them and test the accuracy of their reports. In justice to them (they having nothing to gain by a false report) I am bound to say that not in a single instance did I notice aught that was not duly recorded to the best of their ability, and that correctly. May I therefore claim for their reports some weight and value.

Case I.—I saw this case on the 31st December, 1864, the vaccine operation having been performed on the 22nd of the same month, and the variola eruption appearing on the 27th, or five complete days after. The results of the vaccine operation were quite characteristic of its age, and the variola eruption was at a stage corresponding to the date given; the case was a mild one, and recovered. The vaccine lymph for this operation was obtained from a district fifty miles distant, where there was not a single case of small-pox.

Case II.—This case, which I had an opportunity of visiting more than once, was vaccinated on the same date as the other, but in another district, and I saw it first on the 2nd of January, 1865. Variola appeared on the 29th December, 1864, or seven days after the vaccine operation. In this, as in the other, I could not detect, either at this or any subsequent visit, the slightest modification in either disease. This case also recovered. The vaccine lymph was brought from a distance, where there was not a case of small-pox.

It would be needless to multiply the description of these cases, as in none which I personally inspected, and at all stages of both diseases, could I notice any modification in either; and after a considerable experience of small-pox, during my residence of nearly thirteen years in India, I unhesitatingly state that, had the cases been brought before me, and the fact of their having been vaccinated concealed, I should have viewed them as cases of ordinary small-pox. As it was, however, I searched carefully for any modification, but, as I have above stated, failed to detect it.

4. *The conclusions I have arrived at, as the result of my*

experience on the subject, and acquired during the vaccinating seasons of 1864-65, 65-66, *and* 66-67.—When the cases of this synchronism were first reported to me, I thought they might possibly be due to the vaccine lymph employed, either not being such, or tainted with variola. The great irregularity, however, as regards the period at which the variola eruption appeared, subsequent to the vaccine operation, when compared with the reverse of this, as seen in cases of inoculation, removed all suspicion on the score of the vaccine lymph; and this was fully confirmed by the circumstance of several of the cases, vaccinated with the same lymph and at the same time, not exhibiting the variola eruption seen in the others. Were further proofs necessary that the vaccine lymph could not have originated the variola met with, they would be found by inquiring into the symptoms of the five cases recorded in the accompanying table, in which the variola eruption appeared within the 24 hours subsequent to the performance of the vaccine operation. In these five cases, the ordinary train of symptoms met with in inoculation (a practice I may mention which I have witnessed, and which till lately was common in the Himalayahs), could not have been gone through; unless we suppose the maturation of the primary pustule, the primary fever, and the appearance of the secondary eruption could be all crowded into these 24 hours, and this unusual haste up to this period suddenly cease, and the inoculated (if such it may be called) vesicle and the secondary eruption run through their remaining courses with the regularity and perfection witnessed in ordinary vaccination and cases of true variola. The true cause of this synchronism appears to me to be due to the variola poison being in the stage of incubation, and that of various duration, at the time of the vaccine operation; while the much greater frequency of this synchronism in the season 1864-65, when compared with the other two, was dependent on the circumstance of the epidemic of small-pox being much more severe and extensive in 1864-65 than in the other years under notice. Fearing, however, that in these cases some variola virus might possibly become mixed with the vaccine lymph, and knowing what a minute quantity of the former was capable of producing variola, when inserted as in vaccination; I issued strict orders on the first appearance of this synchronism, that no vaccine lymph in any form was to be collected from the cases in which this coincidence had been witnessed.

I am aware that much might be statistically arrived at from the table appended to this, but I will content myself with endeavouring to establish the following :—

1. That vaccination may be successfully and beneficially

performed, and, as regards India, during the season favourable for its performance, at any period when variola is imminent, subsequent to the febrile, and prior to the appearance of the papular stage of that disease.

2. That when vaccination is thus had recourse to, it will reduce the mortality from small-pox from 40 or 50 per cent. to a little less than 6 per cent.

1. *That vaccination may be successfully and beneficially performed, and, as regards India, during the season favourable to its performance, at any period when variola is imminent, subsequent to the febrile, and prior to the appearance of the papular stage of that disease.*—In support of this conclusion I will take the five cases recorded in the first column of the accompanying table. In these instances, as before remarked, the variola eruption appeared within the twenty-four hours subsequent to the performance of the vaccine operation, and they all recovered. Now, in these cases it must be allowed that the febrile stage of small-pox had been passed, as, though the period of the variola eruption may be lengthened subsequent to the occurrence of this febrile stage, it is very rarely reduced to less than forty-eight hours; this latter circumstance, therefore, will add seventeen more cases, making a total of twenty-two, of which all recovered.

2. *That when vaccination is thus had recourse to, it will reduce the mortality from small-pox from* 40 *or* 50 *per cent. to a little less than* 6 *per cent.*—This point is, I think, satisfactorily established by the results recorded in the appended table, in which the mortality in a total of 169 cases is only 5·9 per cent.

Before concluding, I would merely add that, though I hesitated to bring this subject before the profession on the results of a single vaccinating season, viz., that of 1864-65, yet the experience gained in the two subsequent ones, tending only to support the conclusions I arrived at from the first, seemed to me to warrant their publication for the benefit and opinion of my professional brethren at home and abroad. It may not be uninteresting to record the effect which the occurrence of this synchronism had on the natives in the district where it was met with, and where I was striving to establish a system of voluntary vaccination. On its first appearance I was not unnaturally anxious for the success of my scheme, when I saw small-pox follow the operation had recourse to for its extinction. This anxiety, however, was soon set at rest, for the natives, seeing so many of these cases recover, and being well aware of what the stage of incubation meant, at once called my vaccination a very good "medicine" for small-pox.

TABLE OF CASES OF THE SYNCHRONISM OF VARIOLA AND VACCINE MET WITH IN THE VACCINATING SEASONS OF 1864–65, 1865–66, AND 1866–67; WITH THE RESULTS.

Season.	Total number of cases.	Recovered.	Died.	Rate of Mortality.
1864–65	105	98	7	6·6 per cent.
1865–66	36	34	2	5·5 „ „
1866–67	28	27	1	3·5 „ „
	169	159	10	5·9 „ „

TABLE SHOWING THE PERIOD IN DAYS WHICH ELAPSED BETWEEN THE VACCINAL OPERATION AND THE VARIOLA ERUPTION IN THE ABOVE 169 CASES.

Season.	1 day.	2 days.	3 days.	4 days.	5 days.	6 days.	7 days.	8 days.	9 days.	10 days.	11 days.	12 days.	13 days.	14 days.	
1864–65...	3	9	11	23	13	8	12	5	8	2	5	1	3	2	total number of cases 105
1865–66...	1	4	5	7	7	6	5	—	—	—	—	1	—	—	„ „ „ 36
1866–67...	1	4	4	1	5	3	3	3	1	—	1	—	1	1	„ „ „ 28
	5	17	20	31	25	17	20	8	9	2	6	2	4	3	„ „ „ 169