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VACCINATION.

A Report read before the American Social Science Association, at New York, October 27, 1869.

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VACCINATION.

A REPORT READ AT THE GENERAL MEETING OF THE AMERICAN SOCIAL SCIENCE ASSOCIATION, AT NEW YORK, OCTOBER 27, 1869.

At the instance of the General Committee of the Department of Health of this Association, a committee of three was constituted, last summer, to consider the subject of Vaccination.

The members of the committee thus formed are, Dr. D. F. Lincoln, of Boston; Professor William A. Hammond, of this city; and myself. The paper which I now have the honor to present is substantially, in a somewhat abbreviated form, the Report of that Committee. The labor of preparing this Report devolved upon Dr. Lincoln, but the views stated are the unanimous conclusions of the Committee.

The facts presented are generally not new, and most of them are probably familiar to many now present. The aim of the Committee has been to present, in an accessible and intelligible form for popular use, the essential truths relating to vaccination, and to offer some suggestions for its more universal and efficient performance in this country.

In opening this subject, a few words about the small-pox will not be out of place. Terrible as is this disease, its danger is little likely to be appreciated by us, living at a time when its ravages have been so much restricted. Other pestilences affect the imagination more strongly. Around the plague there gathers a cloud of oriental mystery, of mediæval and chivalrous romance, of historic incident and personality. The yellow-fever is a rare visitor; the cholera is only occasionally with us; both are foreigners, and to both is attached somewhat of the respect due to guests from beyond sea. But the small-pox presents neither interest nor terrors for us. It is nothing more than an excessively disagreeable complaint, affecting only careless and vulgar persons, and occasionally

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carrying off some who are little missed. It is forgotten that the small-pox is as dangerous to the community as either the plague, the yellow-fever, or the cholera. At the time of its prevalence, it were no hard bargain to have exchanged it for either of the other diseases. If ever the practice of vaccination falls into disrepute, we shall have a new pestilence among us, destroying yearly from three to six thousand persons in and about New York. And any one of us who allows himself to remain unprotected will do well to reflect that he practically exposes himself to the infection of a disease which destroys from one-fifth to one-half of those it attacks. The severity with which small-pox has attacked our savage tribes is well known. They seem peculiarly open to the destructive influence of the white man's plagues. This is, however, not alone true of the disease under consideration, for the typhus or ship-fever has at times not simply decimated but destroyed whole tribes of Indians, leaving their white neighbors almost unharmed.

There is no doubt that the small-pox has existed in China, and probably, also, in Hindostan, from a very remote antiquity. It appeared in Egypt and Arabia about the middle of the sixth century, and was carried into Europe by the conquering Mussulmans. As the disease came from the East, so did the invention of inoculation. The Chinese have long been in the habit of implanting the disease, with a view to preventing the more disastrous effects which follow it when acquired accidentally. They "sow" the crusts in the nostrils of the person to be inoculated; or they powder them, and, mingling them with aromatic substances, make a snuff, of which the person takes a pinch. The Hindoos inoculated by the prick of a needle dipped in variolous pus. Thus, both these nations have come into the possession of a principle which really lies at the foundation of the modern practice of vaccination, namely: that a mild form of the disease will preserve from a second attack, just as surely as a severe form. By artificial implantation the small-pox poison is introduced into the system, and, once for all, the susceptibility of the system to small-pox is excited and exhausted. How this takes place is not under-

stood. But vaccination will do the very same thing, as far as the essential is concerned; that is, it will exhaust the capacity of the system for having the small-pox.

The cow-pox is not a contagious disease, like the inoculated small-pox, yet there is good reason for believing that the cow-pox, whether in man or in the lower animals, is really the small-pox, deprived of its virulence and its capacity for transmission through the air.* If ever theory was proved by fact, this has been; for actual inoculation of cows with small-pox matter has been frequently resorted to, with the effect of generating the cow-pox pure and simple. Moreover, lymph from the cow-pox thus produced has been used in vaccinating tens of thousands of children, and has proved perfectly satisfactory in every respect, acting precisely like lymph from the spontaneous cow-pox, and furnishing efficient protection against the small-pox. As a rule, cow-pox can only be had once by the same person.

There are several eruptions, to which cows, horses, and some other animals are subject, which resemble the genuine cow-pox; such as in horses the "grease," once erroneously thought to be the origin of the disease in cows. Genuine horse-pox furnishes the means for successful inoculation, like genuine cow-pox, and is equally protective.

Inoculation for the small-pox, to which we just now alluded, was introduced into England by Lady Mary Wortley Montagu. Accompanying her husband to Constantinople, whither he was sent on a mission from the British Government, she found that it was the fashion there to convey small-pox in a mild form to children, by pricking them with needles dipped in the variolous pus. Greatly struck with the value of the operation, as well as its apparent mildness, she determined upon bringing it into use. To this end she took the most efficient means in her power, by causing her infant son to be inoculated, and subsequently, upon her return to England, her daugh-

* This statement needs a little correction; for, while it is notoriously impossible for one child to "catch" the cow-pox from another, it is at least probable that it is sometimes communicated from one cow to another without actual contact.

ter also. This took place in 1721. But, though her example was followed by many of the nobility, and even by the royal family, the practice never became anything like universal. The danger was too apparent. In 1721, Dr. Boylston inoculated 244 of the inhabitants of Boston, New England, with a mortality of six; and this, being about one in sixty, was the usual rate. Great improvements were afterwards made in the operation by using only one puncture instead of several, restricting the patients' diet, and allowing them to go about freely in the open air. But, unfortunately, the disease could be taken as easily from any one of these inoculated persons as from one having the natural small-pox. The result of this artificial dissemination of small-pox through the community was that, in the last part of the eighteenth century, one-fourth more deaths occurred from small-pox, in proportion to the population, than in the first part. By an act of the British Parliament, passed in 1841, it was made a penal offence to inoculate the small-pox. The same prohibition stands in the statutes of several of our own States.

To Dr. Edward Jenner is due the credit, we may almost say, of abolishing this disease in Christendom. By no lucky accident did he come into possession of the secret of vaccination. He did not actually discover that the blisters upon the udders of the Gloucestershire cows contained a preservative against small-pox. A belief in this protective power had for many years been current among the milkers and the illiterate peasants of his neighborhood. Jenner, however, did more than discover; he *proved.* From the time when the subject first awakened his interest until the day of his triumphant success, he was laughed at by his brethren in the profession as a dreamer; his idea was voted a mere hobby, and his enthusiasm a bore. He expended six thousand pounds in money, and the labor of many years, in the furtherance of his investigations, and, when completed, he published them without reserve or stipulation.

His first work was entitled "An Enquiry into the Causes and Effects of the Variolæ Vaccinæ," and appeared in 1798. More recent investigations have, almost without exception,

confirmed Jenner's propositions; and his descriptions remain unexcelled.

The cow-pox takes best, and shows best, in young children. When some of the lymph is implanted under the skin, the puncture shows no sign of anything unusual for a day or two; then it reddens, a pimple forms, and on the pimple a little blister, which may be plainly seen on the fifth or sixth day. On the eighth day the blister (vesicle) is plump, round, translucent, pearly white, with a clearly marked edge, and a depression in the centre; the skin around it, for half an inch or so, is red and swollen. Jenner compared it to "the section of a pearl upon a rose-leaf." *This vesicle*, and, still more, the *circle of inflammation around it* (called areola), *are the two points which prove the vaccination to be successful.* The vesicle is most perfect on the eighth day (that is, the day-week after the operation); the areola, on the day or two following. The vesicle dries up in a few days more, and a crust forms, which falls off from the twentieth to the twenty-fifth day. The scar or pit left behind is the best proof of successful vaccination, when we cannot see the process itself. It should be round or oval, rather sunken, and dotted at the bottom with little pits; sometimes radiated. If several vesicles run together, the mark will of course be less circular. A slight rash usually comes upon the child's body about the eighth day, and lasts perhaps a week; he may be a little feverish, or may remain quite well.

If matter direct from the cow is used in vaccination, the process is apt to be retarded, and the result less certain. But perfectly "good" vaccinations may require a day or two longer than the time here given. Poor or spurious cow-pox is apt to run a too rapid course; sometimes the whole process is gone through in eight or ten days, leaving a scar hardly visible, and wholly worthless for the purpose of protection.

If the child has an eruption on the skin, vaccination must be put off till that is cured; otherwise he probably "will not take." He ought to be in good health in other respects, if possible.

Infants catch the small-pox at least as readily as adults, and

the rate of mortality among them is proportionably high. A single fact, stated upon the highest English authority, will serve at once to illustrate this point, and to fix it in the memory. In the year 1863, an unusually severe epidemic of small-pox raged in London. Of the children who died—and who constitute a large majority of the entire mortality—"*seven-eighths* (7/8) might have been saved, if all had been vaccinated before the age of two months." Good judges consider the operation safe at the age of four or six weeks. It is certainly not too much to say that, even in remote country districts, the period of vaccination ought not to be postponed beyond the sixth month.

When a person has taken small-pox, the disease remains latent until the twelfth day (inclusive). Then he becomes feverish; and after two days more the rash appears. Vaccination, on the other hand, requires only nine or ten days to reach its perfection; and, if performed within two days of the time when infection occurred, it will have time to form its areola—the true characteristic of perfect vaccination—before the fever commences. If performed later, its course is commonly interrupted as soon as the fever appears, and the operation is partially or wholly unsuccessful. For example, let us suppose that a man visits a friend's house on Monday. On Tuesday, he discovers that there was a person sick with small-pox in that house. He has never been vaccinated, or, rather, as is often the case, he was only nominally vaccinated. He goes on Wednesday, therefore, and has the operation properly performed two days after contagion has occurred. If successful, the vesicle is perfect on the next Wednesday, and the areola on Thursday, and the man is protected; but, if the operation had not been performed, the small-pox would have begun on Friday. And, if he were vaccinated even three days after contagion, the small-pox would appear, though in a modified form; but, if four days, the disease would not be hindered or modified at all. Nevertheless, it is well to vaccinate in almost all cases of supposed contagion.

In vaccinating from the cow or from a child, lymph ought not to be taken from any but a perfect vesicle. No blood

must be mingled with it. The lymph is best taken on the day-week of the vaccination, but may be drawn sooner; if later, it is of very uncertain quality. The centre of the vesicle is lightly punctured with a lancet, and the fluid oozes out. The point of the instrument, which, for this method, must be very sharp, is dipped into the fluid, and plunged under the skin of the child to be vaccinated. This is repeated in four or six different places. If a little blood is drawn in inserting the lancet, this is of no consequence at all; let it remain and dry on. Some prefer to scrape the skin lightly, or to score it with the lancet-point, and then rub the lymph upon the place thus prepared.

If care is taken, only one case in one hundred and fifty will fail in skilful hands. But most physicians find it inconvenient to vaccinate "from arm to arm," and therefore use points of ivory or quill, dipped in the vaccine lymph and dried; others take a bit of the scab—powdered and dissolved in glycerine or water—to insert, instead of fresh lymph. These methods, however, are far less certain than that first described. Many physicians fail once in three or four times; and it is very much to be regretted that so many are content with imperfect results. *For, when a person is once vaccinated, though poorly, it becomes difficult or impossible to vaccinate him properly.* Nevertheless, if the first result is unsatisfactory, let the trial be repeated as soon as convenient, and as often as may be required until a satisfactory result is attained. There are a very few persons who, from unknown causes, seem to be unsusceptible; but upon some subsequent trial the system may receive what it first refused.

The lymph direct from the cow sometimes occasions troublesome, even dangerous, inflammation and fever. It does not produce any better vesicles than those from humanized lymph, and it is much harder to make it take.

A thorough vaccination protects the system against small-pox as surely as an attack of the disease itself would. Some persons have small-pox twice; and some have it after a thorough vaccination; but a person who is not protected by the vaccination would not be protected by having had the

disease itself. Such was Jenner's belief, founded upon the view that cow-pox is but a variation of small-pox; and statistics, as far as they go, point in the same direction.

Thorough vaccination, in the modern sense of the term, implies the possession of four or more good cicatrices or marks. With this number of marks, the chance of taking small-pox is very small indeed; and, if taken, it will be in so mild a form as to be hardly an object of dread to the patient. The following statistics will fully justify these positions. The first series refers to upwards of 50,000 children, examined in London by Drs. Buchanan and Seaton, in 1863. Of those children who had no marks of vaccination, 360 in every 1,000 had scars of small-pox, or more than one-third; while, of those bearing marks of vaccination, only 1·78 in 1,000 had such traces. And by separating those vaccinated into classes, the following results were obtained:

Of those having					
One vaccine cicatrix,	6·80	per 1000	had	marks	of small-pox.
Two vaccine cicatrices,	2·49	"	"	"	"
Three " "	1·42	"	"	"	"
Four or more "	0·67	"	"	"	"
Of those having mark or					
marks of *bad quality*,	7·60	"	"	"	"
tolerable "	2·35	"	"	"	"
excellent "	1·22	"	"	"	"
One mark of *bad quality*	19·00	"	"	"	"

So much for the degrees of protection afforded by different degrees of vaccination. As for those who take small-pox after vaccination, the following table will show how vastly greater the chance of recovery is for them than for the unvaccinated. It is based upon 15,000 cases, observed and treated by Mr. Marson in the London Small-pox Hospital.

Classification of patients affected with small pox.	Number of deaths per cent. in each class respectively.
1. Unvaccinated, ...	37·00
2. Stated to have been vaccinated, but having no cicatrix,	23·57

Classification of patients affected with small-pox.	Number of deaths per cent. in each class respectively.
3. Vaccinated:	
a. Having one vaccine cicatrix . . .	7·73
b. " two vaccine cicatrices . . .	4·70
c. " three " " . . .	1·95
d. " four or more vaccine cicatrices .	0·55
α. Having well-marked cicatrices . . .	2·52
β. Having badly marked cicatrices . . .	8·82
4. Having previously had small-pox	19·00

This shows the likelihood of death to well-vaccinated persons with small-pox to be one-fourteenth of that to which badly vaccinated persons are exposed. These two tables amply justify the statement that it is very desirable to have multiple vaccine cicatrices if possible.

No one will deny the immense benefit which has resulted in the aggregate protection afforded to nations and armies. In England, at the close of the last century, there died annually of small-pox 3,000 persons to every million of population; while from 1841 to 1853, the average was 304; from 1854 to 1863, 171. In many Continental countries and cities, the results have been even more striking than this. In Sweden, the annual small-pox death-rate was 2,050 in a million; reduced, during the period from 1810 to 1850, to 158; in Westphalia, 2,643 deaths, reduced in a similar period to 114; in Bohemia, Moravia, and Austrian Silesia, from 4,000 to 200; in Copenhagen, from 3,128 to 286; and in Berlin, from 3,422 to 176.

Since the year 1853, vaccination has been, to a certain extent, compulsory in England. In that year an act was passed, known as Lord Lyttleton's Vaccination Act, "to extend and make compulsory the practice of vaccination." By this act penalties were provided for the refusal to allow a child to be vaccinated. But, as no special officer was appointed to see to the enforcement of the law, it had very little practical result. The unsatisfactory working of the act led to the promulgation of an order of the Privy Council, under date of

December 1, 1859, for the improvement of public vaccination. By this order, a system of inspection was directed to be instituted, with reference especially to the operation of vaccination, and its efficiency in unions where the amount of infant vaccinations, compared with the number of births, appeared to be especially low. These systematic inspections have been so useful in promoting vaccinations that their lordships propose to continue them throughout all the unions of England.

Revaccination is now generally considered desirable in every case, when the period of puberty is past; say, at sixteen or eighteen years of age. This operation, even when successful, seldom produces the effect of a first vaccination. The resulting cow-pox reaches its height about the fifth or sixth day, and a scab forms on the eighth. It resembles, in short, the result of a spurious vaccination, with hasty and imperfectly formed vesicles.

In the Würtemberg army in 1831–5, and the British army in 1861, several thousand soldiers were revaccinated. The curious result was attained that, in those who bore marks of small-pox, as well as those previously vaccinated, more than half the vaccinations succeeded.

In the Prussian army revaccination has been performed upon every recruit since 1833; the result being that the annual deaths from small-pox (which at one time previously were 104) have not averaged more than 2.

In the Bavarian army revaccination has been compulsory since 1843. From that date till 1857, not even a single case of unmodified small-pox occurred, nor a single death from small-pox.

Similar good results have followed the institution of revaccination in the armies of Great Britain, Denmark, Sweden, and Baden.

Supposed Evil Consequences of Vaccination.—It is hardly necessary to allude to the extravagances of the first opponents of the operation. It was stigmatized as impious; the subjects of it would, it was said, become impregnated with all imaginable diseases and characteristics of the bovine genus; they would low like kine, and their foreheads would sprout with

horns. Some, in later years, have tried to trace all the physical evils that plague modern society to the root of vaccination. Modern medicine has been charged, to a certain extent justly, with rescuing a multitude of weaklings, who, under a healthy barbarism, would have died young—"as they ought"!—while as things are now constituted they survive to adult age, trailing about discouraged souls in tired bodies, and transmitting to weakly children an incompetent vitality. But it needs only a moment's reflection to show that small-pox kills the strongest as well as the weakest. We cannot spare its victims. They are a substantial loss to the community. It is also said that those who would else have died of small-pox, now die of some other disease that has taken its place. In the sense intended, this is simply untrue. The rate of mortality in London, for example, is but three-quarters of what it was a century ago, exclusive of small-pox. Thus, while the general risk of death is one-fourth less, that from small-pox is almost extinguished.

There is a vague feeling among the community at large, and even among physicians, that vaccination now and then transmits a constitutional disease. "Is it possible, doctor, that my child can have taken scrofula from a scrofulous child through vaccination?" Without declaring that such a thing is absolutely impossible, we may safely say that it is a great deal easier for the child to have taken it from its own parents. It would seem impossible—judging from all known analogy—to communicate any disease besides the cow-pox from a properly formed vaccine vesicle. To illustrate this principle, it may suffice to say that the small-pox, most contagious of all diseases, cannot be communicated in this way. A person may be vaccinated just before the small-pox breaks out upon him, and he may have a good vaccine vesicle; but another person vaccinated from this vesicle will have cow-pox, and nothing more.

In England, probably thirty millions of vaccinations have been performed during the present century. With what evil results? Marson, who has performed over 50,000 vaccinations, "has never seen other diseases communicated with the vac-

cine disease, nor does he believe in the popular reports that they are so communicated." Leese, with an experience scarcely less extensive, agrees with Marson. Dr. West, who has treated, during seventeen years, 26,000 infants and children, is of the same view. Professor Paget, speaking from a large experience, says: "Now, vaccination, . . . though I believe it very rarely does, . . . by disturbing the general health, may give opportunity for the external manifestation and complete evolution of some constitutional affection, which but for it might have remained rather longer latent." "This is the worst thing," he says, "that can with any show of reason be charged against vaccination; even this can very seldom be charged with truth." That is to say, a child with a "humor in the blood" will be apt to have the humor "break out" whenever the system is irritated, whether by vaccination, by teething, or by bad diet.

It is forgotten, and most unjustly, by those who decry vaccination, that the bugbear scrofula was once a real danger of most threatening import to those who survived the small-pox. In constitutions predisposed to scrofula or to consumption, we find that small-pox used to be one of the most frequent causes of the development of these diseases; deafness was also a frequent result; and as for blindness, it is stated by Sir Gilbert Blane that, during the latter half of the last century, two-thirds of the applicants for relief at the Hospital of the Indigent Blind owed their loss of sight to small-pox. The practical conclusion is strongly put by Dr. Seaton in a single sentence: "The 56,000 lives, which at the least are now, on an average, saved annually from small-pox in England alone, are not gained without here and there a child getting erysipelas from its vaccination, and even, in cases of excessive rarity, dying of it; but what reasonable man ever hesitates on account of this risk to have his child vaccinated?" Let us, then, throw all possible safeguards around the operation of vaccination; let it be a punishable offence to perform it badly; but let us not venture to compare the evils of cow-pox with those of small-pox. Ignorance and recklessness have made vaccination a pest, not a blessing, to a few unfortunates. But malpractice in the per-

formance of an operation proves not the danger of operating, but the incompetence of the operator.

It remains a contested point how far the vaccine virus loses its efficacy by transmission through many series of human subjects. Dr. Seaton, Medical Inspector to the Privy Council, believes that the deterioration is due to carelessness on the part of operators, who frequently select lymph that has passed the suitable period, or lymph from imperfect vesicles or from adults. He says: "It is in truth not to the cow, but to adequate care and skill on the part of vaccinators in the selection of the children and vesicles from which lymph is taken, that we must look for maintaining stocks of active lymph." And, without venturing to discuss further this question, surely it is pertinent to suggest that, if Mr. Marson can produce "typical vesicles," as well-formed as those produced by Jenner, from humanized lymph, and meets with entire failure only once in 150 cases, there must be some reason besides degeneration of lymph for the great frequency of failure and partial failure in other hands. If the number of people whom vaccination fails to protect is steadily increasing, it is worth while to consider whether this is not due to increasing neglect of precautions in performing the operation; and, especially, to the use of lymph which does not present the recognized marks of goodness.

Another source of fallacy may be indicated: How do we know that vaccinations are becoming less efficacious? This is inferred chiefly from the great number of instances in which revaccination is successful. But does this success prove that the individuals concerned were liable to an attack of small-pox? We think not. We just now quoted the instances of the armies of Great Britain and Würtemberg. Here several thousand men were revaccinated, and the operation was about as successful upon those who had had the small-pox as upon those who had only been vaccinated previously. In a very large number—about one-third of each class—the revaccination was completely successful. This shows merely that a protected person—one not liable to take small-pox—can sometimes be revaccinated with success.

In Boston, vaccination is performed gratuitously upon large numbers of children by persons in the employ of the government of that city. The same is done in New York by the Public Dispensaries. This service is performed most thoroughly and satisfactorily, by gentlemen who have the confidence of their professional brethren. In fact, physicians are in the habit of frequently resorting to the public vaccinators to renew their own supplies of lymph. During the late war, great quantities of lymph were put up in capillary glass tubes at the New York Central Dispensary, and distributed to the surgeons in the United States service. The lymph thus stored is nearly as effective as that taken directly from the arm, and seems not to deteriorate by keeping.

Here, then, is an actual nucleus for a system of public vaccination. It seems impracticable in this country to attempt, as the English are doing, to enforce vaccination upon everybody, under penalty of fine and imprisonment. But there is much to be done in the way of increasing the facility with which vaccination can be performed. In the first place, the public ought to be satisfied that the men appointed by the State are more likely to do their work thoroughly than are the average of private practitioners. This is really the great and essential point; for upon it will depend the success of Government commissions of enquiry, or any other measures that may be taken. Can the medical profession be expected to support a system which will take away a certain portion of their practice? Very likely, yes; for the operation is to many a troublesome one, and is not paid in proportion to the loss of time it involves. Cannot, then, the Governments of States, or the General Government, be induced to take the simple step of offering vaccination gratuitously to all, under guarantees of purity, such as the public would confide in? The following measures are here suggested in a very general way:

I. A "Bureau of Vaccination," to be established by the General Government, with its own chief, and a corps of subordinates responsible to him. The duties of the bureau should consist in supplying lymph in sealed glass tubes to any physi-

cian or sea-captain, within the United States, making application for the same; in accumulating and investigating evidence relating to vaccination; and in conferring with such commissions from the States as might desire information or aid.

II. Commissions of Enquiry, to be appointed by the several States.

III. Provision for free public vaccination, also by individual States, upon a scale embracing the whole community. Every country, town, and settlement should be visited as often as once in six months; and every family in large cities should be notified at stated times that vaccination will be performed gratuitously, if desired.

It will be seen that the value of the measures proposed depends entirely upon the character of the officers appointed to carry them into effect. This cannot be otherwise. No legislation can be worth a farthing without competent executive authorities. Able and faithful men can, doubtless, be found, willing to devote themselves to this important work; and it is not difficult to see that such men, vested with competent powers, will effect most valuable improvements in the condition of vaccination in this country.

In concluding, a brief account of the English laws respecting vaccination, and their practical working, may be in place. The statements made are derived from the annual Reports of the Medical Officer of the Privy Council.

The "National Vaccine Establishment" (formerly "Institution") was founded by Act of Parliament, in 1808. Though at first its scope included the investigation of scientific questions connected with vaccination, its functions have for many years past been practically restricted to maintaining for general use, and distributing as wanted, a supply of trustworthy lymph; for which object it supports a number of stations where gratuitous vaccination is extensively performed. The supply from the establishment is supplemented by that from a number of other stations, in several of the largest towns.

In 1840, an act of Parliament was passed, providing that vaccination at the public cost might be claimed by the local authorities of any parish of England and Wales. By a second act, it was provided that gratuitous vaccination should not place its recipient in the position of persons receiving public relief. By a third act, in 1853, it was made obligatory on parents and guardians that every child, its health permitting, should be vaccinated within three months from birth; or, if an orphan, within four months; and penalties were made recoverable from parents or guardians neglecting to fulfil this obligation. In 1861, the law put into the hands of guardians of the poor the power of prosecuting violations of this law, at the public expense.

Under the Poor Laws, the whole of England and Wales is divided into districts, called Unions. The authorities, to whom the care of the poor in the several unions is committed, make contracts with medical men for the performance of vaccination. The minimum of compensation is fixed by law at 1*s.* 6*d.* *per caput.* But provision was made by Parliament, a few years since, to pay gratuities, not exceeding 1*s.* for each child vaccinated, in addition to the fees contracted for. In order to distribute these gratuities equitably, a biennial inspection of the whole of the kingdom has been established, by which the character of each operator's work is estimated. Those whose results appear the best receive the full sum of 1*s.* per vaccination; those of the next degree of excellence, 8*d.*; and a great many are found not worthy of any gratuity.

These arrangements for vaccination are in force throughout the whole of England and Wales; and the great mass of the population tends to avail itself of them, in order to comply with the law which makes infant vaccination compulsory. It is estimated by good authority that from two-thirds to three-fourths of all children born are vaccinated by the public vaccinators.

Supervision and inspection, by gentlemen of high professional standing, have formed, for the past twelve years, a very important part of the work of the Privy Council in reference to vaccination. In the words of Dr. Sanderson, one of the In-

spectors, "Arrangements in themselves have but little effect in extending the practice of vaccination, unless they are combined with measures of supervision; and supervision without arrangement is more effectual than arrangement without supervision."

Owing to the frequency of careless and incompetent vaccinators, the Privy Council issued an order, to take effect January 1, 1860, that every person thus contracted with must have, besides the ordinary qualifications necessary for a district medical officer, also a special certificate of instruction or examination in the practice of vaccination, given by some public vaccinator whom the Privy Council authorize to act for the purpose. The requirements of instruction include six weeks' attendance at some one of the educational stations. The necessity of this regulation appears from the statement of Mr. Marson, whose experience in the Small-pox Hospital has satisfied him that "vaccination is, as a rule, much better performed abroad than in England." A very large portion of the population is stated to be vaccinated imperfectly; which is attributed to the absence, in former times, of an authorized standard of vaccination, such as the Privy Council is now endeavoring to establish. Full and explicit instructions for vaccinating under contract have been issued, upon which it is unnecessary to dwell. It is reported, for the year 1867, that 142,107 charges of lymph were distributed by the National Vaccine Establishment. Most of these were upon ivory points; about 8,000 were in capillary tubes, and a small number upon bits of glass. They were supplied by twenty-one stations, situated in London and some of the larger towns; of which thirteen are used as educational institutions for physicians wishing to be qualified as public vaccinators. These stations are inspected yearly, both in reference to the stock of lymph and to their educational business.

In general, the laws requiring vaccination have been far from attaining complete success. In some places almost every child born is vaccinated, either by the public officer or by private practitioners; but in others the Inspectors have had to report a scandalous neglect in the performance of vaccina-

tion, in spite of the law. Yet, even when prosecutions were not actually made, the existence of the law was a great help in effecting public readiness to have children vaccinated. In many places the people, almost without exception, would have their children vaccinated if strongly urged by the proper authorities, even without recourse being had to the enforcement of the law.

The medical man who contracts with local authorities for the performance of vaccination agrees to be present at a specified place, on a given day or days, the hours being sometimes stated, sometimes not. Among the most frequent causes of the imperfect performance of vaccination has been not a deficiency in the number of operators (as might at first be supposed), but the reverse condition. The subdivision into districts has been carried to such an extreme as to form one of the greatest impediments to proper vaccination. A very large number of the contractors cannot pretend to fulfil the conditions imposed upon them. For example, in a district where only fifty births occur yearly, it is preposterous to require attendance twice a week at the station. Properly to fulfil the duties of his position, the vaccinator ought to be sure of the presence of ten new cases, on an average, every week. With this *average*, there will be weeks when on the appointed day only four or five are presented at his office. If the number fell lower still, it might easily happen that there would be no child from whom it would be quite desirable to vaccinate the new-comers. The vaccinator would then be reduced to the alternative either to use preserved lymph or to vaccinate directly from an inferior arm; and to this latter practice is ascribed a great amount of poor vaccination. When, therefore, the annual number of births falls much short of five hundred, as is the case in most rural districts, it is recommended that semi-annual visits be made, at which the whole infant population may be vaccinated at three or four sessions on successive weeks. A small town should be visited once a quarter; a large town, weekly.

Other causes of the partial failure of the law have been the following:

Absence of suitable provision for serving notices upon parents and guardians, and for prosecuting delinquents;

Low rate of payments to contractors;

On the part of the contractors, negligence; use of stored lymph instead of fresh; allowing their duties to be performed by deputy; want of skill for the operation, a deficiency which may exist in men who otherwise are excellent practitioners;

Objections of the poor. These usually resolved themselves into an unwillingness to take trouble. But in some places the parents caused great annoyance to the operators by refusing to allow lymph to be taken from their children's arms.

The question of the advantages and dangers of vaccination is still kept before the British public by the occasional refusal of some person to allow a child to be vaccinated, followed by the payment of the legal penalty for such contumacy. Within a year or two a society has originated in London, having for its object to discourage vaccination by appeals to popular ignorance and prejudice; but the thoroughly unscientific character of the most of those who oppose vaccination renders it unnecessary in this report to do more than allude to their efforts. The law is there pressed to an extent to which it would be quite impossible to force it here. For direct compulsion we must find some substitute; and hitherto there has been no single measure devised, of more efficiency in securing general vaccination, than the requirement which is now made in several of our States, that public-school children shall show evidences of vaccination. But the question of measures proper to be adopted has been elsewhere discussed.

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