Vaccination and small-pox in England and other countries showing that compulsory re-vaccination is necessary, with an account of the German Vaccination Commission of 1884, and extracts from the reports of the Royal Commission on Vaccination (1889), etc / by Edward J. Edwardes.

VACCINATION AND SMALL-POX

IN

ENGLAND AND OTHER COUNTRIES

SHOWING THAT

Compulsory Re-vaccination is Necessary

BY

EDWARD J. EDWARDES, M.D.Lond.

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WITH AN ACCOUNT OF THE GERMAN VACCINATION COMMISSION OF 1884, AND EXTRACTS FROM THE REPORTS OF THE ROYAL COMMISSION ON VACCINATION (1889), ETC.

BY

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VACCINATION AND SMALL-POX

CHAPTER I

INTRODUCTION

After nearly a century of the practice of vaccination, not only in this country, but throughout the civilised world, the notion is strongly urged by a few persons to do away with vaccination altogether, or else to render it no longer compulsory. The medical profession throughout the world is unanimous, with a few rare exceptions, as to the power of vaccination to protect against small-pox; the various Governments of Europe continue, some of them to provide for and encourage vaccination gratis, some to enforce it; Germany has had, besides compulsory vaccination in infancy, compulsory *re*-vaccination of all school children for nearly twenty years, with the brilliant result that small-pox is all but abolished, and epidemics have ceased; and yet we are told that vaccination is perfectly useless, and a delusion. Some even go so far as to say that its practice should be made penal. One or two persons of undoubted scientific authority have joined in the hue and cry against vaccination, and call it a grotesque superstition.

The admitted facts on which the opponents of vaccination rely are the following:

1. Epidemics still occur in countries said to be well

vaccinated. In the years 1871–4 all Europe suffered from the severest small-pox epidemic of the present century. Bavaria, considered to be a very well-vaccinated country, had 4748 deaths from small-pox in a single year, 1871; and in London in the same year the deaths from this cause were 7912 (2422 per million living). This great outbreak occurred seventy years after the abundant use of the Jennerian prophylactic which was to eradicate small-pox from Europe. And many naturally ask, what then is the good of vaccination? Again, in 1877–8 an epidemic broke out in Sheffield, a city so well vaccinated that only two per cent. of its inhabitants were found by a special census to be unvaccinated persons; nevertheless over 4000 vaccinated persons were attacked by small-pox, and over 200 (vaccinated) died of it.

2. It is a fact that syphilis has been transferred by vaccination; this is allowed by the upholders of vaccination. The Registrar-General's figures show that a great increase in the annual mortality from syphilis has occurred since the enforcement of vaccination, and this increase is by some opponents ascribed to vaccination. Again, numerous deaths (316 in six years, 1881–6) have been certified as due to erysipelas after vaccination. So that it cannot be denied that some danger attaches to vaccination, under certain conditions of carelessness.

One of the purposes of the writer is to show the degree of this danger.

3. Since the vigorous enforcement of vaccination *more adults die of small-pox* per million of population than when vaccination was merely optional. In other words, one effect of vaccination has been to shift the incidence of small-pox from childhood to adult life, from an age when life is less valuable to the community to an age when it is more valuable. In the last century small-pox was a

disease of children; it is now a disease chiefly affecting adults.

4. It is admitted that great improvements in sanitation have been made during the present century, and to these the opponents of vaccination ascribe all the decrease of small-pox.

Other reasons for abolishing vaccination are adduced by persons whom I will call Sentimental Antivaccinists. They say that cow-pox is not only a disease itself, but is attended with the risk of the transference of all sorts of constitutional peculiarities. If the lymph used be obtained from a child, they talk of a host of diseases which may possibly be implanted by vaccination besides those already mentioned. If the lymph is calf-lymph, then we do not know what risks we are running. Apart from immediate disease, in either case various unknown influences, so they assert, may possibly be present. Some say that vaccine lymph is a "putrid juice," an unclean thing, anathema. Others again stand aghast at the fact that those medical men who are public vaccinators are paid by the nation for the work which they do, and these opponents descend so low as to assert that the medical profession supports vaccination only or mainly because it is pecuniarily interested in "keeping it up."

Some admit the protective power of vaccination, and, where it is properly performed, the almost entire absence of any risks of any kind, but strongly object to compulsion. They say very plausibly:—Vaccinate your own children, but leave ours alone. They, like the rest, will be fully answered in the following pages. Many well-meaning people talk much about nature. They say:—Let us follow the methods indicated by nature; let us eat and drink little, and exercise much, breathing pure air and assiduously cultivating happiness; then small-pox will not

come nigh our dwellings, *ergo* there is no need for vaccination, which is rather to be carefully avoided.

The subjects dealt with in this little work will be examined in the following order :

1. The evidence for the assertion that vaccination exerts a protective influence against small-pox, *i. e.* confers more or less insusceptibility to attack.
2. The chief objections that have been urged against this evidence.
3. The nature of the proof of the above assertion.
4. The risks attending vaccination, their kind and degree.
5. The necessity for compulsory re-vaccination.

The statistics laid before the German Vaccination Commission (in 1884) will be reproduced,* together with the conclusions arrived at, and an abstract of the discussions.

Vaccination will be treated in these pages, not from an exclusively English, but an European point of view. The question being after all a scientific one, we will use all the evidence we can get, and deduce a true estimate of the value of vaccination from the experience of various countries of its use for nearly a century.

* See the author's letter to 'The Times,' November 26th, 1885. See also the *interim* Reports of the Royal Commission on Vaccination appointed in 1889, and still sitting.

CHAPTER II

THE EVIDENCE THAT VACCINATION EXERTS A PROTECTIVE INFLUENCE AGAINST SMALL-POX

The Nature of this Evidence

THERE is an inherent difficulty in proving scientifically that vaccination protects against small-pox, viz. that in reality we have to establish a negative proposition, and the difficulty of doing this in any given case is proverbial. We have to prove that where efficient vaccination is, there small-pox epidemics are not; or, stated less absolutely, in countries with more and more efficient vaccination the small-pox mortalities are less and less. This difficulty will be met, not by relying exclusively on any one line, but by the convergence to one point of several distinct lines of argument, each based on its own distinct mass of evidence. The arguments which belong here may conveniently be arranged as follows:

1. The argument from the personal experience of those who are familiar with small-pox.

2. The historical argument, *i. e.* small-pox mortality before and since the use of vaccination.

3. The incidence argument, *i. e.* both the incidence and the fatality of small-pox amongst the vaccinated and unvaccinated respectively.

4. The geographical argument, or the comparison of a well-vaccinated country with less well-vaccinated and with badly vaccinated countries in respect of their small-pox mortalities.

The protection conferred by small-pox itself.—But before examining into the protection conferred by vaccination we must first examine that conferred by an attack of small-pox itself. (The reason why I avoid the word "insusceptibility" is merely because it is a seven-syllabled word—a terrible word.) The first conclusion of the German Commission runs thus:—"*With rare exceptions one survived attack of small-pox confers immunity against any subsequent attack.*" Thus small-pox does not absolutely and universally protect against itself. Even third attacks in the same individual have been recorded. Dr Koch told the Commission that he himself had seen a patient in a third attack of small-pox, which proved fatal. Professor Hebra, of Vienna, had attended this man in the two previous attacks. Professor Wunderlich, whose writings on clinical thermometry are known to the whole civilised world, and who is called by Koch "a reliable and exact observer," asserts that he saw one patient have two attacks *in the same epidemic*. This is the only instance on good authority of an early second attack, and it remains a curiosity in medical literature. "No doubt most alleged cases of second attack rest on mere hearsay or on diagnostic error" (Koch). Amongst 22,641 small-pox cases in German military hospitals in 1871–2 only one second attack is recorded—a man had a slight form of small-pox three months after a severer form. Dr Krieger saw one certain second attack in 500 observed cases; two more were doubtful. Dr Reissner found no second attack in 12,000 cases. Bousquet collected thirty-four second attacks amongst 16,051 cases of small-pox during thirty epidemics. Dr Siegel reported twenty-six such in 3188 cases in Leipzig in 1871. Wunderlich found twenty-two second attacks in 1727 cases in Leipzig in 1871, and six of them were fatal. (The early second

attack has been already mentioned.) In former times all cases of second attack were reported as having occurred in children, or persons a little older—never in adults. This clearly points to error in diagnosis (Reissner). So much for the protection afforded by small-pox itself—not an absolute one, after all. We will now go on to that afforded by vaccination. The first argnment is—

I. The Argument from Personal Experience

By this is not meant the experience of "the man in the street," nor that of speculative theorists, but the experience of medical superintendents of small-pox hospitals; also of medical men who, though unconnected with such hospitals, have treated thousands of cases in severe epidemics, and generally of those who are practically acquainted with small-pox. Dr Wallace has told us that this question is a purely statistical question; while many opponents of vaccination, on the contrary, do not love statistics. It will be evident to any one who reflects a moment that small-pox being a disease, and a highly fatal disease too, the opinion of medical authorities perfectly familiar with this disease must be worth something. Now medical men are practically unanimous in their belief that vaccination exerts a protective influence against small-pox. Dr Koch* declared, whilst speaking about the value of statistical evidence generally, that "after all he attached great importance to personal experience, and relied upon it to a great extent. . . . . I have seen much small-pox [he said], and have vaccinated and re-vaccinated thousands of persons, and I have acquired the profound conviction that vaccination does exert a protective influence against small-pox. My own experience may not be thought worth much, but when it is corroborated by the vast personal

* See official Report of German Vaccination Commission.

experience of experts in this subject it becomes of importance. In other medical questions personal experience is allowed its full weight. Why not in this?" Why not, indeed?

Dr Russell, of Glasgow, says, "After closely observing over 1000 cases of small-pox in hospital, I have become deeply impressed with the helplessness of medicine when face to face with the unmodified disease. . . . When a case presents itself, the first question in prognosis is regarding vaccination. . . . If *vaccinated*, then the attitude is one of hope that the disease may be cut short, however bad present appearances are, though, in fact, the probability is that the symptoms are from the first trivial. If *unvaccinated*, then the attack will probably be severe, the eruption copious or confluent, and we recognise a virulence and deep constitutional disturbance against which the resources of medicine are powerless. As regards the individual, the opportunity for medical interference is past, and we can only turn his case to profit by following on those about him the practice from the neglect of which he suffers."

Such is the verdict of personal experience, and authorities by the hundred might be cited to the same effect.

II. The Historical Argument,

i. e. the small-pox mortality in any country before and since the use of vaccination respectively.

For this we must know from an official census what was the population of the country selected in the last century. The small-pox deaths considered alone might mislead us altogether; *e. g.* if the deaths have decreased from 4000 to 1000 while the population has increased from four millions to eight millions, the small-pox mortality has decreased to one eighth of what it was, not one fourth. But the

pre-vaccinatory era was the pre-statistical era, and England in particular was very late in establishing a census, as England was very late in adopting compulsory vaccination. Fortunately there is one country which we can utilise in this respect, viz. Sweden.

Small-pox in the Last Century

But before going any further we must cite some testimony from contemporary authors on the former prevalence of small-pox, because many opponents of vaccination assert that it was only a mild disease of childhood. It was almost exclusively a disease of childhood—this is true, for the simple reason that it was so prevalent everywhere that almost every child was attacked by it, and those who survived were protected for life. That is why it was a disease of childhood. How small-pox affected unprotected populations we learn from Sir J. Simon's papers on vaccination. In Iceland in 1707–9 a small-pox epidemic killed 18,000 persons in a population of only 50,000—a mortality of 360,000 per million. In Krantz's 'History of Greenland' we read that in 1734 the first epidemic of small-pox carried off two thirds of the inhabitants. Whole districts were depopulated. "In one island they found only one little girl with the small-pox upon her, together with her three little brothers; the father, having first buried all the people in the place, had laid himself and his smallest sick child in a grave raised with stone, and had ordered the girl to cover him."

Herr Korosi, Director of the Statistical Bureau of Hungary, cites the following authors:

Süssmilch, an eminent statistician of the time of Frederick I, estimated that nearly every one had small-pox, and that it carried off a twelfth part of mankind.

Dr Jani, of Gera, writes that in the year 1756 there

were 317 births in Gera, and that in the same year there 208 children died of small-pox.

Hufeland, no mean authority, writes in 1799, "In Halle the [small-pox] mortality was moderate, for only a third died"—meaning, no doubt, a third of the children, not of the whole population.

Hildebrandt, another old writer, tells us that if it could be found that a man had died a natural death without having had an attack of small-pox, he must have had it before he was born.

Our own country will be referred to presently. Let us now examine the Swedish mortality year by year since 1774.

(1) Sweden

Small-pox Deaths per Million Inhabitants each Year from 1774 onwards

(Before Vaccination.)

Year.	Small-pox Rate.	Year.	Small-pox Rate.
1774	1033	1788	2514
1775	630	1789	3125
1776	736	1790	2729
1777	944	1791	1423
1778	3187	1792	876
1779	7227	1793	939
1780	1593	1794	1749
1781	696	1795	2954
1782	1159	1796	1957
1783	1826	1797	746
1784	5805	1798	579
1785	2361	1799	1593
1786	311	1800	5126
1787	818		

Average of 27 years = **2008.**

(PERMISSIVE VACCINATION.)

Year.	Small-pox Rate.	Year.	Small-pox Rate.
1801	2570	1809	1009
1802	645	1810	359
1803	612	1811	241
1804	606	1812	166
1805	449	1813	266
1806	610	1814	121
1807	874	1815	191
1808	749		

Average of 15 years = **631.**

(COMPULSORY VACCINATION.)

Year.	Small-pox Rate.	Year.	Small-pox Rate.
1816	235	1851	707
1817	95	1852	433
1818	123	1853	78
1819	62	1854	56
1820	55	1855	11
1821	14	1856	14
1822	4	1857	151
1823	14	1858	345
1824	226	1859	388
1825	448	1860	184
1826	222	1861	49
1827	212	1862	37
1828	90	1863	76
1829	18	1864	182
1830	36	1865	323
1831	210	1866	292
1832	212	1867	252
1833	386	1868	342
1834	351	1869	354
1835	147	1870	183
1836	45	1871	78
1837	117	1872	81
1838	384	1873	265
1839	622	1874	935
1840	207	1875	484
1841	74	1876	136
1842	18	1877	79
1843	2·7	1878	44
1844	1·8	1879	31
1845	1·8	1880	38
1846	0·5	1881	65
1847	3·8	1882	34
1848	20	1883	27
1849	99	1884	12
1850	395	1885	0·8

Average of 70 years = **173.**

The foregoing tables show us at a glance an enormous reduction in the deaths from small-pox mortality since vaccination came into use, and especially since it became compulsory. Taking one year with another, 2008 persons died from small-pox every year before vaccination began, but only 173 yearly since it was made compulsory. To put the case more forcibly still, if we call a year showing a rate of over 1000 an "epidemic year," then before vaccination every two years out of three were epidemic years. There are seventeen such years during twenty-seven years altogether; but *after vaccination* begins there is *only one such year*, and after compulsory (*i. e.* efficient) vaccination begins *no such epidemic year occurs during the whole period of seventy years.* (The average rate for the three years 1885–7 is only 2 !)

The reader must allow that a great reduction of small-pox in Sweden occurred after the introduction of vaccination. Of course the tables do not prove that it was in consequence of vaccination; the mere fact of the reduction is all that is insisted on here.

We will now consider Copenhagen, of which we know the population from 1750 onwards, and the small-pox deaths each year. We will group these figures in decades for sake of shortness, and give the yearly average of those deaths per million of population during each decade.

(2) Copenhagen *

Small-pox in each Decade from 1750 *to* 1872.

Period.	Population.	Deaths from Small-pox.	Per Million yearly.
1750—1759	60,000	4,059	6,765
1760—1769	65,000	2,208	3,397
1770—1779	70,495 (1769 census)	1,288	(Average **3,567**) 1,828
1780—1789	78,451	2,068	2,635
1790—1800	83,604 (1796 census)	2,686	3,213
	Permissive Vaccination, 1801.		
1801—1810	95,876	644	(Average **660**)
	Compulsory Vaccination, 1810.		
1810—1819	104,790	—	—
1820—1829	112,420	116	103
1830—1839	119,442	569	476
1840—1849	126,787	247	195
1850—1859	143,591 (1855 census)	4	(Average **130**) 3
1860—1869	177,368	5	3
1870—1872	181,291 (1870 census)	224 (The great epidemic)	124

Again we observe an enormous reduction, viz. from a yearly average of **3567** before vaccination, to **130** since vaccination was made general.

(3) England

Dr Jurin, secretary of the Royal Society in the last century, estimated that "upwards of 7 per cent., or somewhat more than a fourteenth part of mankind, die of small-pox." But Dr McVail says that Jurin probably

* Korosi, 'Kritik der Vaccinations-Statistik, und neue Beiträge zur Frage des Impfschutzes,' Berlin, 1890.

over-estimated the deaths, being guided by the mortality in London, always much higher on the average than that of England. The annual average of the small-pox deaths per million living in Boston, Lincolnshire, during the years 1749—1802 was 2718.

In Chester the rate in the last century = 3300; and Mr C. E. Paget tells us that in 1775 this city contained only 1060 persons who had not had small-pox, *i. e.* 1 in 14 inhabitants (Dr McVail). Thus the rate in the last century was certainly above **2000**; Sir Lyon Playfair says it was at least **3000**.

The Registrar-General's figures begin in 1838 (four years are blank as to small-pox, viz. 1843-6).

ENGLAND.—*Small-pox Deaths per Million living each year from* 1838 *to* 1890

1838–53 (Vaccination optional)	064, 589, 661, 400, 168, ? ? ? ? 246, 397, 264, 262, 389, 401, 171	Average of 12 years	=**417.**
1854–71 (Vaccination enjoined)	151, 131, 116, 202, 329, 193, 136, 64, 78, 286, 364, 301, 139, 114, 91, 67, 113, 1012 . . .	Average	= **154.**
1872–90 (Vaccination enforced)	821, 98, 88, 35, 99, 173, 74, 21, 25, 119, 50, 36, 83, 104, 10, 18, 36, 0·8, 0·6	Average	= **99.**

The steady reduction is at once evident.

Here we see that while the average rate in the last century was certainly above 2000 yearly—probably nearer 3000 than 2000—during the last nineteen years it is a twentieth part of 2000. It is perfectly fair to divide the yearly rates into vaccination periods, as the Registrar-General has done, because it enables us to see the successive effects of successively better vaccination laws, and we want to bring out these effects, not to hide them. But the figures are so given that they may be examined year by year without reference to the above periods.

(4) London

The small-pox rate during the last century will be considered presently. The following is the rate per million living for small-pox year by year since 1838, when our official statistics commence:

1838–53 (V. optional)	2169, 353, 673, 563, 188, 225, 890, 440, 122, 427, 724, 229, 215, 448, 478, 86 . .	Average of 16 years	= **514.**
1854–71 (V. compulsory)	277, 408, 204, 59, 90, 425, 323, 77, 128, 687, 185, 214, 457, 436, 190, 87, 302, 2422 .	Average	= **387.**
1872–90 (V. enforced by v. officers)	537, 34, 17, 13, 207, 710, 388, 121, 125, 619, 111, 35, 227, 230, 1, 2, 1, —, 1 . .	Average	= **178.**

The average small-pox mortality is far above that of England generally, but the usual reduction is manifest.

London before Vaccination came into Use

The Registrar-General's statistics begin with the year 1838, so that the small-pox rate per million living during the last century cannot be officially vouched for. But apart altogether from the population, we have a sure basis on which to make a comparison between this century and the last as regards the mortality from small-pox, for we have the deaths from small-pox, and we have also the deaths from all causes (as given in the bills of mortality); we have therefore only to compare these two data at different epochs. Dr Guy has done this (see '250 Years of Small-pox in London').

Average Annual Small-pox Mortality during each Decade as a Percentage of the General Mortality, 1701—1880

1701—1800 (Pre-vaccination era).—58, 8, 8, 7·7, 7, 10, 10, 9·7, 9, 9 . . .	Average percentage	= **8·6.**
1801–50 (Era of permissive vaccination).—6·7, 4, 3, 1·6	Average	= **3·8.**
1851–80 (Era of compulsory vaccination).—1·17, 1·13, 1·9	Average	= **1·4.**

The eras are given in round numbers.

Again, a reduction that cannot be gainsaid is manifest upon the introduction of vaccination, and a still more marked reduction when vaccination was made compulsory.

If (Dr Guy says) an epidemic be defined as an outbreak causing 10 per cent. of all deaths, then in forty-eight years (1629–36 and 1647–86) of the seventeenth century there were ten such epidemics; in the eighteenth century thirty-two such epidemics; in the nineteenth century not one such so far. Even in the epidemic of 1871 the above rate was not quite reached.

Again, before vaccination, small-pox was nine times as fatal as measles, and seven and a half times as fatal as whooping-cough. It has now become quite insignificant as a cause of death compared to either (Dr McVail, 'Vaccination Vindicated,' Cassell and Co., 1887).

Dr Greenhow's Table

But a very fair estimate of the population in past times has been made (see Dr Greenhow's table in the First Report of the Royal Commission), so that we can give approximately the small-pox rate per million at various periods. The following are the data.

King's estimate of the population of London in 1685 is 530,000.

The 'Companion to the Almanack' for 1828 gives for the year 1750 a population of 653,000.

The census of 1851 gave a population of 2,362,236.

If King and the almanack err, they err in excess (Dr Greenhow).

On this basis, and making each of the above years the middle of ten years, we can give the average annual rate per million for various diseases during a decade of each century with a fair approach to accuracy.

	1681–90.	1746–55.	1846–55.
All diseases	42,100	35,500	24,900
Small-pox	**3,139**	**3,044**	**338**
Lung diseases	6,930	7,340	6,820
Fevers	6,330	5,390	3,850
Strumous disease	8,010	10,990	2,060

Dr Farr's Estimates

Yearly Average Small-pox Death-rates per Million living for various Periods

During the period	1629–35	the average rate was	1890
„ „	1660–79	„ „	4170
„ „	1728–57	„ „	4260
„ „	1771–80	„ „	5020
(Vaccination introduced)	1801–10	„ „	2040
„ „	1831–35	„ „	830
Registrar-General's figures begin	1838–53	„ „	514
(Compulsory vaccination, 1853)	1854–71	„ „	388
(Enforced vaccination, 1871)	1872–90	„ „	178

Again we observe an astonishing decline since vaccination came into use. The reader will bear in mind that Dr Greenhow's and Dr Farr's tables are founded on estimates of the population, not on official figures. But they are both distinguished statisticians—Dr Farr has been called the "Father of vital statistics,"—and the above estimates of Dr Greenhow were recently quoted before the Royal Commission (first report).

These examples will perhaps suffice to convince the reader that an enormous reduction in small-pox mortality has ensued upon the use of vaccination, and that this reduction becomes more marked as the vaccination laws become more stringent. These are facts, but no inference will be drawn from them till the objections are met.

(5) Scotland: before and after 1864

The example of Scotland is instructive because a distinct epoch is marked by the year 1864. Previous to

this year vaccination was optional; after this year it was enforced with a high degree of efficiency.

Annual Small-pox Deaths per 100,000 *living*

1855–64 (Vaccination permissive).—44, 43, 28, 11, 22, 49, 25, 13, 52, 55 . . . } Average = **34.**

1865–89 (Vaccination compulsory).—12, 6, 3, 0·4, 1·9, 3·4 [42·8, 71·8, 32·7, 35·8], 2·1, 1·1, 1, 0·1, 0·2, 0·2, 0·5, 0·08, 0·3, 0·3, 1, 0·6, 0·2, 0·07, 0·3 . . . . } Average = **8.**

The figures enclosed belong to the years of the great epidemic, notwithstanding which the average annual mortality from small-pox since 1865 is only a quarter of what it was during the period 1855—1864.

Now for the last century. In Glasgow, during the eighteen years 1783—1800, the small-pox rate per 100,000 was at least **470**. In Kilmarnock the average rate must have been at least **400**. (See Dr McVail's Report to the Local Government Board; also his work, 'Vaccination Vindicated.')

Enough examples have now been given to prove that a remarkable fall in small-pox mortality ensued upon the introduction of vaccination. When we reflect that vaccination was made compulsory in various countries, at great trouble and expense, not out of mere compliment to Jenner, but in anticipation that small-pox mortality would be reduced by it, experimental observations and optional trials having strongly justified this anticipation, it seems probable, to say the least, that the reduction of mortality which actually followed its use was due to its use. Here for the present we leave this argument, and take the next.

III. The Incidence Argument

We now reach our third argument, viz. the incidence and fatality of small-pox amongst the vaccinated and

unvaccinated respectively. How do the latter behave towards small-pox? Does it attack them equally, and kill them equally when attacked, or either of these separately? If vaccination has no influence on the susceptibility to small-pox, if vaccination is a grotesque superstition, then small-pox will attack and will kill the vaccinated and unvaccinated alike, in exact proportion to their respective numbers. If we knew the proportion of the vaccinated to the unvaccinated throughout the population, and could always obtain reliable information as to the "vaccinated condition" in all small-pox patients, it is evident that the question of the use or uselessness of vaccination would at once be definitely settled; there would be no room for further argument. This information it would be chimerical to attempt to obtain as regards the *general population.* But it has been obtained *for isolated portions of the community* with very great care; *e. g.* certain cities, certain branches of public service, and, as a crucial test, nurses in small-pox hospitals. Such statistics I now proceed to put before my readers; and I will supplement them with a few interesting cases. We will begin with the Sheffield report, the most exhaustive and valuable report of its kind ever made. (See Dr Smith Barry's Report, with Preface by the Medical Officer to the Local Government Board.) I beg my readers not to be frightened at the tables, but to plod through them line by line. They embody in each line large and most important information, and the remarks taken from Sir G. Buchanan's prefatory letter will aid the reader to grasp their significance.

1. *The Sheffield Small-pox Epidemic of* 1887–8

A severe epidemic outbreak of small-pox occurred in Sheffield in 1887–8, and Dr Smith Barry was commis-

sioned by the Local Government Board, or rather by its Medical Officer, to make a searching inquiry on the spot. Dr Barry's report, which reaches to March 31st, 1888, when the epidemic was distinctly declining, has been separately printed; it is also embodied in the report of the Royal Commission on Vaccination.

The Special Census of Sheffield

Dr Barry began by making a special census of the whole population of Sheffield, in order to know the proportion of the vaccinated to the unvaccinated. It was found that the former constituted 98 per cent. of the population—in other words, the inhabitants were found to be nearly all vaccinated persons, only 2 in every 100 being unvaccinated. This small unvaccinated fraction of the community was like a fragment of the whole population in the last century, as Sir G. Buchanan expresses it, and it will be very interesting to learn what proportion of small-pox attacks and deaths it contributed. As the age for public vaccination in England is three months, children under this age are altogether excluded in the following statistics.

A. *All Ages*

Of 268,397 vaccinated persons, 4151 took small-pox and 200, or 1 in 1300, died (*i. e.* 1·5 per cent., and 0·07 per cent. respectively).

Of 5715 not vaccinated, 552 took small-pox and 274 died, or 1 in 20 (*i. e.* 9·7 per cent., and 4·8 per cent.).

Thus the vaccinated enjoyed a 6-fold immunity from attack and a 68-fold security against death as compared with the unvaccinated.

But let us see what the division into age-classes, for the vaccinated and unvaccinated separately, can teach us.

B. *Age-classes*

VACCINATED.

Ages.	Population at that age.	Cases =	per cent.	Deaths =	per cent.	Fatality.	Deaths per 100,000 in each Age-class.
Under 5 years . . Except children under 3 months	33,393	121	0·36	1	0·003	0·8	3
5—10 „	34,843	232	0·67	5	0·014	2·	14
10—15 „	32,965	629	1·9	11	0·03	1·7	30
15—20 „	27,111	979	3·6	19	0·07	2·	70
20—30 „	44,788	1267	2·8	69	0·15	5·4	150
Above 30 „	92,041	899	0·97	95	0·1	10·4	100

UNVACCINATED.

Under 5 years .	1,981	128	6·5	66	3·3	51·	3,300
5—10 „ .	278	100	36·	34	12·2	34·	12,200
10—15 „ .	235	91	38·7	32	13·6	35·	13,600
15—20 „ .	282	84	29·8	53	18·8	63·	18,800
20—30 „ .	884	98	10·6	61	6·9	62·	6,900
Above 30 „ .	2,028	49	2·4	28	1·4	57·	1,400

We see here an astounding difference between the vaccinated and the unvaccinated in respect of two distinct things:

(*a*) The liability to attack.

(*b*) The fatality amongst the attacked.

Let us now divide the above into cases under ten years of age, and cases above ten.

Under Ten Years of Age (excluding infants under three months)

Of 68,236 vaccinated persons, 353 took small-pox and 6 died; *i. e.* 0·5 per cent. and 0·009 per cent.

Of 2259 not vaccinated, 228 took small-pox and 100 died; *i. e.* 10·1 per cent. and 4·4 per cent.

Thus the vaccinated under ten enjoyed a 20-fold im-

munity from attack and a 480-fold security against death as compared with the unvaccinated under ten.

Above Ten Years of Age

Of 196,905 vaccinated, 3774 took small-pox and 194 died; *i. e.* 1·9 per cent. and 0·1 per cent.

Of 3429 not vaccinated, 322 took small-pox and 174 died; *i. e.* 9·4 per cent. and 5·1 per cent.

Or the vaccinated above ten years had a 5-fold immunity from attack and a 51-fold security against death as compared with the unvaccinated.

But of the *twice-vaccinated* only 0·3 per cent. had small-pox and only 0·008 per cent. died; *i. e.* the twice-vaccinated had a 31-fold immunity from attack and a 640-fold security against death as compared with the unvaccinated.

The attack-rate—

per 1000 in the	twice	vaccinated	=	3,	and the	death-rate	= 0·08
„	„	once	„	=19	„	„	= 1
„	„	not	„	=94	„	„	=51

The far higher fatality amongst the unvaccinated teaches us that the attacks were severer in this class, even amongst those who recovered. And, conversely, the far lower fatality amongst the vaccinated indicates that the course of the disease was far lighter amongst the vaccinated. But a more crucial test was applied, viz. an analysis of persons living in *houses invaded* by small-pox.

C. *Persons in Invaded Houses*

(*a*) *All Ages* (excluding children under three months)

Of 18,020 vaccinated, 4151 (= 23 per cent.) had small-pox and 200 (= 1·1 per cent.) died.

Of 736 not vaccinated, 552 (= 75 per cent.) had small-pox and 274 (= 37·2 per cent.) died.

(*b*) *Under Ten Years* (excluding children under three months)

Of 4493 vaccinated, 353 (= 7·8 per cent.) had small-pox and 6 (= 0·1 per cent.) died.

Of 263 not vaccinated, 228 (= 86·9 per cent.) had small-pox and 100 (= 38·1 per cent.) died.

(*c*) *Above Ten Years*

Of 13,435 vaccinated, 3774 (= 28·1 per cent.) had small-pox and 194 (= 1·4 per cent.) died.

Of 469 not vaccinated, 322 (= 68·6 per cent.) had small-pox and 174 (= 37·1 per cent.) died.

The immunity of the vaccinated, compared with the unvaccinated, was—

At all ages, 3-fold from *attack*, and 33-fold from *death* when attacked.

Under ten years, 11-fold from *attack*, and 381-fold from *death* when attacked.

Above ten years, 2½-fold from *attack*, and 26-fold from *death* when attacked.

We have information regarding certain special classes in Sheffield.

D. *Special Classes*

(*a*) Of 161 *attendants in small-pox cases* (in five hospitals and infirmaries), 18 had had small-pox previously; none of these were attacked. 62 were once vaccinated in infancy; 6 took small-pox, 1 died. 81 had been revaccinated; not one took small-pox.

(*b*) Of 830 *soldiers*, all nominally revaccinated, 12 took small-pox, 1 died. *In all* 12 *the revaccination had been unsuccessful.*

(*c*) Of 372 *police*, up to February 10, ten (not revaccinated) took small-pox. Then a general order for revaccination was issued, after which there were no more cases.

(*d*) Of 290 *post office* men and boys on permanent staff (under the General Post Office regulations all such had been revaccinated on entering the service), none contracted small-pox.

The Saving of Life by Vaccination in Sheffield

(*a*) Under ten years.—Amongst the vaccinated the deaths were **6** by the end of March, **9** by the end of the epidemic. But for vaccination (judging by the behaviour of the unvaccinated under ten years) these figures would have been **3000** and **4400** respectively.

(*b*) Above ten years.—We cannot give a numerical estimate with such certainty, because in the last century a survived attack of small-pox protected against a future attack better than vaccination in infancy protects. But revaccination was shown in this epidemic to afford a protection against small-pox equal to that given by small-pox itself.

2. *Chemnitz*

The only other city in which a special census of the whole population was made, in order to ascertain the exact proportion of the vaccinated to the unvaccinated, is Chemnitz. Dr Flinzer tabulated very elaborate statistics about Chemnitz during the epidemic of 1871. As they fully bear out the results we have already seen from the examination of Sheffield, and as they are to be found in the Reports of the Royal Commission, I refer the reader to these, especially as the Chemnitz figures are not so complete as the Sheffield, inasmuch as only two age-classes are given, viz. above and under fifteen years respectively. The following figures were cited before the German Commission. In Chemnitz, in 1871—

Of 4652 persons who had had small-pox before, 2 were attacked by it: 0·04 per cent.

Of 1928 revaccinated persons, 16 were attacked by it: 0·8 per cent.

Of 54,981 vaccinated, including revaccinated persons, 802 were attacked by it: 1·5 per cent.

Of 5712 not vaccinated persons, 2546 were attacked by it: 54·6 per cent.

The whole population of Chemnitz numbered 64,255.

3. *Von Kerchensteiner's Bavarian Statistics* (1871–2)

No special census was made here, but both Dr Koch and von Kerchensteiner asserted that the unvaccinated were only about one half per cent. of the population. Dr Boeing's estimate of 4 per cent. does not show much difference. In fact, Bavaria was considered one of the best vaccinated countries in Europe as far as primary vaccination goes. The small-pox attacks numbered 30,742; the deaths, 4748. Of the persons attacked, 29,429 were vaccinated persons (95 per cent.). After all, the cases were only 0·68 of the population (1 in 150 nearly); whereas in former times they had formed as many as 10 per cent. Examination showed the following general results:

In the revaccinated the fatality was 5 per cent.; in the once vaccinated, 14 per cent.; in the unvaccinated, 45 per cent.

Of the unvaccinated patients, at least seven eighths were children under one year. He had the age-classes.

Dr Boeing (an opponent of compulsory vaccination) estimated that the unvaccinated formed 4 per cent. of the population, and that the fatality was thus:—in the twice vaccinated, 8 per cent.; in the once vaccinated, 30 per cent.; and in the unvaccinated, 60 per cent. The reader must remember that this was some years before revaccination was made general throughout

Germany by law, and that therefore we have no guarantee for the quality of the revaccinations.

Dr Koch said that it had been a matter of surprise that so much small-pox had shown itself in such a well-vaccinated country as Bavaria, but this was the very reason why they had adopted compulsory revaccination. "It was seen that primary vaccination, though most carefully carried on in Bavaria, was quite insufficient" (German Vaccination Commission Report).

4. *Nurses in Small-pox Hospitals*

I regard the evidence under this head as of very great value, because nurses in small-pox hospitals are perpetually exposed to the contagion of small-pox. Their hospital life is passed in its atmosphere.

Dr Collie writes thus (Quain's 'Dict. of Med.'):—"During the epidemic of 1871, 110 persons were engaged in the Homerton Fever Hospital in attendance on the small-pox sick; all these, with two exceptions, were revaccinated, and *all but these two escaped small-pox*. . . .

"The experience of the epidemic 1876–7 was of the same kind; all revaccinated attendants having escaped, whilst the *only one* who had not been revaccinated took small-pox and died of it.

"So, in the epidemic of 1881, of 90 nurses and other attendants of the Atlas (Small-pox) Hospital Ship, *the only person* who contracted small-pox was a housemaid who had not been revaccinated." (The italics are my own.)

This testimony is so remarkably forcible that many attempts have been made by the opponents of vaccination to upset it in various ways—some honest, some dishonest.

It is dishonest to argue thus:—Either a nurse has small-pox or she has not small-pox. If she has, she becomes a patient, and is no longer a nurse, but is reckoned among

the patients; if she has not, she remains where she is. For my part, I cannot bring my mind even to imagine that the medical superintendents of our small-pox hospitals are abandoned liars, as they must be if this is true. I prefer to regard them as men of honour. But a Vaccination Committee was recently appointed by the Epidemiological Society to examine into and report on these "nurses' statistics" (see 'Trans.,' vol. v, new series), confining its attention to those "in practical attendance on cases of small-pox." The committee reported that out of 1500 such attendants **43** *contracted small-pox, "and not one of these* 43 *had been revaccinated."*

Further, of 734 nurses and attendants in the Metropolitan Board Hospitals—

79 had had small-pox previously to their entrance; they escaped.

645 were revaccinated on entrance; not one took small-pox.

10 *escaped revaccination, and the whole* 10 *took small-pox.*

It is at least an honest objection that nurses get "seasoned" to small-pox. But it is not true. They have no time to get "seasoned" to it gradually; they enter its atmosphere at once. And as to other infective fevers, Dr Collie says, "The only way in which nurses become seasoned against fever is by taking the disease, which they all do unless they have had it before" (Dr McVail, 'Vaccination Vindicated').

5. *The Post Office Service*

All persons on the permanent staff of the Post Office are required to undergo vaccination on entrance, unless it has been done within seven years previously.

Out of over 10,000 employés not one died of small-pox

in the 1871 epidemic, nor in the whole period 1870—1880, and there have been only ten slight cases.

6. *Dr Siegel's Leipzig Statistics* ('Report of German Vaccination Commission')

Owing to an anti-vaccination agitation in 1869 only 30 per cent. of the children were vaccinated, and in 1870 only 15 per cent. Then comes the great epidemic, and the deaths were 2500 in a population of 200,000.

Of the total number of attacks 3881 were medically observed and reported fortnightly (amongst these observed cases there were 721 deaths). Of these 3881 cases 1600 belonged to children under fifteen years, of whom—

1350 were not vaccinated; the deaths were 488: 36 per cent. fatality.

250 were vaccinated persons; the deaths were 8: 3 per cent. fatality.

Of these eight cases, in two there was a doubt about the success of the vaccination.

The 250 cases were mostly extremely slight.

The 1350 cases were as a whole severe cases, as, indeed, the mortality shows.

7. Dr Eulenburg related to the German Vaccination Commission that a man in Posen had his workmen (150) all vaccinated except one, who refused; this one alone of the 150 soon after had small-pox, and died of it.

Korosi cites a similar instance in the Budapest garrison.

IV. The Geographical Argument

This argument, though indirect, is very powerful. It consists in contrasting well-vaccinated countries with badly vaccinated countries.

1. The German Statistics, 1884

The following statistics were prepared by the Imperial Sanitary Bureau, Berlin, for the use of the German Vaccination Commission of 1884, to show the effect of the law of 1874, which made revaccination compulsory during school age throughout the empire, in addition to vaccination in infancy.

Now these statistics are so striking, and form such a convincing body of evidence in favour of vaccination followed by revaccination, that the opponents of vaccination in this country have tried to minimise their influence by asserting that compulsory revaccination was a general practice in Prussia long before 1874. They have even brought forward an old law containing provisions for the prevention of infectious diseases generally, and including regulations as to revaccinations in Prussian boarding schools, as well as in the army. Of course we know that the vaccination of all recruits on their joining the Prussian army was compulsory ever since 1831, or thereabouts; and it is true that in some isolated districts—*e. g.* in the Jaxt district of the adjacent kingdom of Würtemberg—all school children at the age of thirteen were revaccinated for twenty years before the law of 1874. But this law first made the practice general throughout the whole German empire. What say the Germans themselves about this law? I quote from the official report of the Commission of 1884, literally translated.

(*a*) Dr Koch (Herr Geheimer Medicinal-Rath Professor) spoke as follows: "The design of the tables is to illustrate the effect of the law of 1874, and it is presumed that every reader will understand by the term 'compulsory vaccination' the compulsion ordained by the vaccination law of Germany, viz. the compulsion to vaccination and revac-

cination. And this compulsion exists in Germany alone; no other country has a compulsory vaccination of the kind."

(*b*) Again, p. 107 (the same speaker): "Dr Boeing says that he has not been answered as to the fact that in Bavaria in 1871–2 a well-vaccinated population suffered severely from small-pox. I will repeat what I believe I have already said on this point, so as to make the matter perfectly clear. The Bavarian population was certainly well vaccinated, but only in regard to the first vaccination (in infancy); it was not revaccinated, because at that time unfortunately the compulsory vaccination law was not in existence. We are all agreed that the protection which the first vaccination gives only lasts a short time. . . . . It only showed that the vaccination which we formerly had was insufficient, and that it must be perfected by revaccination. Since this took place small-pox has all but disappeared from Bavaria, as we have already heard." This quotation is a long one for the sake of the context.

(*c*) Von Kerchensteiner says (p. 95), "It has been said that in Bavaria, although vaccinated—I mean by this simple (a single) vaccination up to the year 1874, from thence onwards vaccination in Herr Geheimrath Koch's sense of the word— . . ."

(*d*) But strongest of all comes the testimony of an opponent of compulsory vaccination on the Commission, viz. Dr Boeing (p. 39): "*Wir haben vor* 1874 *im Preussen auch kein Impfgesetz . . . . sodann ist der Einfluss der Revaccination, den wir erst seit* 1875 *haben, kein grosser;*" which being interpreted is, "We have in Prussia no vaccination law before 1874, ... so that the influence of revaccination, which we have first from the year 1875, is no very great one." (I may as well give his reason; it is that up to that year, 1884, only the age-class from twelve to twenty-one years was affected by the law, an age naturally

least affected. That may be, but a striking change then took place, and has persisted ever since.)

To argue that Prussia, or any other kingdom of Germany, had compulsory revaccination generally enforced before 1874 is worse than stupid; it is a deliberate untruth. But the statement is still made from time to time in this country.

(*e*) Once more Koch (p. 46): "The same thing is seen when we compare the statistics of mortality of one and the same country, *e. g. Prussia, before and after the introduction of revaccination by the vaccination law of* 1874."

Dr Arthur F. Hopkirk gave the following evidence before the Royal Commission appointed in 1889:

"In 1834 a law was passed making vaccination and revaccination compulsory on all soldiers in the Prussian army, but there was no law making vaccination itself compulsory for the civil population of Prussia until the 8th of April, 1874, a law which came into action in 1875.

"In 1835 there was in Prussia an ordinance passed dealing with cases of infectious diseases, which declared that should any child suffer from small-pox, then its parents or guardians might be punished; but there was no law rendering it absolutely compulsory that every child should be vaccinated.

"Before 1874 . . . the printed law was only for schools where nothing was paid; where the children paid there was no compulsion; and what compulsion there was was only indirect, the word of the parents being sufficient."

Text accompanying the statistical charts (prepared by the Kaiserliche Gesundheitsamte, Berlin, for the German Vaccination Commission, 1884):

"The most reliable index of the prevalence of small-pox is afforded by the mortality therefrom. In order to learn

the effect of the vaccination law, which has introduced compulsory vaccination as a means of protection against small-pox, we may statistically compare—

"(1) The small-pox mortality of an entire country after the introduction of such law with that mortality before its introduction.

"(2) The small-pox mortality of a country with compulsory vaccination with that of a country without compulsory vaccination.

"(3) The small-pox mortality in large cities with compulsory vaccination with the same mortality in large cities without compulsory vaccination.

"Reliable returns as to small-pox illnesses as distinguished from the deaths can be derived only from army statistics, and they are very useful in assisting us to form a judgment on the subject. We may therefore compare—

"(4) The number of small-pox illnesses in an army in which revaccination is rigidly performed, and which enjoys the relative protection afforded by a well-vaccinated community, with the small-pox morbidity of such armies as are scantily revaccinated, and which are surrounded by badly vaccinated populations.

A. Prussia.—*Before and after the Vaccination Law of* 1874

The deaths from small-pox per 100,000 living each year for the period 1816–82 were—

1816–30.—45, 27, 29, 20, 10, 17, 20, 19, 14, 15, 14, 25, 19, 19, 24.
1831–50.—11, 30, 60, 48, 27, 18, 15, 16, 14, 16, 14, 22, 28, 27, 15, 15, 9, 13, 10, 15.
1851–70.—12, 18, 39, 43, 9, 7, 13, 26, 19, 18, 30, 21, 33, 46, 43, 62, 43, 18, 19, 17.
1871–72.—243, 262 (the great epidemic). 1873–4.—35, 9.
1874—(Revaccination of general population in school age made compulsory.)
1875–82.—**3·6, 3·1, 0·3, 0·7, 1·2, 2·9, 3·6, 3·6.**
1883–86.—4·00, 1·5, 1·4, 0·5.

"Here we see that during the whole period 1816–70 the small-pox mortality was fairly steady, but temporarily raised by a mild epidemic outbreak every ten or twelve years. The average annual mortality between these outbreaks lay between 15 and 20, or 15 and 25, while during the epidemic periods it rose for two years or so at a time to 40 or 50, or even 60."

In 1871–2 occurred the frightful epidemic in connection with the war.

In 1873–4 the mortality rapidly sinks, as usual after severe epidemics.

In 1874 revaccination at the age of twelve years became compulsory.

From 1875 onwards the influence of this law becomes apparent; for while without this law the small-pox mortality would soon have reached its old figures, it now fell to, *and has persistently remained at*, a lower figure than any since the beginning of this century. That this striking diminution was really the consequence of compulsory vaccination, and not merely an effect of the great epidemic, is proved in the following table:

B. Austria.—*Small-pox Deaths each Year from* 1842 *to* 1881 *per* 100,000 *living*

1842–43–44.—20, 16, 13.
1845–46.—Data are wanting.
1847–71.—14, 18, 21, 15, 26, 25, 51, 59, 62, 31, 36, 56, 44, 23, 22, 31, 53, 84, 45, 36, 47, 33, 35, 30, 39.
1872–74.—189, 323, 178 (the great epidemic).
1875–76.—57, 39 (the usual decline).
1877–81.—**53, 60, 50, 64, 82.**

"Previously to 1871 small-pox mortality in Austria behaved much like that of Prussia, though higher on the whole. The great epidemic of 1872–3–4 was more fatal and lasted longer than in Prussia. During the next two years the mortality fell as usual after epidemics. Here

the influence of the epidemic in lowering the mortality ceases, and the latter *rises at once to its old figures*, as before the epidemic period, and even higher. The rise was not merely a temporary rise.

"The remarkable and persistent decline in Prussia since 1875 can only be due to the vaccination law of 1874, because all other conditions remain the same in the two countries. The only difference is that in Prussia the re-vaccination of all children at the age of twelve years was made compulsory in 1874."

C. German and Foreign Cities contrasted

The following are the deaths from small-pox each year per 100,000 living:

Foreign Cities

London (1870–82).—30, 242, 53, 3, 1·6, 1·3, 20, 70, 38, 12, 12, 61, 11.
Paris (1872–82).—5, 0·9, 2, 13, 20, 6, 4, 45, 108, 49, 29.
Vienna (1870–82).—46, 74, 536, 228, 135, 113, 167, 84, 75, 46, 73, 123, 108.
St. Petersburg (1878–82).—144, 142, 21, 28, 77.

German Cities

		Compulsory Revaccination.
1870–82.—		
Berlin . .	22, 632, 138, 11, 2,	5, 1·8, 0·4, 0·7, 0·7, 0·8, 4·7, 0·4.
Hamburg	25, 1075, 95, 0·8, 0·5,	0, 1·8, 1·2, 0·2, 0, 0, 2·2, 0·4.
Breslau .	13, 356, 282, 13, 0·8,	0, 0, 0·7, 1·5, 0·3, 0·7, 1, 3·2.
Dresden .	9, 360, 85, 13, 4,	2·5, 0·5, 0·9, 0, 1·8, 3·6, 2·6, 1·3.
Munich .	? 88, 61, 2·9, 1,	0, 0·5, 0, 0·9, 0, 0, 10·3, 2·9.

"Both German and other cities suffered severely in the epidemic of 1871–2. But whilst in all cities outside Germany the small-pox mortality, after a temporary decline, rose to a considerable height, in all the large German cities, as in Germany generally, it has remained persistently at strikingly low figures. Hardly a better illustration of the effect of the compulsory (re)vaccination law of 1874 can be afforded than by contrasting together, *e. g.*, London and Berlin:

	1870–4.	1875–82.
London . .	30, 242, 53, 3, 1·6,	1·3, 20, 70, 38, 12, 12, 61, 11.
Berlin . . .	22, 632, 138, 11, 2,	5, 1·8, 0·4, 0·7, 0·7, 0·8, 4·7, 0·4.

"The same startling contrast appears when, *e. g.*, Breslau and Vienna are compared."

D. Comparison of Armies

Small-pox Illness and Deaths per 100,000 *Strength*

French Army

1867–69.—Attacks: 231, 633, 372.
Deaths: 18, 42, 22.
1870–71.—Returns are wanting.
1872–81.—Attacks: 60, 27, 39, 141, 230, 222, 213, 115, 153, 111.
Deaths: 10, 4, 3, 17, 28, 19, 20, 9, 15, 8.

Austrian Army

1870–79.—Attacks: 687, 815, 1798, 1658, 1003, 336, 274, 412, 344, 303.
Deaths: 17, 40, 101, 108, 67, 21, 10, 25, 15, 22.

Prussian Army

1867–69.—Attacks: 74, 38, 43. In 1870, 1st half, attacks = 30
Deaths: 0·8, 0·4, 0·4. „ „ deaths = 0·0.
1870–71.—(Deaths in brackets) 565 (33). In 1871, 2nd half, 684 (27).
1872.— „ „ 161 (5·6). In 1873, 1st quarter, 36 (2·6).
1873–74 „ „ 7·3 (0·3) (*i. e.* with the 1st quarter of 1874).
1874–82.—Attacks: 8·3, 6·4, 6·3, 4·8, 4·5, 2·1, 6·9, 4·5, 2·2.
Deaths: **none** in the whole period.

"Like the general populations of the countries in question, the armies suffered severely during the great epidemic of 1870–1. During the Franco-Prussian war the German suffered far less from small-pox than the French army, although in France it came into contact with a population amongst which small-pox was rife.

"The war itself, with its fatigues and privations, could not have caused the great increase in the small-pox mortality, for the Austrian army suffered even still more severely in the same epidemic.

"The harmful influence of being surrounded by a community affected by small-pox, and the relative protection afforded by being amongst a community free from this disease, are at once evident on comparing the small-pox morbidity in the German army before and after *the law of* 1874, *which made revaccination compulsory throughout the whole population;* for it must be admitted that revaccination had already been practised in the German army with a fair degree of carefulness for several decades previously.

"It is worthy of remark that since 1874 not a single death from small-pox has occurred in the German army, while both the Austrian and French armies still show a very high small-pox mortality. No other reason than the influence of a rigidly adopted system of primary and secondary vaccinations can be made to account for the astonishing difference between the German and other armies as regards small-pox."

General Remarks.

"In the preceding tables statistical principles have been rigidly adhered to. Collective populations are compared with collective populations, cities with cities, and armies with armies. Moreover the subjects of comparison are numerically so vast, that the errors inevitably connected with smaller figures are eliminated.

"In Germany, as a whole, small-pox has diminished to a degree never before known, so far back as any records go; whilst in all neighbouring countries it is still very prevalent, as usual.

"The German cities scarcely suffer from small-pox at all, which in all foreign cities still continues to claim its victims.

"Lastly, the German army is almost entirely free from

small-pox, whereas the Austrian and French armies still suffer severely."

The reader will now understand, if he has taken the trouble to read the foregoing figures and text, why the anti-vaccinists of this country make such a fight about the date of the adoption of compulsory revaccination in Germany. Nothing that I could say would add any force to the well-written text which accompanies the statistics, except that the good effect still continues. The deaths per million from small-pox in Germany during the three years 1886–8 are **3**, **3**, and **2**; and most of the deaths occur on the frontiers, close to badly vaccinated populations. The cases are all sporadic, epidemics being unable to gain a footing.

2. The Epidemic of 1870–4. How it affected various Countries

The following figures are from the 'Kritik der Vaccinations-Statistik,' by Herr J. Korosi, chief of the Hungarian Statistical Bureau. It must be premised that Prussia was a badly vaccinated country previous to this epidemic—being then as far behind England as she is now before England, as regards vaccination.

Small-pox Deaths per Million living in the two worst years of the Epidemic of 1870–1. (Korosi)

Comparatively well-vaccinated countries:—Scotland (1871–2), 1470; England (1871–2), 1830; Sweden (1873–5), 1660; Bavaria, 1660.

Comparatively badly vaccinated:—Prussia (1871–2), 5060; Holland (1870–2), 5490; Austria (1872–4), 6180.

In the first four countries compulsory primary vaccination had been long in use, though not enforced rigorously in England, the necessary arrangements not being then in

existence. In the three latter countries general compulsory vaccination was practically non-existent.

Comparison for the Epidemic, 1871–2

The share of total small-pox mortality borne by children under five, in certain groups of affected towns in countries with differing Vaccination Laws (Dr Thorne Thorne, 1st Report, Royal Commission, 1889, &c.):

	Small-pox Rate per 100,000.	The *Deaths under 5 yrs.* form the following percentages of the *Deaths at all ages.*	Prevailing Vaccination Laws.
Holland— 8 chief towns . 1871–2	1009	60·7	"No general vaccination law. Indirect compulsion at school age."
Prussia— Berlin & Leipzig 1870–2	772	46·6	"Law only nominal for infants. Practically no compulsion till school age. No penalty unless small-pox followed neglect."
London 1871–2	297	36·7	"Imperfect but improving machinery of law, requiring vaccination at three months of age in towns."
17 unions . . . 1871–2	312	34·3	
Scotland— 8 chief towns . 1871–2	223	23·7	"More efficient law, operating at six months of age, and achieving annually, since January 1st, 1864, 96·5 (vaccinations) per 100 births."

In Holland, with the worst vaccination, the children contribute 60 per cent. of the small-pox deaths. Their contribution steadily declines in countries with better vaccination laws, down to 23 per cent. in Scotland, with the best vaccination.

3. Comparison of Countries in Recent Times

(Arbeiten aus dem k. k. Gesundheitsamte, Bd. ii, Dr. Rahts)

During the three years 1885–6–7 the average annual number of deaths from small-pox per million living was—in Sweden, 2; in Germany, 5; in England, 53. (The figure for 1888 is 2.)

Sweden is the home of compulsory vaccination; Germany has compulsory revaccination; England has compulsory vaccination in infancy only.

In the following countries, general compulsory vaccination (even in infancy) does not exist, and the corresponding figures are—for Switzerland, 167; Belgium, 184; Austria, 371; France, 389; Italy, 506; Hungary, 1184.

Reader, look on this and look on that. You have a group of countries with shameful neglect of vaccination and very high small-pox mortality, and you have another group of countries with stringent vaccination laws and very low small-pox mortality.

Inasmuch as small-pox is chiefly prevalent in towns we will add the following statistics of most of the towns and cities of Europe, from an article by Regierungsrath Dr Rahts, in the 'Arbeiten aus der k.k. Gesundheitsamte:'

4. Comparison of European Towns in Recent Years

Small-pox Deaths per 100,000 *Population*

		1886.		1887.		1888.
Germany . .	194 towns	0·4		0·4		0·4
Switzerland .	15 „	21·8		—		0·8
England . . .	28 „	7·7		3·6		6·4
Belgium . . .	71 „	19·4		4·1	(69 towns)	9·5
France	51 „	—		31·0		—
Austria	49 „	32·5	(52 towns)	36·9		54·2
Hungary . . .	12 „	242·8	(29 towns)	129·0	(12 towns)	11·9

The results of compulsory revaccination are here plain enough.

In 1886 the English twenty-eight towns showed a mortality 19-fold that of German towns; in 1887, a 9-fold mortality; in 1888, a 16-fold mortality.

The corresponding Belgian figures are 48-fold, 10-fold, and 24-fold; the Swiss are 54-fold in 1886, 2-fold in 1888; the Hungarian are 607-, 322-, and 30-fold (!); the Austrian are 81-, 92-, and 136-fold (!).

CHAPTER III

OBJECTIONS AGAINST THE STATISTICAL EVIDENCE IN FAVOUR OF VACCINATION

No deductions have as yet been drawn by the writer from the preceding evidence in a systematic manner. Some reasonable objections will first be considered, and answered one by one.

First Objection—Sanitary Improvements

It is argued that the proved decline of small-pox since vaccination came into use is not due to vaccination, but to improvements in general sanitary arrangements. The population of to-day is a healthier population than that of a hundred years ago; the death-rate from all causes is much lower than it was, even in the beginning of the registration era. In particular "fever" has declined very much. Our sewage arrangements are better, our drinking water is purer, the inspector and the analyst are abroad, and generally we are healthier than our forefathers, and live longer. The opponents of vaccination go on to say

that these improvements have had the main share in reducing the mortality from small-pox.

(*a*) But all this argument is at once disposed of by the following reasoning of the Registrar-General ('Report of the Royal Commission on Vaccination' (1889), vol. i). I must apologise for bringing forward any more statistics, but I beg my readers to study carefully the following little table and its title.

Mean Annual Deaths from Small-pox at successive Life Periods per Million living at each such Life Period, 1847–87

	All Ages.	Under 5.	5—10.	10—15.	15—25.	25—45.	Above 45.
In 1847–53 (Vaccination optional)	305	1617	337	94	109	66	22
In 1854–71 (V. obligatory but not enforced)	223	817	243	88	163	131	52
In 1872–87 (V. enforced)	114	242	120	69	122	107	47

Here we see that the fall in small-pox mortality shown for "all ages" *took place exclusively in persons under* 15 *years of age*, and most of all in children under 5 years, in which class the fall is 85 per cent., in the next class 64 per cent., in the next 27 per cent.

In the next class (15 to 25 years) there is actually a *rise of* **11** per cent.; in the next (25 to 45 years) the *rise is* **62** per cent., and above 45 years the *rise is* **113** per cent. That is to say, for every 100 children under 5 who died of small-pox in the period 1847–53 only **15** children died in the period 1872–87; but for every 100 persons above 45 who died in the earlier period **213** persons above 45 died

in the later period. This settles the sanitary improvements argument, because such an influence would affect the mortality *at all ages alike*, instead of which we have here directly contrary and striking changes at different ages. The general death-rate (from all causes) fell only 6 or 7 per cent., while the small-pox rate fell 85 per cent. (in the first life-period). As an example of a disease which has been really affected by sanitary improvements take "fever," which has also declined very much, like small-pox, and observe its behaviour at different ages.

Fever, Decline of, at various Life-ages

	All Ages.	0—5.	5—10.	10—15.	15—25.	25—45.	Above 45.
Average rate—							
In 1847–53 .	1139	1512	1118	911	1103	910	1388
In 1854–71 .	870	1297	933	713	807	656	972
In 1872–87 .	367	426	379	344	431	327	323

"The fever fall has been, as one might have expected, at all ages; in small-pox the decline has been only (in persons) under 15" (Registrar-General).

At ages above 45 the fall has been even greater than in early childhood (see table).

(*b*) Fever is a vague term which was formerly used by medical men to cover a multitude of diseases. The Registrar-General says, "In former times a great deal was called fever that was not fever."

Dr Thorne Thorne handed in to the Commission the following table showing the very great alterations in the figures for one class of *fevers* (remittent) in the Registrar-General's reports, "to illustrate the fallacy of dealing with death-rates and shares of mortality when the definition of 'fevers' as a group is not constant."

Remittent Fever (actual) Deaths

	Period.	At all ages.	Under 5 years.
In the 7 years	1874	79	—
	1875	70	1
	1876	48	—
	1877	81	—
	1878	90	—
	1879	82	—
	1880	76	—
But in the next 7 years	1881	239	154
	1882	246	152
	1883	194	132
	1884	177	109
	1885	138	87
	1886	127	72
	1887	93	59

"The deaths at ages under 5 ('infantile remittent fever') would appear to have been *placed with enteric fever before* 1881; since when they have gone along with 'remittent fever' at ages over 5 into the class of malarial diseases" (1st Report Royal Comm.).

It is only in comparatively recent times that typhoid fever (enteric fever) was separated from typhus fever (jail fever, famine fever); and it was only after this separation that its predisposing causes and chief modes of dissemination could be properly studied. This study showed that typhoid spreads chiefly by contamination of drinking water with the excreta of typhoid patients, not by direct contagion, as in the case of typhus. The great care now shown by the governing bodies of most towns, both in procuring a water supply as pure as possible and in providing for efficient sewage arrangements, has had the happy effect of enormously reducing the mortality from typhoid. Typhus is another "filth disease," chiefly due to famine and overcrowding, and it is fast dying out under the influence of improved sanitation. Thus we have two causes for the remarkable decline in fever, viz. im-

proved diagnosis by medical men—who now seldom use the term "fever" by itself—and improved sanitation. In other words, special causes have been at work here, as a special cause has been at work in the case of small-pox.

The only other zymotic diseases for which we have separate returns since 1838 are measles and whooping-cough, and they are found to be almost as prevalent as ever; *they have not declined.*

The rates for	1851–60	1861–70	1871–80	1881–87 are:
For measles . . .	412	442	378	442
„ whooping-cough	503	527	512	449
„ scarlet fever .	876	972	716	378
„ small-pox . .	221	163	236	59

Thus "improved sanitation" has had no influence on measles and whooping-cough, but some special cause has had an astonishing influence in reducing the small-pox rate, and this cause cannot possibly be improved sanitation. Scarlet fever has declined in the last two decades, owing, Dr Thorne Thorne thinks, to stricter isolation, and the greater use of hospitals for that purpose.

(*c*) The comparison of Germany with Austria (see p. 36) is an additional argument, for both countries have shared in any sanitary improvements.

So much for the first objection.

Second Objection—Natural Decline of Small-pox

Plague has died out of Europe, and so has sweating sickness, two diseases once very fatal in England; why may not small-pox be dying out from causes unknown to us?

Unfortunately for this objection, the fact is that small-pox is not dying out, but is still the cause of enormous loss of life *in those countries which have no stringent compulsory vaccination laws* (see above, 'Comparison of countries in the years 1885–6–7,' p. 43). And those who

know tell us that this disease is apparently more fatal now than in the last century.

Third Objection—Age-classes

This is now an obsolete objection, but it may as well be mentioned and disposed of. It is an objection which Dr Wallace enlarges upon, and it is this:—Statistics show that most of the cases of small-pox amongst the unvaccinated occur in young children under the vaccination age. Now small-pox is very fatal at this early age, and therefore the deaths amongst the unvaccinated are more numerous than they otherwise would be. And Keller's Austrian railway statistics are said to show that if the cases be divided into age-classes, so that we can confine our attention to later ages than infancy and early childhood, the vaccinated and unvaccinated show an almost equal fatality.

The reader must bear in mind that this objection relates only to the fatality of small-pox amongst the vaccinated and unvaccinated respectively, and does not affect in the least those statistics which deal solely with small-pox mortality in any country or town apart from reference to the vaccinated or unvaccinated condition of the patients. Further, it has already been abundantly refuted in anticipation (see the table of age-classes in the Sheffield epidemic on p. 25).

The Sheffield epidemic teaches us that, *confining our attention exclusively to persons above ten years of age*, the deaths were **51**-*fold* more numerous amongst the unvaccinated than the vaccinated (Dr G. Buchanan's letter). This refutes the age-classes objection.

It is true that the mortality among the unvaccinated is highest among the very young unvaccinated, while it is lowest among the very young vaccinated. The contrast is

most striking at this age, but the contrast is striking at all ages, that is all that can be said.

But a few words on the celebrated statistics of Keller. English anti-vaccinists, who seem to differ somewhat in their modes of warfare from their brethren on the Continent, have made a great fuss about Keller, and have written whole pamphlets about him. But it is my duty to be pitiless upon them in the cause of truth, perhaps to open the eyes of some of them. To begin with, the "sanitary" medical men of Vienna, the Stadtphysicat, went over the very same ground as Keller, and brought out quite opposite results, *i. e.* they found that the evidence told strongly in favour of vaccination. Again, Keller's results are not based on sound statistical principles, for he deduces percentages of deaths from one actual death, or two or three deaths—a ridiculous procedure, which has been aptly called by the anti-vaccinists themselves the "percentage swindle."

But worse remains behind. Herr Korosi in 1887 went over the whole ground again, and found that KELLER DIRECTLY FALSIFIED THE RETURNS originally supplied to him by the railway surgeons. Korosi obtained from eight surgeons copies of their original returns; *all eight had been altered by Keller* so as to tell against vaccination. Keller's bias was well known in Vienna.

Dr Pichler, of Steiersdorf, had fortunately sent a copy of his return in 1873 to the Comitätsbehörde of Lugos; in his case Keller had altered the figures "68" to "38." At the International Medical Congress in Washington, 1887, a special committee was appointed to examine and report on Keller's statistics. The committee reported—and the signatures include that of Dr A. B. Arnold, President of the Section of General Medicine—that all the returns submitted to them were without exception "falsified in

such a manner as to raise the mortality from small-pox amongst the vaccinated while that of the unvaccinated was lessened." So there is an end of Keller's monstrous statistics, which occupy so prominent a place in Dr Russel Wallace's pamphlet against vaccination.

I may also mention Müller's Berlin statistics (giving age-classes), only to dismiss them in the same sentence by saying that they are so erroneous both quantitatively and qualitatively that Müller himself has repudiated them.

Fourth Objection—Lower Resistance of the Unvaccinated

Apart from the fact that the greatest mortality in small-pox amongst the unvaccinated occurs amongst young children—at least during severe epidemics—the unvaccinated at all ages are said to be weaker than the vaccinated. In the first place, only healthy children are vaccinated; the weaklings escape vaccination, and weaklings succumb more readily to small-pox or any other disease. In the second place, small-pox epidemics are found to affect the the poorest and most crowded quarters of cities, where all the conditions of life are unfavorable, more than the richer quarters. Now there are more unvaccinated among the poorer than among the richer classes. But whether the unvaccinated are more numerous amongst the poorest classes or not, they will succumb more readily to small-pox than those who are better off.

Such is the argument, and it is a perfectly justifiable one as far as it goes. But it does not go far.

In the Sheffield investigation each of the eight districts making up the borough was treated statistically as if it was a separate town,* so that an accurate comparison can be made between the richer and the poorer quarters.

* The Sheffield statistics already given (pp. 24—27) refer to *all Sheffield*. The statistics for each of the eight districts will be found

The fatality among the unvaccinated is found to be no higher in the more crowded parts than in the richer quarters. Even the *hospital fatality* among the unvaccinated is not above the average.

Sheffield—Fatality in Eight Subdistricts during Epidemic 1887–8. *Deaths per* 100 *Attacks in each of* 3 *Classes.*

District.	All Classes.	Vaccinated.	Unvaccinated.	
Attercliffe	9·7	5·2	39·1	
North Sheffield*	9·7	5	27·4	*General* mortality rate above the average here. Very crowded quarters.
Ecclesall	9·1	4·5	36·6	
Sheffield Park	8·7	4·6	33·3	
South Sheffield	12·2	4·4	37	
West Sheffield	13·1	5·9	30	
Brightside	8·2	4·6	31·3	
Nether Hallam	7·5	4·5	27.3	
Upper Hallam	7·7	8·3	0·0	
Total for Sheffield	9·3	7·7	31·1	
Cases treated in hospitals	14·2	8·1	32·7	

Dr (now Sir George) Buchanan tells us, in his report for 1881, that the children of the poor are better off as regards protection from small-pox than the children of the richer classes, because of the superiority of public over private vaccinations. (All *public* vaccinations are under the control of the Local Government Board, and the result is subjected to thorough periodical inspection. Special awards are made for high efficiency. Over *private* vaccinations there is no control, and the medical man is often tempted by anxious mothers to "vaccinate lightly." "Light" vaccination is a serious error.)

Fifth Objection—Small-pox Inoculation

This practice was extremely fashionable in the latter

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in the 'Report of the Royal Commission,' also in Dr Smith Barry's report.

* Roughly grouped together as *crowded* populations (not *largest*). A marked difference would be required to affect the argument.

part of last century, and was not made illegal till 1840. Some opponents of vaccination maintain that the great decline in small-pox mortality which ensued after the introduction of vaccination was due, not to vaccination, but to the discontinuance of inoculation of small-pox. The disease was milder thus acquired, but each inoculated person became a fresh centre of infection. There is some doubt amongst the learned in this subject as to whether or how far these inoculations increased small-pox mortality. It appears probable that they did so, and that a slight reduction in the mortality early in this century might fairly be ascribed, therefore, to this discontinuance. But that this cause could have had only a very slight share in the reduction of small-pox mortality when vaccination came in is negatived at once by the case of Sweden, where small-pox inoculations never became popular, but where the usual marked reduction of small-pox ensued upon the use of vaccination. Copenhagen is another instance resembling Sweden.

Sixth Objection—Doubtful Vaccinations

We know that the question whether a person has been successfully vaccinated or not cannot always be answered with certainty. It is maintained by some that the makers of statistics utilise these doubtful cases to favour vaccination. If such doubtful patients die of small-pox they are called unvaccinated; if they recover they are put amongst the previously vaccinated; in either case they support vaccination. Dr Lorimer makes this charge; Dr Wallace makes a great deal of it.

But the fact is that all conscientious statisticians do make a class for the doubtful cases. Dr Russell has a special class; so has Dr Gayton, with his table of over 10,000 cases; and Mr Marson included the deaths of the

"vaccinated, but no marks," amongst the admittedly vaccinated. In any case *the doubtful patients are very few* compared with the rest—far too few to make any appreciable difference in the results. This, again, is a trivial objection.

Seventh Objection—Chicken-pox Deaths

Chicken-pox by itself is never fatal, but every year deaths are registered as due to chicken-pox. It is objected that these are in reality small-pox deaths. Some, or even most of them may be so, and the Registrar-General accordingly gives a table of chicken-pox deaths from 1855 to 1887 (Report Royal Commission, vol. i).

Here they are, per million living, for each year:—3, 3, 2, 3, 2, 2, 2, 2, 3, 3, 2, 2, 2, 2, 3, 3, 3, 3, 3, 3, 5, 4, 5, 5, 4, 4, 5, 4, 3, 4, 3, 3, 3.

It is seen that these deaths are remarkably constant. If they are all considered as small-pox deaths, the rates for the two later of our three periods of successively more efficient vaccination will be 218, 119, instead of 154, 106.

I have now exhausted the list of reasonable objections against the statistical evidence for vaccination. There are, however, some unreasonable arguments—*ad captandum* statements—written to impress the ignorant. We are told that the Registrar-General's statistics about small-pox are unreliable, because they are "made up" by medical men who *are pecuniarily interested in keeping up vaccination*. Medical men do a good deal for nothing already, but I imagine that no one will expect them to vaccinate the nation *gratis*. As to certificates of death, they are *gratis* already! The anti-vaccinists do not honour themselves by making base imputations. It is true another reason is given why certificates of death from *small-pox* are unreliable, viz. because nearly twenty years ago a

medical man suppressed part of the truth respecting a death from *vaccination*—from the avowed, explicitly put motive of acting for the public good. But a death from *small-pox* is unmistakable for anything else, and the certificate of death is an open document, handed (*gratis*) to the relatives of the deceased, so that concealment of the truth is impossible here.

CHAPTER IV

ON THE NATURE OF THE PROOF OF THE ASSERTION THAT VACCINATION EXERTS A PROTECTIVE INFLUENCE AGAINST SMALL-POX

We have gone through our four arguments. The first was the argument from the personal experience of those qualified to judge. The other three—the historical, the geographical, and the incidence arguments—have each been supported by abundant statistics, embracing vast populations and many countries, and in every case (except the estimates of the population of London in the last century) derived from official sources, which admit of no cavilling. All the reasonable objections against the obvious inference from these statistics have been, I think, fairly presented and refuted, one by one. The question remains—Do the statistics *prove* that the reduction in small-pox mortality since vaccination is due to vaccination? This question goes down to the very basis of our methods of reasoning on things in general. It may perhaps assist if we call to our aid Stuart Mill's 'Canons of Induction,' and see how they apply. We all use these canons every day in every conclusion that we come to;

they are simply an analysis of the various ways or "methods" which connect a given effect with a presumed cause, or *vice versâ*.

The First Canon, or the Method of Agreement

The historical argument shows us that in every country where vaccination has been introduced a striking reduction of mortality has followed. Examples have been given (*vide supra*), and Sir J. Simon has given a table from official sources showing this; indeed, the fact of the reduction is not questioned. The countries agree in having only one circumstance in common likely to produce this result, viz. vaccination; this circumstance, then, in which they agree, is *probably* the cause of the proved result. The countries have other circumstances in common, it is true, *e.g.* improved sanitation, telluric changes, &c.; but the former influence has been conclusively shown to have had no part, or only an insignificant part, in the proved effect, and no one has invoked the latter as yet.

Again, the geographical argument shows us that several countries in Europe agree in being well vaccinated *compared with the rest of Europe* (see p. 43). These countries all show very little small-pox compared with the rest of Europe. They *agree* in having efficient vaccination, comparatively speaking, and this is the only circumstance in which they agree; it is therefore *probably* the *cause*.

The Second Canon, or the Method of Difference

This is the method of experiment.

As already said, in one or two countries there is good vaccination. In all the rest there is bad vaccination, real compulsory vaccination is non-existent. Small-pox deaths are a minimum in the former, but very numerous in the latter. These two sets of countries *differ* only in respect of good vaccination; they share pretty equally in

any sanitary improvements. Mill's second canon teaches us that this circumstance alone in which they differ is probably the cause of the observed effect.

The Fifth Canon, or Method of Concomitant Variations

i. e. increased or diminished effect with increase or diminution of the cause. As the cause gradually varies, the effect gradually varies *pari passu ;* their variations are "concomitant." This method is peculiarly applicable, and it may be used here in three different ways, viz. as to time, place, and degree.

(*a*) Considered as to *time*, we could not have a better example than England. Before vaccination came into use, the average small-pox rate was about 3000. Then follows the era in which vaccination was optional ; the average rate for 1838–53 (with four years omitted) is 417. Then comes enjoined vaccination (1854–71), with a rate of 154. And lastly, with enforced vaccination (1872–90), the rate is below 100. Thus with more and more vaccination we get less and less small-pox, that is to say, more and more increase of effect.

(*b*) Considered as to *place*, we can form a list of countries in three categories—thoroughly vaccinated, moderately vaccinated, and badly vaccinated. Germany is the only thoroughly well-vaccinated country in Europe ; then come together Sweden, Scotland, England, three countries which have compulsory vaccination in infancy only ; lastly, there are several large countries practically without compulsory vaccination. In Germany small-pox is a minimum ; in Scotland, Sweden, England, taking many years, there is more small-pox ; and in the countries without any compulsory vaccination small-pox mortality is still frightful to contemplate. Thus there is an exact gradation of effect corresponding to gradation of cause.

Where there is most vaccination there is least small-pox, and *vice versâ*. This is not theory, but fact.

(*c*) Considered as to *degree of vaccination* as indicated by the marks left on the arm, Dr. Gayton has distributed his cases in categories according to the excellence of the vaccination, and the following is a digest of over 10,000 cases of small-pox at every age in each category, treated by Dr. Gayton himself.

An Analysis of Dr. Gayton's 10,403 *cases of Small-pox showing the fatality according to the vaccination marks at each age*

Deaths per 100 *attacks in each age-class*

Ages.	Good Marks.	Imperfect Marks.	Vaccination nominal.*	Not Vaccinated.
0— 5	0·0	11·5	39·8	56·5
5—10	0·9	5	19·3	35·2
10—15	1·1	3·4	19·6	23·3
15—20	1·9	6·3	19·0	42·1
20—30	3·9	13·1	32·1	49·8
30—40	9·5	14·8	35	40·7
Above 40	12·5	19·1	33·5	43

1*st Report of Royal Commission.*

The above table *at every age* shows a remarkable and steady gradation of mortality according to the vaccination, a variation of effect in exact accordance with variation of the cause. Mill's fifth canon—in other words, methodized common sense—teaches us that vaccination is the cause of the extremely low mortality which the vaccinated show compared with the unvaccinated.

Thus whether the influence of vaccination on small-pox is *proved* or not by the preceding evidence *depends on what amount of proof* is required in this case. As Stuart Mill says, we cannot be absolutely certain that the sun

* "Nominal" means here—"said to have been vaccinated, but no marks visible."

will rise to-morrow, it is only *extremely probable* that he will rise. Far more proof is afforded for our proposition that vaccination confers more or less insusceptibility against small-pox than what suffices us for most of our conclusions in daily life, and infinitely more than what is required by our legislators for the various propositions upon which new laws are framed. *Of course* it cannot be directly proved that vaccination has ever saved a single human life. No one says it can. The very nature of the case prevents such proof. The historical argument by itself is indirect; the geographical argument by itself is indirect; the incidence argument, though direct, can never be applied to the whole population, and thus form the basis of national statistics on the subject; while the argument from personal experience remains a matter of personal experience.

But the preceding arguments, taken together, prove irresistibly—

(*a*) That vaccination in infancy exerts a strong protective influence against an attack of small-pox, and a still stronger influence against death from small-pox.

(*b*) That a repetition of vaccination (about the age of ten) renders the individual practically as safe from a severe attack of small-pox—only the severe attacks are dangerous to life—as if he had survived an attack of small-pox itself.

A Sketch of the Progress of Vaccination

The following are the main features of this progress—a proof in itself. During the last century there was a legend current, not in one place, but in many distinct places, that certain milkers who had had sores on their hands from milking cows that were affected by cow-pox enjoyed complete immunity from small-pox. One farmer in England actually vaccinated himself and family long before

Jenner. Jenner heard of this legend, and brooded over it for years and years, anxiously looking out for any cases of cow-pox in the neighbouring farms, and sticking to the track like a sleuth-hound. At last he experimented on the subject, brought it before the profession and the public, and conceived the grand idea of utilising cow-pox universally, so as to eradicate small-pox. Inoculations of the virus of small-pox itself into vaccinated persons failed to produce small-pox, thus conclusively showing that vaccination conferred insusceptibility against small-pox. His own stock of lymph failed, but he had done his work. Other experimenters and then other nations took up the idea, and, inasmuch as vaccination appeared to perform all that was expected of it, some nations made it compulsory early in this century, with the result of immediately reducing small-pox mortality to a remarkable extent. The country where it originated pondered over it for half a century before legally enjoining it, and then another twenty years before enforcing it. Its permissive use largely reduced small-pox, and its compulsory use reduced it still further. Meanwhile it was established that the protection conferred was not permanent, but was lessened to a great extent with the lapse of time after vaccination. Then army vaccinations began in Prussia and Wurtemberg about 1831; in England nearly thirty years later. The original belief that permanent protection followed one vaccination was found to be quite erroneous; and as a matter of fact the adult populations of vaccinated countries were found to be more liable to small-pox, and to furnish more deaths per million, than in the last century. This was because in the last century the adult population was for the most part *permanently* protected by a survived attack of small-pox in childhood; whereas the insusceptibility after early vaccination is only *temporary*, *i. e.* as

regards complete insusceptibility, for even at the latest ages persons who have been vaccinated in infancy show on the average a far lower fatality than those who have never been vaccinated at all. Then came the very severe epidemic of 1870–74, which affected all Europe to a degree of which people then living had had no previous experience, though it was mild compared with the frequent epidemics of last century. Germany looked the matter in the face, and, recognising that vaccination in infancy alone was quite insufficient to prevent epidemics, passed the *re*-vaccination law of 1874, while England had only just begun to have efficient primary vaccination, seventy years after Jenner. The action of Germany has been justified by a splendid success. Small-pox mortality in Germany is less than in any country of Europe; it has sunk to insignificance, and epidemics of small-pox are abolished.

CHAPTER V

THE RISKS ATTENDING VACCINATION—THEIR KIND AND EXTENT

Let us begin with the conclusions of the German Vaccination Commission, which numbered three opponents of compulsory vaccination among its eighteen members. The following conclusion was *unanimously* voted:

"Under certain conditions vaccination may be injurious to health. In the use of human lymph the danger of transferring syphilis, although extremely slight, cannot be entirely avoided. Any other bad effects are apparently due only to accidental wound diseases" (erysipelas is meant).

There were no votes against the following, but three votes were withheld:

"All these dangers may, by precautions in the performance of vaccination, be reduced to such a minimum as to make the benefit of vaccination infinitely outweigh any possible injurious effect."

Lastly, all voted the following except one abstinent:

"Since the introduction of vaccination no scientifically proveable increase of any disease in particular nor of the general mortality has occurred that can be regarded as a consequence of vaccination."

Thus not one member voted against any of the above resolutions, while *only two diseases are mentioned*, viz. syphilis and erysipelas.

The debate which preceded the above conclusions will now be given as an abstract. The Commission first considered whether vaccination was ever dangerous in itself, apart from the risk of inoculating other diseases.

Professor Koch said that cow-pox was essentially a disease of course, but not a disease in the popular acceptation of the word "disease," not a disease practically speaking. Dr Grossheim, who represented the army, declared that no chronic constitutional disturbance had ever followed the army vaccinations, while acute indispositions were extremely rare. Returns called for in 1882 showed that only six men in every 100,000 showed decided indisposition after vaccination; one man had died of "blood-poisoning" out of a total of 1,200,000 vaccinations. The medical meaning of the term "disease" was a different meaning from the popular; in the former a toothache, an ingrowing nail, anything which disturbed the body, was a disease. It was acknowledged that temporary febrility was common after vaccination, but this went down in a few hours.

Then followed the consideration of other diseases after vaccination. Koch began the subject by saying that *syphilis* came first, though it did not deserve to stand in the foreground. *He was not aware that any death after vaccination had ever been established as due to transferred syphilis;* in the isolated cases that occurred this was a curable disease, that generally was cured. The exact number of transferences he could not give. A number of cases had been recorded which had been found erroneous on investigation; perhaps other genuine cases had not come to light. He thought it would suffice to say that syphilis had been transferred by vaccination, that the number of such transferences was extremely small, and that the danger might be entirely avoided by the use of animal lymph. The only other danger, practically speaking, was *erysipelas;* all cases of "blood-poisoning" were primarily cases of erysipelas. As to any other diseases, all they could say was that there was a theoretical possibility of some of them being imparted, *e. g.* tuberculosis, but no such case had ever been established. Vague expressions about "scrofula" were often used, especially by anti-vaccinists, but they all knew that the incubation stage was here so long that it would be quite impossible to establish any connection between tuberculosis and vaccination. There existed abundant opportunities for children to be infected with the virus of a disease so extensively diffused. No other diseases needed any mention. As to vaccination-erysipelas, there was an early form and a a late form. Only the early form could be ascribed to the vaccination itself, and therefore fairly chargeable to it. They had now learnt to experiment with the micro-organism causing erysipelas, and knew how to avoid it by proper treatment of the lymph, or rather by proper antiseptic methods of obtaining it.

Only syphilis and erysipelas then required to be mentioned. Bad wounds were sometimes made through bad treatment of the vaccination vesicles by the parents, who applied all sorts of things to them. Hence occasionally ulcers, eczema, and lymphatic gland swellings.

Such was Koch's contribution. Here we have one of the foremost men in Europe—no one is more experienced in the artificial transference of diseases — discussing from a scientific point of view the theoretical possibilities of transferring diseases by vaccination, and telling the Commission that they need only consider two diseases. And English anti-vaccinists scarcely mention the chief danger to life, viz. erysipelas, in their indictment of vaccination! Their procedure is, and always has been, to run to the Registrar-General's returns and find what disease happens to be increasing in this particular country, and then ascribe this increase to vaccination. This senseless procedure has this inconvenience, that it obliges them to alter the list every few years. And it is altered accordingly. Cancer is now talked about, and their Continental brethren must laugh in their sleeves. To be consistent, if vaccination is to be charged with the increase of any diseases that happen to increase, it ought also to have the credit of causing the decline of any diseases which happen to decline.

But to return to the German Commission. This question came last—all the chief conclusions were answers to carefully framed questions—Have any particular diseases, or has the general mortality, increased since the introduction of vaccination? We have read the conclusion in answer to this. The words "scientifically proveable" were only inserted as a concession to Dr Boeing. Another opponent of compulsory vaccination, Dr Weber, brought forward the well-known English official table of diseases which

have increased since vaccination, but confessed that they did not carry the scientific weight that would be required to connect them with vaccination. He attached importance to the increase of scrofula; but as to syphilis, he acknowledged that the causes of its increase (in England) were too numerous to allow of any particular conclusion being drawn. Thus two of the three opponents on the Commission *gave up syphilis* as regards any increase in the mortality therefrom being due to vaccination. Now for the other side.

Dr Grossheim said that their minutely classified army statistics gave no support to the idea of any increase of disease of any sort as the result of vaccination. Returns from 1873 to 1882 showed a steady decrease of all diseases, of the general (army) mortality, and of inabilities for service.

Dr Krieger brought forward statistics from Alsace-Lorraine, extending from as far back as 1564 down to 1877, and these showed a decided reduction of the general mortality on the introduction of vaccination. The births had not increased; the deaths had decreased.

Dr Eulenburg (Prussian Medical Ministry) referred to Swedish statistics reaching from 1715 to 1795; also from 1825 to 1850, the deaths being given for each age-class of five years. In the latter period (1825–50) a decline was shown in the general mortality (as compared with 1715–95) in every age-class except the youngest, in which the mortality was stationary.

Dr Krieger also gave figures showing that in Strasburg the average yearly general mortality (viz. from all causes) had sunk from 37 per 1000 in the last century to less than 33 in this.

A far greater reduction of the mortality from all causes has occurred in England. All this is given to show that

no increase of the general mortality, or of any particular disease, has taken place since vaccination came into use, such as might fairly be attributed to this practice.

The Commission decided to recommend that the use of animal lymph—already then largely used in Germany—should gradually supersede altogether the use of human lymph, so as to render the transference of syphilis impossible; any danger of erysipelas would be avoided by the use of strict antiseptic methods in obtaining, preserving, and distributing the lymph.

So far for the German Commission. Now for a few diseases asserted by anti-vaccinists to follow vaccination in England.

(1) *Cancer* must have a word or two, because those utterly ignorant of the subject may have been impressed by clamour and capital letters. There is an increase of deaths from cancer, but this increase (*a*) has occurred only in the later periods of life, while below twenty-five years the deaths from cancer have actually decreased; (*b*) has affected males much more than females, whereas vaccination has affected males and females alike. So the increase cannot possibly have anything to do with vaccination.

(2) *Syphilis.*—We have seen how the Germans treated this subject. They decided to adopt calf-lymph, because even if the calf were vaccinated with human syphilitic lymph, the calf-lymph could not cause syphilis, as the virus cannot exist outside the human body. It is plain that owing to this last reason human lymph preserved in glass capillary tubes must be equally safe. Now public vaccinators are continually renewing their lymph by fresh supplies from the National Vaccine Establishment. And Pfeiffer—one of the highest authorities—wrote only a few years ago, "True cow-pox virus, retro-vaccine virus (calf-

lymph), and human lymph are all equal in certainty of effect, course, and protective power. But animal lymph quite excludes syphilis, which is also equally excluded in the use of human lymph by the exercise of ordinary care. Accordingly no essential preference can be bestowed on animal lymph."

The fact is that the transference of syphilis by vaccination is a very rare occurrence—nearly as rare as a comet, far rarer than an eclipse. It has been made a bugbear of by the anti-vaccinists. Mr G. Lee and Mr T. Holmes, two eminent specialists, have stated that they had never seen syphilis as a consequence of vaccination. And Mr J. Hutchinson said, in 1887, that though he had been on the look-out for ten years, he had not met with a single case. He would probably have been consulted if a case had come to the notice of the authorities. Previous to this he had been consulted with regard to twenty-six cases—cases only, not deaths—of transferred syphilis; and Dr McVail tells us in his work that two other cases have also been published. After millions of vaccinations, these are all the cases that have been established in this country, and it appears that no death from syphilis has ever been shown to follow public vaccinations, which are under the care of the Local Government Board. The instructions of the Board are to take no lymph from any child that is not obviously healthy, to take lymph only a week old, and to take only that which exudes of itself on puncture; and these rules, if followed out, make it impossible to convey syphilis. For though, as Mr Hutchinson concedes, it is quite possible for syphilis to be present in the system without being diagnosed, it is practically impossible for congenital syphilis to be present in any infant to such an extent as to render infection possible, without *very prominent and well-known symptoms.*

It appears that the transference of syphilis by vaccination, even from a child who is unquestionably visibly syphilitic, is a very difficult matter to achieve. Dr Cory tried heroically, in the cause of science and humanity together, and only succeeded *on the fourth attempt* in producing a vaccination sore on his own arm which was pronounced to be syphilitic. But a reporting committee of experts declared that as to all the three children last tried, "they were in such a condition of obvious syphilitic disease as would certainly have precluded their use as vaccinifers by even an inconsiderate and reckless vaccinator."

The public may rest perfectly easy on this subject. Our authorities, the medical officer to the Local Government Board and his staff, would be the first to announce any cases which came to their notice, and Dr Cory published his own case at once.

Now as to the increase in this country of mortality from syphilis in the official returns since vaccination was made compulsory. Syphilis mortality has increased, but it is easy to show that this increase has nothing whatever to do with vaccination. As Dr McVail shows in Scotland, where the age for vaccination is six months (not three), no less than 65 per cent. of the deaths from syphilis at all ages take place *before the vaccination age*. At the age of six to twelve months the deaths fall to 11·6 per cent. of the deaths at all ages. In fact, the whole increment in Scotland falls within the first three months.

Again, the vaccination age in England is three months. Now, if vaccination caused the increase in the deaths from syphilis, the percentage of these deaths immediately after this age would differ from that of Scotland. But in all three periods of the first year, viz. 0—3 months, 3—6 months, and 6—12 months, the percentages are almost

exactly the same in England as they are in Scotland. In both countries the deaths from syphilis diminish rapidly after the first three months, though it would not be a logical procedure to ascribe this decrease to vaccination. The fact is that our knowledge of syphilis, especially hereditary syphilis, and the particular form of hereditary syphilis which is called congenital syphilis, has become very much enlarged during the last thirty years. A great many more cases are now diagnosed as syphilitic than was possible in former times. Hence more deaths are ascribed to syphilis by medical men. There may be other causes for the increased number of deaths in the Registrar-General's Reports, but the above is certainly one cause, and a very important one, well recognised amongst the medical profession.

Lastly, Korosi applies his own method. He had 20,574 patients in nineteen Hungarian hospitals carefully examined as to their vaccination condition. The vaccinated formed 83 per cent. of the cases admitted for indifferent diseases, *i. e.* diseases that no one could possibly connect with vaccination. As regards the syphiiitic cases, the vaccinated formed 83 per cent. of all the syphilitic patients ; vaccination, therefore, could not be a factor here, or a higher percentage would have been found. (The same was true of *erysipelas* and *tuberculosis.*) It is curious that in *rickets* far fewer vaccinated were found than the normal percentage. In *scrofula* and *typhus* the percentage was slightly above the normal, and still higher in *cholera.* These are of course only coincidences.

Wound-sores (*erysipelas, &c.*).—This is nearly always caused by *bad treatment of the vesicles*, not by vaccination itself. The careless friction of the vesicles against tight sleeves is quite enough to convert these vesicles into open sores ; and when, as Koch says, all sorts of things are

applied by the mother, the result is occasionally disastrous. The Registrar-General reports a number of deaths every year under the heading "Cow-pox and other effects of vaccination" (erysipelas, &c.); 316 deaths are reported in the six years 1881–6. Erysipelas deaths on the whole have decreased since compulsory vaccination.

A vast amount of nonsense is talked on the subject of the risks of vaccination. All young children, or very nearly all, are vaccinated; nearly all suffer from some ailment or other in the course of the next few months or years, but it is perfectly unreasonable to attribute any such ailment to vaccination merely because vaccination is an antecedent. We might equally attribute street accidents to previous vaccination.

Diarrhœa was ascribed to vaccination at one time! Leicester, of all places, has or had lately more diarrhœa than any large town in England. The deaths from diarrhœa have decreased of late years, it has accordingly been removed by anti-vaccinators from the list, *pro temp.*, of the evils following vaccination.

Dr Creighton has a theory of his own about syphilis after vaccination. He thinks the local sore after vaccination is analogous to the syphilitic chancre *in every case* of vaccination; it is a sore that has acquired by long descent inveterate characters, with an inherent tendency towards sloughing. This inherent tendency sometimes unexpectedly reveals itself in a number of cases, which are mistaken by the medical profession for inoculated syphilitic cases. I am inclined to think that Dr Creighton bases all this on the descriptions and drawings of the earliest vaccine vesicles and ulcerations, obtained while vaccination was still in the stage of experiment, and before proper methods of collecting and preserving the lymph were known—certainly not upon the characters of the

normal vaccine vesicle as now to be seen every day. This is a far-fetched pathological inquiry as to the genesis of the cow-pox vesicle, into which we cannot enter here. But Dr Creighton's book is read by ignorant laymen, and is by them regarded as a deadly onslaught against vaccination. It does not touch the question of its protective influence against small-pox; and as to the terrible characters inherent in the cow-pox vesicle, this is all imaginary. There need be no open "sore" there at all; if there is, it is the result of bad treatment. The writer is not now speaking from blue-books, but from personal knowledge, having been a public vaccinator himself.

CHAPTER VI

THE NECESSITY FOR COMPULSORY REVACCINATION

First the necessity for revaccination will be shown, and then the necessity for compulsory revaccination. This necessity is self-evident; indeed, it has already long been recognised by our authorities, *for we have compulsory revaccination in the army and navy*, whether recruits show marks of previous vaccination or not.

1. *As affecting the individual.*—I ask the reader to turn once more to the Registrar-General's table in the chapter on the objections (p. 45), and remind him again that the *decline* in small-pox mortality at all ages which is there apparent has occurred *exclusively in persons under fifteen years old;* while that mortality in older persons has risen instead of falling, at first slightly, but in the later life periods very much.

Thus good primary vaccination alone, while it brings

about an astonishing reduction of small-pox mortality, nevertheless *shifts the incidence* of small-pox from children to persons of later ages. In the last century small-pox was almost exclusively a disease of children; with vaccination in infancy only it is now rendered a disease chiefly of adults, *i. e.* amongst the vaccinated population. But even so it is never the fatal disease which it shows itself to be amongst unvaccinated persons (see the Sheffield age-table on p. 25), for amongst the former in the age-class "above thirty" the proportion of deaths to attacks is here only 10 per cent., while among the latter in the same age-class it is 57 per cent.

The cause of this is that after childhood there is a natural rise of susceptibility to all diseases in the third quinquennium of life.* The *natural* course of small-pox is thus:—It is most fatal in infancy; the fatality (and susceptibility to the disease) sinks up to the age between ten and fifteen years; after this the fatality rises again with the age. The organism is most resistant at the end of childhood. In well-vaccinated children the system is *completely protected* for a few years with very rare exceptions, and the natural susceptibility of the organism towards all diseases is on the side of vaccination up to the age of ten or twelve years; after this age it is against it, and the system is only *partially protected.*

To combat this behaviour of the natural susceptibility, a renewal of the insusceptibility conferred by vaccination in infancy is absolutely necessary at the age of ten years or soon after. If revaccination be not generally adopted we shall continue to lose valuable adult lives from small-pox amongst the once vaccinated, because epidemics will be able to get a footing here and there, largely aided by

* See Dr. Wolffberg in 'Arbeiten aus der k. k. Gesundheitsamte,' Berlin.

the far greater susceptibility to small-pox amongst the few unvaccinated.

In the last century nearly every one had small-pox in childhood, and those who survived were protected for life with few exceptions. Hence there were fewer deaths among the adult population than at present, though the small-pox mortality as a whole was enormous.

It is not a matter of theory, but a truth shown by abundant experience in all countries, that revaccination puts the individual practically in the same position as if he had gone through small-pox itself. He is practically safe against severe attacks of small-pox for the rest of his life.

It may be useful to illustrate what has been said above about vaccinated persons by a reference to the Sheffield table. Let us study the incidence and fatality, two separate things, and see at each age what proportion per cent. of the vaccinated population *at that age* took small-pox—the incidence, and what proportion per cent. of those attacked by small-pox died of it—the fatality, excluding infants under the vaccination age (three months).

Under 5 years	the incidence is		0·36,	and the fatality		0·8
5—10	„	„	0·67	„	„	2
10—15	„	„	1·9	„	„	1·7
15—20	„	„	3·6	„	„	2
20—30	„	„	2·8	„	„	5·4
Above 30	„	„	1	„	„	10·4

We see that the fatality rises much faster than the incidence, the increasing natural susceptibility making itself more apparent as the age advances, although the fatality is always far below that of persons who have never been vaccinated. Here are the incidence and fatality rates respectively for the *unvaccinated* at ages corresponding to the above:—6·5 and **51**, 36 and **34**, 38·7 and **35**, 29·8 and **63**, 10·6 and **62**, 2·4 and **47**. Here the influence of the

natural susceptibility shows itself in the diminished fatality between five and fifteen years.

Sir G. Buchanan says, "The more transient immunity against small-pox conferred by infantile vaccination is shown by all experience, and now by the experience of Sheffield, to be renewable by a second vaccination after the age of ten. By this renewal, Dr Barry's figures show us, an insusceptibility to small-pox was gained equal in durability to that derived from a previous attack of small-pox, and it was gained without the expense of one person's death for every two who gained it" (Report for 1888).

2. *As affecting the community.*—The following conclusions were voted by the German Commission in 1884, after nearly ten years' experience of revaccination:

"Revaccination is necessary ten years after primary vaccination." (No one voted against this; three abstained.) "The vaccinated condition of the (surrounding) community increases the relative protection against small-pox acquired by the individual through vaccination; and hence vaccination is a benefit not only to the individual, but generally" (*i. e.* to his neighbours). There was only one vote against this; two abstained.

The following is from the text which accompanied the small-pox charts of the (Prussian) army:

"The evil influence of a community affected with small-pox, and the relative protection afforded by a surrounding community free from this disease, is at once evident from the table of illnesses in the German army. For it must be allowed that revaccination had already been practised in the army for several decades, with a fair degree of carefulness. In spite of this, the small-pox cases in 1867–9—*i. e.* before the general revaccination law—were more numerous than after 1874. No other explanation can be

given for this than that just as, during the war, small-pox in the Prussian army considerably increased in consequence of its coming into contact with small-pox in France, *so the same thing must have happened in Germany itself before the war, when there was more small-pox among the civil population* than there has been of late years. It is worthy of note that *not a single death from small-pox has occurred in the Prussian army since* 1874, whereas both the Austrian and French armies still show considerable losses from this cause. No other reason can be made to account for this striking difference than the effect of a rigidly conducted vaccination and revaccination" (*i. e.* of the whole population). (Italics are added.)

Here a very remarkable fact is brought to light. The vaccination of the army was not altered in the least by the law of 1874, and yet small-pox mortality in the army, already very low, sinks to nothing when the general population is better vaccinated.

Koch said before the Commission, "It is therefore the right and the duty of the State to require all its citizens to be vaccinated" (revaccination is included here), "so that the partial protection acquired by the individual may be supplemented by a general protection. . . . The protection afforded by vaccination and revaccination is by no means absolute, and according to our experience an absolutely protected condition of the population will never be obtained. . . . . It is said by some people, 'Let those who like get revaccinated, but do not compel everybody.' This is not just. *It would only be just to argue thus if the individual acquired absolute protection by vaccination.*"

"As to isolation of small-pox patients as an alternative measure, I would ask whether such isolation as would be required to vanquish an epidemic would not be a compulsory measure a thousandfold more an infraction of

personal liberty, and would not cause a thousandfold more resistance, than the incomparably milder measure of vaccination and revaccination in childhood. But even the most rigid isolation would not keep the disease away from us." Dr Siegel pointed out that such isolation would necessarily be always too late. Regarding disinfection of patients and their belongings as a means of staying epidemics, it was condemned as both impracticable and useless.

The further experience of Germany since 1884 only adds strength to Koch's observations.

CHAPTER VII

CONCLUSION

Our authorities are fully aware of the necessity for revaccination; indeed, most of my remarks are digests or quotations from what they have said from time to time in various blue-books. But people will not read blue-books; hence this little pamphlet, which is a digest of blue-books. Great ignorance reigns amongst the people, even well-educated people, on the subject of vaccination and small-pox. Until the nation sees the necessity for revaccination it will not have revaccination. The Registrar-General showed this necessity most explicitly ten years ago. The people do not read what he says, it is buried in a blue-book, but they do read pamphlets and handbills against vaccination, which are tissues of misrepresentation and bad logic, and which are scattered broadcast all over the country. The writer has attempted to give the general

reader a broad view of the whole subject in as few words as possible.

To recur to the subjects of my introduction. The great epidemic of 1870–1 taught us that nearly all Europe was then badly vaccinated. Even in England *efficient* vaccination was non-existent, for it was not till 1871 that vaccination officers were appointed by boards of guardians. Still, England was much better vaccinated than many other countries; in fact, there were a few countries thus distinguished from the rest of Europe, and these few countries have been already contrasted with others (see p. 41). The epidemic in this country, after all, did not cause the small-pox deaths to reach 10 per cent. of all deaths, whereas the common epidemic rate of last century was higher than 10 per cent. on thirty-two occasions. Bavaria suffered lightly compared with Austria; still the outbreak in Bavaria showed that primary vaccination is utterly insufficient to protect a population from epidemics.

Again, it is true that syphilis has been transferred by vaccination, but it has been shown that with ordinary care it is practically impossible for this to occur. Its transferences are very rare, and have never, or very rarely, caused death. "Erysipelas" causes a few deaths every year, but this is nearly always chargeable to bad treatment of the vesicles, not to the lymph, erysipelas being perfectly avoidable by due care. Erysipelas has declined as a cause of death since vaccination became general. Vaccination properly performed, and followed by due care afterwards on the part of the individual, is perfectly harmless.

The shifting of the incidence of small-pox mortality from childhood to adults is a fact *where only infantile vaccination* is in force. But by revaccination the adult is protected as well as the child, and small-pox epidemics

cease to be. One vaccination in infancy is utterly insufficient to prevent epidemics altogether, although it restricts their fatality very remarkably.

As regards future legislation, the only conclusion that can be drawn is that it is both "the right and the duty of the State" to enforce not only vaccination in infancy, but the revaccination of all school children. The law does not want relaxing, but, on the contrary, further extending. As to the liberty of the subject, this is a question of practical politics. I will merely point out that the infringement of liberty enforced by the education laws is infinitely greater than the temporary infringement which compulsory revaccination would constitute. England must follow the example of Germany.

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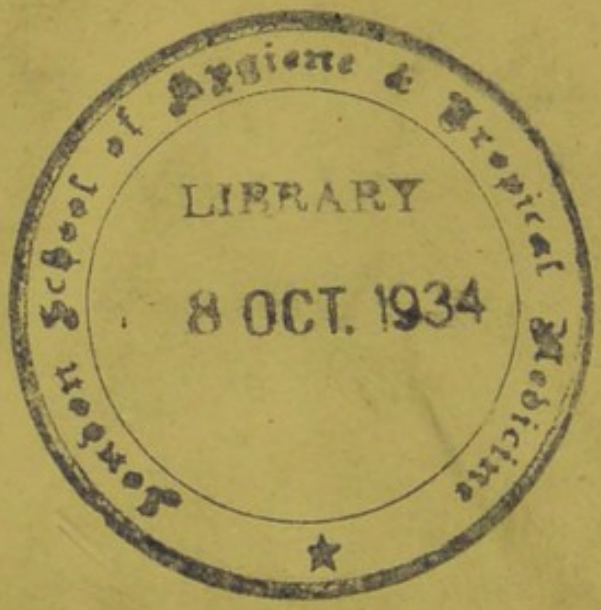
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