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INQUIRY

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INTO THE

PROBABLE CAUSE

OF THE

CONTINUED PREVALENCE AND FATALITY

OF

SMALL-POX.

BY

JAMES STARK, M. D., F. R. S. E.,

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS OF EDINBURGH.

(From the Edin. Med. and Surg. Journal, No. 164.)

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JAMES STARK

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INQUIRY, &c.

MUCH alarm has been created by the outcry raised by some writers in this country and on the continent that small-pox is increasing in consequence of vaccination losing its effects, either from a degeneration of its virus, or from its wearing out of the system after a certain number of years, or from its being but an imperfect preservative against that disease. To check these supposed causes, it has by one class been proposed to go back to the cow for a fresh supply of vaccine matter every two or three years; and Sonderland, Bousquet, Girard, Estlin, Ceely, and others have exerted themselves successfully to procure fresh supplies from that animal. By the other class it has been proposed to repeat vaccination every ten or twelve years; and the Prussian, Hanoverian, Russian, and other governments have actually so far listened to this proposal as to have had their whole standing armies re-vaccinated. While the third class have even seriously proposed to return to the fatal, and now, it is to be hoped, for-ever-exploded plan of inoculating with the small-pox.

Having paid no inconsiderable attention both to small-pox and vaccination; having collected notes and observations for a period of more than twelve years; and being thoroughly convinced that the continued prevalence and fatality of small-pox over all the kingdoms of the globe are owing to an entirely different cause, and as all are aware that the proper preventive means cannot be used unless we know the true cause, I shall, in the development of my views, consider the subject under the four following heads:

1st. Is small-pox a fatal disease at the present day, and has it increased of late years?

2d. Is the prevalence and mortality of small-pox owing to failure in the protective power of vaccination?

3d. Is the prevalence and mortality of small-pox owing to the neglect of vaccination?

4th. Does vaccination afford as perfect protection from small-pox as it is possible to obtain—as perfect immunity from danger as if the person had once passed through the natural or inoculated disease?

1st. Is small-pox a fatal disease at the present day, and has it increased of late years?—Before the introduction of vaccination, small-pox was one of the most fatal scourges of the human race; and it was calculated that in Great Britain and Ireland no fewer than between 40,000 and 50,000 were annually cut off by it. In London alone, on an average of fifty years, 2018 died annually from small-pox before the introduction of vaccination. The following

table exhibits shortly the state of the mortality from small-pox in London before and since the introduction of vaccination.

General and Small-pox Mortality, London.

Year.	Tot. deaths.	S.-pox deaths.	Year.	Tot. deaths.	S.-pox deaths.
1746	28,157	3,236	1811	17,043	751
1747	25,494	1,380	1812	18,295	1,287
1748	23,869	1,789	1813	17,322	898
1749	25,516	2,625	1814	19,783	638
1750	23,727	1,229	1815	19,560	725
1751	21,028	998	1816	20,316	653
1752	20,485	3,538	1817	19,968	1,051
			1818	19,705	421
1795	21,179	1,040	1819	19,228	712
1796	19,288	3,548	1820	19,348	792
1797	17,014	522	1821	18,458	508
1798	18,155	2,237	1822	18,865	604
1799	18,134	1,111	1823	20,587	774
1800	23,068	2,409	1824	20,237	725
1801	19,374	1,461	1825	21,026	1,299
1802	19,379	1,579	1826	20,758	503
1803	19,582	1,202	1837*	24,959	763
1804	17,038	622	1838	52,698	3,817
1805	17,565	1,685	1839	45,441	634
1806	17,938	1,158	1840	46,281	1,235
1807	18,334	1,297	1841	45,507	1,053
1808	19,954	1,169	1842	45,400	360
1809	16,680	1,163	1843		
1810	19,893	1,198	1844		1,804

The ratio of the mortality from small-pox in London may be otherwise expressed. Thus the following table exhibits the proportion of deaths from small-pox out of every 100 deaths, at intervals, from 1629-1842.†

Year.	1629-35	1660-79	1728-57	1771-80	1795-1800	1801-10	1831-35	1837-42
S.-pox.	3.78	5.09	8.00	10.03	9.30	6.95	2.69	3.02

This table, then, though it shows that the mortality from small-pox has greatly diminished since vaccination was introduced, also shows that it has considerably increased of late years.

The following table exhibits the mortality from small-pox over England and Wales, from the Registrar-General's Report.

Years.	1838	1839	1840	1841	1842
Mortality from Small-pox,	16,268	9,131	10,434	6,368	2,715

Duvillard‡ has proved, by a reference to the statistics of different countries, that in the natural state (previous to vaccination) of 100 individuals of 30 years of age, scarcely 4 had escaped an attack of small-pox; that two-thirds of all infants were attacked by it sooner or later; that small-pox in the early years after birth destroyed on the greatest average one out of every three who were at-

* Half year only, July to December.

† Compiled from M'Culloch's Statistical Account of the British Empire,—Wyllan on the Diseases of London,—and Reports of the Registrar-General.

‡ Quetelet on Man.—Chambers' Popular Edit. 1842, p. 45.

tacked with it ; and lastly, that one died out of every seven or eight affected with it, at whatever age that might be.

The following table exhibits the deaths from small-pox in Sweden from 1806 to 1830,* with the proportion they bear to the total mortality.

Years.	No. of deaths.	No. of small-pox deaths.	Propor. of s.-pox to 100 deaths.
1806-1810	75,899	8,633	11.3
1811-1815	65,478	2,429	3.7
1816-1820	62,331	1,541	2.4
1821-1825	58,915	1,948	3.2
1826-1830	71,115	1,639	2.3

This table shows that the mortality from small-pox in Sweden is still as great as in London, though that country is often quoted as being one where that disease has been almost quite extinguished from the universal adoption of vaccination,†—so often do facts contradict theories.

Through the labours of Drs R. Watt, Cleland, Cowan, and A. Watt, we are furnished with a very complete list of the mortality from small-pox in Glasgow for a long period of years, as the following table‡ of the deaths under ten years of age, will show.

Year.	Total deaths.	S.-pox deaths.	Year.	Total deaths.	S.-pox deaths.	Year.	Total deaths.	S.-pox deaths.
1783	719	155	1793	1126	369	1803	940	194
1784	877	425	1794	759	235	1804	863	213
1785	744	218	1795	1048	402	1805	884	56
1786	941	348	1796	797	177	1806	786	28
1787	1016	410	1797	884	354	1807	899	97
1788	1059	399	1798	864	309	1808	1775	51
1789	1058	366	1799	1105	370	1809	1187	159
1790	1236	336	1800	746	257	1810	1027	28
1791	1367	607	1801	766	245	1811	1274	109
1792	902	202	1802	985	156	1812	1278	78
1st.Per	9,919	3,466	2d.Per	9,080	2,894	3d.Per	10,913	1,013

Thus we see that during the 1st period, or from 1783 to 1792, no fewer than 35.94 died from small-pox out of every 100 who died under ten years of age. From 1793 to 1802, 31.87 died from small-pox out of every 100 at the same ages ; while from 1803 to 1812 the mortality from small-pox fell to 9.28 per cent. This fact, while it exhibits the still large mortality from small-pox, most satisfactorily proves the benefits conferred on mankind by the introduction of vaccination—the saving to human life being to the extent of 25 per cent.

Small-pox, however, still continues to prove a fatal disease in Glasgow, as the following table, compiled from the Glasgow Mortality Bills, will show :—

* Encyclopædia Britannica, 7th Edition, 1842, vol. xv. p. 542.

† Dr Reid's Philosophy of Death. Cupar, 1841, p. 109. Baron's Life of Jenner, &c., 2 vols. 8vo. London, 1838.

‡ Cowan, Vital Statistics of Glasgow, 1838, p. 28.

Year.	Total deaths.	Small-pox deaths.	Sm-pox deaths under 5 yrs. of age.	Prop. of Sm-pox to 100 deaths.
1835	7,849	473	433	6.0
1836	9,143	577	521	6.3
1837	10,886	352	303	3.2
1838	7,515	388	329	5.0
1839	8,130	406	348	4.9
1840	9,541	453	346	4.6
1841	9,605	347	308	3.6
1842	8,019	334	275	4.1
Total	70,688	3,330	2,863	4.7

It is to be regretted that I have not been able to procure the mortality from small-pox in Glasgow for the years intermediate between 1812 and 1835, when, it is to be presumed, the mortality would be less. But from 1835 to 1842 the mortality from that disease is seen from the above table to be nearly 2 per cent. higher than in London during the same period. The above table also shows that the chief deaths from small-pox occurred among the young, in fact, among children under five years of age; and the following table exhibits the proportion which the deaths from small-pox bear to the total deaths among those under five years of age.

Table of Deaths under 5 years.

Year.	Total deaths under 5.	Small-pox deaths under 5.	Proportion of small-pox to 100 deaths.
1840	4031	346	8.3
1841	4104	308	7.5
1842	3618	275	7.6

The fact of the increase of small-pox of late years is also shown by reference to the admissions into the Glasgow Infirmary from 1802 to 1836.

Number of Small-pox Cases in Glasgow Infirmary.

Year	No. S.-pox.	Year	No. S.-pox.	Year	No. S.-pox.	Year	No. S.-pox.	Year	No. S.-pox.
1802	0	1809	10	1816	14	1823	46	1830	10
1803	0	1810	2	1817	7	1824	37	1831	12
1804	1	1811	0	1818	11	1825	3	1832	3
1805	3	1812	4	1819	7	1826	1	1833	14
1806	1	1813	2	1820	0	1827	25	1834	62
1807	5	1814	2	1821	33	1828	4	1835	72
1808	0	1815	4	1822	5	1829	1	1836	110
	10		24		77		117		283

Small-pox still cuts off a considerable number in France; but apparently in consequence of the progressive increase in the annual number of vaccinations, from the strict attention which government pays to that subject, the mortality from that fatal disease, instead of increasing as it has done in London, has greatly diminished of late years.

Thus M. Villermé, in his "Tableau relatif aux Vaccinations pratiquées en France, et aux petites Veroles," states that from 1808 to 1826 inclusive, 635,448 cases of small-pox occurred in France, of which 91,807 died. This gives an average of 33,444 cases of small-pox annually from 1808 to 1826, and an annual mortality from that cause of 4,832. To contrast with this I have only been able to procure the returns for 1830, 1835, and 1843, which are given along with the above in the following table:—

Mortality of Small-pox in France.

Year.	Cases of small-pox.	Deaths from small-pox.	Proportion deaths to 100 cases.	
Annually from) 1808-1826. }	33,446	4,832	14.4	or 1 in 6.8
1830	9,764	1,340	13.7	or 1 in 7.2
1835	13,726	1,893	13.7	or 1 in 7.2
1843	11,779	1,379	11.7	or 1 in 8.5

From another report by the Royal Academy of Medicine,* it appears that the same fact is evidenced—viz. the diminution of the number of small-pox cases under the persevering extension of the benefits of vaccination. From 1817 to 1837 inclusive, there died of small-pox in Paris 11,451 persons, of whom 7,034 died during the first half of this period, and only 4,417 during the latter half. The annual average of deaths from small-pox during the first half of the above period was 1,090, while during the latter half the annual average fell to 420.

These facts, then, go to prove that, while small-pox is extending its ravages in this country, it is progressively diminishing over France; and we shall have occasion, under another head, to show that this is owing to the more general adoption of vaccination in that country.

Ireland has often been quoted as one of those countries where vaccination has been very generally adopted. Even Dr Cowan, in 1838, repeats the unauthenticated statement. The Government Census of 1841 proves, however, both what a fearful scourge small-pox is in that country, and how lamentably vaccination is neglected. During the ten years ending June 1841, no fewer than 58,006 were cut off by small-pox; giving an annual average of 5,800 deaths from that fatal disease. This gives a proportional mortality from small-pox of 4.9 out of every 100 deaths—a mortality higher than that of London, and nearly the same as that of Glasgow. Now, using round numbers, and allowing the annual average of deaths from small-pox to be 1000 in France, with a population of thirty-three millions; we have four times that mortality in Ireland from the same disease with less than a fourth of the population, viz. an annual mortality from small-pox of 5800, with a population of only eight millions.

Being anxious to ascertain how Edinburgh stood affected by small-pox, I have, with considerable labour, gone over the records

* Bulletin de l'Académie Royale de Médecine, vol. iii, p 1, &c.

of the burying grounds so far as these are complete in the enumeration of the diseases, and offer the following as the most perfect which the state of these records will allow.

*Edinburgh Mortality Table, 1780-1844.**

YEAR.	Total deaths.	Deaths from small-pox.	Prop. of S.-Pox per 100 deaths.	YEAR.	Total deaths	Deaths from small-pox.	Prop. of S.-Pox to 100 deaths.
1780	1554	215		1810	1587	24	
1781	1471	340		1811	1656	48	
1782	1801	237		1812	1580	30	
1783	1542	201		1813	1658	23	
1784	1685	178		1814	1550	10	
1785	1520	135		1815	1505	40	
1786	1714	378		1816	1911	12	
1787	1787	181		1817	1709	12	
1788	2031	225		1818	1967	35	
1789	1958	318		1819	2266	43	
1780—1789	17063	2408	14.1	1810—1819	17389	277	1.5
1790	1906	160		1820	2639	65	
1791	2377	339		1821	2794	23	
1792	1315	171		1822	2747	30	
1793	1387	173		1823	3298	64	
1794	1201	286		1824	2902	67	
1795	1164	70		1825	3941	24	
1796	1239	269		1826	3824	20	
1797	1102	119		1827	3610	109	
1798	1214	95		1828	3934	11	
1799	1172	184		1829	3423	7	
1790—1799	14077	1866	12.5	1820—1829	33112	420	1.2
1800	898	40		1830	3771	192	
1801	1008	97		1831	3937	15	
1802	1032	61		1832	5512	12	
1803	1419	32		1833	4595	97	
1804	1499	72		1834	3936	76	
1805	1483	36		1835	3801	68	
1806	1359	22		1836	4209	43	
1807	1184	38		1837	5300	195	
1808	1420	40		1838	4560	97	
1809	1142	19		1239	3654	41	
1800—1809	12444	457	3.6	1830—1839	43275	836	1.9

* The records of the Grayfriars burying-grounds are imperfect in the enumeration of the diseases from 1792 to 1819; those of the Calton from 1780 to 1786—those of the Canongate from 1807 to 1809; while the records of the Crosscauseway Chapel burying-grounds are lost from 1799 to 1802, and from 1820 to 1824 St John's Chapel burying-ground records do not take cognizance of the diseases at all. All these are therefore omitted in the above table.

YEAR.	Total deaths.	Deaths from Small-Pox.	Proportion of Small-Pox per 100 deaths.
1840	3983	164	
1841	3888	27	
1842	4154	181	
1843	4841	39	
1844	4264	11	
<hr/> 1840—1844	<hr/> 21130	<hr/> 422	<hr/> 1.9

It will render this table more easily comparable with that of London if we class together in one table the proportion of deaths from small-pox out of every 100 deaths during periods of ten years.

Proportion of small-pox deaths out of every 100 deaths in Edinburgh during the years,—

1780-89	1790-99	1800-09	1810-19	1820-29	1830-39	1840-44
14.1	12.5	3.6	1.5	1.2	1.9	1.9

This table, then, though it demonstrates that the mortality from small-pox in Edinburgh for the last few years is nearly a half lower than in London, and less than a half lower than in Glasgow, exhibits, like these cities, a slight increase of late years.

In Prussia, though small-pox, from the attention which government pays to vaccination, is far from that dreadful scourge which it is in this country, it will be seen from the following returns that it still forms a fraction of the mortality.

General and Small-Pox Mortality in Prussia.

Year.	Total deaths.	Deaths from small-pox.	Proportion of S.-pox to total deaths.
1820—1834	5,457,209	44,685	1.3 per cent.
or annually	363,813	2,979	1.3
1839	430,098	2,128	0.4
1840	418,624	2,410	0.5
1841	415,256	2,195	0.5

In the Austrian dominions, again, small-pox still commits fearful ravages, as the following table of returns from some of the provinces, for 1832, 1833, and 1836,* will demonstrate.

Small-Pox Mortality in Austrian Dominions.

1832.		1836.	
	No. of S.-Pox.		No. of S.-Pox.
Austria on the Enns,	1683	Austria on the Enns,	564
Dalmatia,	36	Styria,	394
Hungary,	1545	Bohemia,	679
Venetian territories,	9687	Moravia and Silesia,	146
		Galicia,	1262
		Lombardy,	766
1833.		Dalmatia,	839
Austria on the Enns,	5466	Carinthia,	98
Moravia and Silesia,	177	Carniola,	266
Styria,	1491	Maritime territories,	98
Illyria,	3148	Tyrol,	349
Maritime territories,	160		

* Medicinische Jahrbucher des Osterr. Staates 1835 and 1838, and Allgemeines Repertorium, 1836 and 1839.

I regret that I have not been able to procure the returns from the whole of the provinces for any one complete year. The above were all the returns for these years published in the journals referred to.

From this review, then, of the mortality from small-pox in many of the kingdoms of Europe we see that it is still a very fatal and prevalent disease; and that in several of them, particularly in our own land, it has been rather on the increase of late years. Every one, therefore, will see the importance of ascertaining the true cause of this fatal prevalence; as, unless the cause be ascertained, we cannot hope to apply the remedy. It is from having completely misunderstood the cause, that so many fanciful theories have been started to account for its prevalence; and that physicians have almost always attributed it to some assumed fault of the vaccine lymph, as if it were from some failure in its protective power that the small-pox continued to rage. I trust I shall be able to prove by unquestionable facts what the true cause is, and thus enable all to apply the remedy.

2dly. *Is the prevalence and mortality of small-pox owing to failure in the protective power of vaccination?* Scarcely was vaccination introduced into general practice, and its decided efficacy proved, than a few individuals were found so wedded to old prejudices, so averse to open their eyes to facts in medicine, that they asserted its virtues were merely temporary, and would wear out of the system in a few years, leaving it as unprotected from small-pox as if no vaccination had taken place. Others not only used this argument, but also stated that, within ten years after its introduction, the vaccine virus was visibly decreasing in protective power, and that in a few years thereafter it would no longer be able to produce that change in the system which should enable it to resist an attack of small-pox. A period of forty-five years has now elapsed since vaccination was generally introduced, not only to Britain, but to almost all countries of the globe, and I shall endeavour very shortly to show how far the theoretical fears of these disbelievers of its antivariolous powers have been fulfilled.

In endeavouring to estimate the antivariolous powers of the vaccine lymph, we must endeavour to ascertain the exact state of the population with regard to vaccination, or at least of that portion to which we refer for proofs of its protective powers. It is therefore perfectly apparent that we cannot refer to the *general* population of any country, seeing that we do not possess any accurate statistical tables of the number vaccinated and unvaccinated; and from this circumstance the occurrence of cases of small-pox among the general population, of itself neither proves nor disproves a single point connected with this subject. We have, however, even thus an approximative proof that the vaccine virus neither wears out of the constitution, nor yet degenerates by its numerous transmissions through the human subject. The tables which we have given above demonstrate that the mortality from small-pox has most materially decreased since vaccination became general. If, however, the pro-

fective powers of vaccination failed in ten, fifteen, or twenty years, by this time the whole of the adult population ought to be as liable to small-pox as if they had never been vaccinated; and, if the vaccine lymph degenerated after a period of twelve or twenty years, all those who had been vaccinated with matter which had been twelve or twenty years in use,—that is, all those under twenty years of age ought to be equally liable to an attack of small-pox. In fact, on this supposition the whole population ought to be as liable to an attack of small-pox as if they had never been vaccinated—the old, because by this time the protection afforded by one vaccination had worn out of the constitution—the young, because they were vaccinated with such exhausted virus, that it could afford no protection against small-pox for more than one or two years. What, however, is the case? Not only is small-pox rare in the adult over Britain generally, but the chief-cases occur among children under five years, in the very class who, according to any supposition, ought, *if vaccinated*, to be the most perfectly protected. Thus in the Registrar-General's Report of the mortality of England and Wales for the year 1838, it is stated that the ages of 8706 persons who died of small-pox was obtained, and it was found that no fewer than 7575 were under five years of age, and only 1131 above that age. The same conclusion is arrived at from consulting the able statistical report of Dr Watt on the mortality in the large towns of Scotland, in the Transactions of the British Association, by which it appears, that over the whole kingdom the average per centage of deaths from small-pox is nearly the same for those under five years of age. Thus in 1839, in Manchester, 89·341 per cent. of those who died from small-pox were under five years; in Liverpool, 85·328 per cent. were under five; in Edinburgh, 82·683 per cent.; in Glasgow, 85·729 per cent.; in Perth, 87·755 per cent.; and in Dundee, 85·258 were under five years of age out of every 100 who died of small-pox. The statistics of Ireland, again, exhibit this fact in a very striking light. In the "Report of the Commissioners appointed to take the census of Ireland for the year 1841," we find that, for the ten years ending 6th June 1841, no fewer than 58,006 deaths occurred from small-pox. Of these, however, no fewer than 49,038 were under five years of age, while only 8,968 were above that age.

These facts, therefore, prove approximatively that the protective power of the vaccine virus does not wear out of the constitution in ten or twenty years, otherwise the great mortality would be among adults and not among children. As we shall have occasion to notice afterwards, it is more than probable that the mortality from small-pox among children is from no failure in the protective power of vaccination, but from their never having been vaccinated.

It is necessary, however, in a rigid inquiry after truth, to ascertain whether a class of men who are properly vaccinated are thereby for ever after protected from the ravages of small-pox. Of only one class of men can it be said that means are taken to ensure that all are protected by vaccination from the ravages of that loathsome

disease—I mean the military class. Let us see, therefore, how far they are protected from that disease, or whether, as they advance in years, they become more liable to be attacked by it.

From the Government “Statistical Reports of the sickness, mortality and invaliding among her Majesty’s troops,” extending from 1817 to 1836 inclusive, we learn that the dragoon regiments and guards, with an aggregate strength during that period of 44,611, and a total mortality of 627, lost only 3 cases from small-pox. The troops at Gibraltar, with an aggregate strength during that period of 60,269, and a total mortality of 1291, lost only one from small-pox. In the West Indies the British or white troops, with an aggregate strength, from 1817 to 1836 inclusive, of 86,661, and a total mortality of 6,803, had not a single death from small-pox, though several epidemics of small-pox have ravaged the islands during that period. The black troops on the same station with an aggregate strength during the same period of 40,934, and a total mortality of 1645, completely escaped that loathsome disease. At Bermuda at Nova-Scotia, at New Brunswick, at the Cape of Good-Hope, and at the Mauritius not a single death from small-pox occurred during these twenty years; and even the white troops of Western Africa wholly escaped this disease, which was carrying off hundreds of the black unprotected population.

With regard, however, to three other important stations, we are, from other sources, furnished with the means of comparing the mortality of small-pox among the only partially protected general population with that among the protected troops. In Malta the British troops from 1818 to 1836 inclusive had an aggregate strength of 40,826, and a total mortality of 665; only two deaths, however, occurred from small-pox. Among the civil population of Malta, however, epidemic small-pox broke out in 1830, and continued during the whole of that and the succeeding year, carrying off no fewer than 1,169 persons, being 1048 deaths from small-pox out of a mortality of 3407 during the year 1830; and 121 out of a mortality of 2581 in 1831. This fact, then, shows the perfect protection which was afforded to the properly vaccinated troops; for while small-pox was raging so fearfully among the native Maltese that a third of the mortality was caused by that disease in 1830 alone, only two fell victims to its severity among the military during the extended period of 19 years.

In Ceylon, again, the small-pox during the period included in the Government reports has thrice broken out in an epidemic form; besides the cases which are always occurring in the sporadic form; and we learn from the excellent report of Dr Kinnis,* who was for several years superintendent of vaccination in the Colombo district, that these were in 1819, 1830 and 1834. These are the only years during which accounts were kept of the cases of small-pox among the native population, and it is stated that in

1819,	there occurred 7,874 cases of small-pox, of which 2,945 died.
1830	806 169
1834	425 94

* A Report on Small-pox as it appeared in Ceylon in 1833-34. Colombo, 1835.

The statistical reports show that from 1817 to 1836 inclusive, the white troops in Ceylon, with a total mortality of 3000, lost only 4 from small-pox, 8 cases alone of that disease having occurred; the Malay troops, with a total mortality of 858, lost only 9 from small-pox; while the Pioneer corps, with a mortality of 647, lost only one from that fatal disease. Dr Kinnis states, that during the last epidemic of small-pox not a case occurred among any of the white or native troops.

Equally conclusive facts we find in the Madras army statistics,* published by Government, under the superintendence of Dr George Pearse, Secretary of the Medical Board, Madras. The European troops of the Madras Presidency division, from 1829 to 1838 inclusive, a period of ten years, had an aggregate strength of 103,431, and a total mortality of 4,725; of this number, however, only 2 deaths were from small-pox.† To exhibit, however, the prevalence of small-pox among the native population with whom the troops were in habitual intercourse, it is mentioned that in the native infirmary there, from 1827 to 1838 inclusive, no fewer than 352 cases of small-pox were admitted, of which 179 died.

Among the European troops of the southern division of the Madras army, not a single case of small-pox occurred, from 1834 to 1838 inclusive, though it prevailed to a considerable extent among the native inhabitants. Indeed, Mr Morgan, in his medical report of the 57th regiment, published in the Madras Quarterly Medical Journal for April 1840, states that although small-pox almost constantly exists in Cannanore or some of the neighbouring villages, in which the regiment was stationed, not a single case had occurred among the men of that regiment up to the date of the report.

I have not been able to learn whether any cases of small-pox occurred among the white troops at Calcutta from 1832 to 1834, but the following table‡ will exhibit the fearful ravages of that disease among the native population during that period—a population which is only very partially vaccinated, and is reckoned at about 300,000.

1832—died of small-pox,—679	1839—died of small-pox,—81
1833 - - - 2548	1840 - - - 22
1834 - - - 36	1841 - - - 56
1835 - - - 53	1842 - - - 25
1836 - - - 16	1843 - - - 336
1837 - - - 266	1844 - - - 2924
1838 - - - 1507	

“ In the villages around Calcutta, (we learn from Dr Stewart’s

* Report on the Medical Topography and Statistics of the Presidency Division of the Madras Army. Madras, 1842.

† The “ Report of Committee of the Statistical Society of London on the Sickness and Mortality among European and Native Troops serving in the Madras Presidency,” includes the specification of diseases for a period of twelve years, from 1827 to 1838. During this period the total mortality among the European troops was 6,221, but only two from small-pox, as in the Government returns for a shorter period. In fact, the small pox deaths occurred in the years 1837–38.

‡ Dr Stewart’s Report on Small-pox in Calcutta, and Vaccination in Bengal. Madras Spectator, Dec. 7, 1844.

report,) the mortality was fearfully great, and in many instances whole families were swept away."

These are the only definite facts on which I have been able to lay my hands relative to the protective powers of vaccination. It is to be remembered that when a recruit is examined for the army, attention is always paid as to whether he has been vaccinated or not; and if he has not gone through that preventive, or had small-pox naturally, he is forthwith vaccinated. It is only therefore of the military we can procure distinct proofs that all have undergone vaccination; and when we find that these men resist the small-pox when living in constant intercourse with a people among whom it is committing fatal ravages, we are forced to conclude that the vaccine virus has neither degenerated in protective power in consequence of its frequent transmissions through the human subject, nor does its protective power materially wear out of the constitution after a lapse of years.

Having thus shown that the existing prevalence and mortality of small-pox is not owing to any failure in the protective powers of vaccination, we proceed in the next place to inquire,—

3dly. Is the existing prevalence and mortality of small-pox owing to the neglect of vaccination? Few facts have been published relative to the numbers of the inhabitants of any country protected by vaccination; yet several incidental facts are noticed, which allow us to estimate comparatively the proportion of the population who have been vaccinated. These facts are all the more valuable that they have not been published with the view of proving any particular theory, but are mentioned incidentally in the course of treating of other subjects.

M. Bousquet, in his "Traité de la Vaccine," mentions, relative to the population of Marseilles, that in 1825, when attacked with an epidemic small-pox, the population was divisible into three classes; 30,000 had been vaccinated; 8,000 had neither been vaccinated nor had small-pox; and 2000 had been inoculated with small-pox, or had the small-pox naturally. A whole fourth of the population was therefore unprotected against small-pox, and the natural consequence was, that, during the fatal epidemic which at length attacked them, no fewer than 1448 died of this disease in a few months.

M. Villermé, in his interesting paper entitled "Tableau relatif aux Vaccinations pratiquées en France, et aux petites Veroles,"* states that from 1808 to 1826 there occurred over France 10,815,996 births, of which only about one-half, or 5,845,003, were vaccinated; thus leaving the half of the population exposed to the ravages of small-pox. The natural consequence of this unprotected state of such a number of the population was abundantly evidenced by the fact, that during these years, viz. from 1808 to 1826 inclusive, no fewer than 635,448 cases of small-pox occurred, of which number 91,807, or 1 in 6.8, died, and 45,302, or 1 in 12.4 of the remainder were rendered invalids or disfigured; giving an average mortality from small-pox for each of these years of 4832.

* Annales d'Hygiene Publique, vol. i. 1829, p. 480.

Almost every year exhibits the same carelessness with respect to vaccination, and the usual consequence, viz. a great amount of deaths from small-pox. Thus in 1830 there were born in France 398,516, of whom only 253,972 were vaccinated. During that year there occurred 9,764 cases of small-pox, of which 1340 died, or 1 in 7.2, and 831 were disfigured or rendered invalids.

In 1835, again, 745,444 births occurred in France, only 518,734 of whom were vaccinated. During that year 13,726 cases of small-pox occurred, of which 1893 died, or 1 in 7.2, and 1486 were disfigured or rendered invalids.

In 1843, again, 910,387 births occurred, of which only 547,646 were vaccinated; or in the proportion of 60.1 to every 100 births. During that year 11,779 cases of small-pox occurred, of which number 1379 died, or 1 in 8.5. The following table will exhibit these statements at a glance.

France 1808-1843.

Year.	Births.	No. vaccin.	Prop. to 100 births.	No. cases of small-pox.	Deaths from small-pox.	Propor. deaths to 100 cases.	Numerical proportion.
1808-1826	10,815,996	5,845,003	54.0	635,448	91,807	14.4	or 1 in 6.8
1830	398,516	253,972	63.7	9,764	1,340	13.7	or 1 in 7.2
1835	745,444	518,734	67.1	13,726	1,893	13.7	or 1 in 7.2
1843	910,387	547,646	60.1	11,779	1,379	11.7	or 1 in 8.5

These facts therefore show that in France, where government pays much attention to vaccination, a very large proportion of the population neglect the blessings offered them gratuitously, and thus keep up an infectious and loathsome disease continually among them. If we look to the mortality, however, of this disease in France during the years above enumerated, we shall see that it is the very same as before the introduction of vaccination, being about 1 in 7 attacked with the disease. This fact then of itself demonstrates that the cases attacked were those which had never been vaccinated. This conclusion is, however, verified by the last French Government Report which has reached me, viz. that of 1843, published in the *Journal des Debats*. After enumerating the births and number of vaccinations, it states that "of those not vaccinated 11,779 were attacked with the small-pox." In fact, the number of cases given in the table above.

Though a little out of the immediate object of inquiry, a strong fact may be mentioned, showing the influence of vaccination in diminishing the proportion of cases of small-pox, and of course in diminishing the mortality from that disease; and as the fact shows what perseverance in the use of protective means on the part of government can do, I make no apology for introducing it here. The French government pays much attention to the extension of vaccination, and it is a notable fact, much to their credit, that the numbers vaccinated have steadily increased since 1826, and just in that proportion the cases of small-pox have diminished in number.

Thus, from 1808 to 1826 the proportion of vaccinations to births was nearly the same during all that period, being 540 vaccinations for every 1000 births, or very nearly as 5 to 10. During that period the annual average of deaths from small-pox over France was 5100. By 1838 the proportion of vaccinations to births had only increased as 5 to 8; yet the annual average of deaths from small-pox had fallen to about 1500.

In Paris alone, from 1817 to 1827, there died from small-pox 7034, but from 1827 to 1837 the mortality fell to 4417.

Or, in other words, so long as the proportion of vaccinations did not exceed one-half or five-tenths of the births, the mortality from small-pox in Paris averaged 1090 per annum; but when the vaccinations amounted to five-eighths of the births the average annual mortality from small-pox in Paris fell to 420. This statistical fact certainly holds out the strongest motive for perseverance, and even excites the hope that the universal adoption of vaccination would quite extinguish the small-pox.

In Sweden, again, we learn from the tables which have from time to time been published, that vaccination is neglected even there to a much greater extent than most writers on vaccination would have previously believed. The following table, compiled from the government returns, will exhibit this fact in its true light.

Table of Annual Proportion of Vaccinations to Births in Sweden.

Years.	Annual aver. of births.	Annual aver. of num. vacc.	Annual aver. unpro. by vac.	Ann. propor. of vac. and unvaccin. to 100 births.	
				Vaccinat.	Unvac.
1816-25,	90,480	63,491	26,989	70.1	29.9
1826-30,	94,946	62,972	31,974	66.3	33.7
1831-35,	95,359	68,145	27,214	71.4	28.6

From this table we learn that nearly a-third of the population are unprotected by vaccination. Or, if we allow for the deaths which occur among the infants previous to vaccination, that a fourth of the population of Sweden are unprotected from the ravages of small-pox by having never been vaccinated. That small-pox should keep its hold among such an unprotected population need therefore surprise no one; the chief wonder, indeed, is that the mortality from that disease should be so small as the table formerly given shows it is.

The Austrian government has published a statement relative to vaccination, which exhibits in a very strong light the point for which I am now contending, viz. that small-pox is kept up from the neglect of vaccination, and that a very large proportion of the population are unprotected by vaccination. The following table exhibits the returns from a few of the Austrian provinces for 1832 and 1833. I know not whether similar returns were made for the other provinces.

Years.	Provinces.	Number vaccinat.	No. in which vac succeeded	No. in which vac failed.	Number remaining unvaccin.	Cases of small-pox.	
						Inoculat.	Not inoc.
1832.	Dalmatia,	9,266	9,132	134	604	8	28
	Hungary,	185,972	184,834	1,138	—	—	1,545
	Venetian Territories, }	55,222	52,740	2,482	15,416	3,981	5,706
	Austria on the Enns, }	19,143	18,023	1,120	20,748	—	1,683
1833.	Austria on the Enns, }	17,690	17,095	595	18,559	177	5,289
	Moravia and Silesia, }	70,302	67,500	2,802	12,400	59	118
	Styria,	20,005	19,202	803	5,331	—	1,491
	Illyria,	17,119	—	—	3,964	718	2,430
	Maritime Territories, }	14,432	14,260	172	2,538	27	133

From this table it appears, not only that about 1 out of every 43 failed to take the infection of vaccination, but, what especially concerns our present inquiry, that "*more than one-fifth of the total population remained unvaccinated.*" Such are the words of the Report; and with such a state of the population who can wonder that upwards of 10,000 cases of small-pox should annually occur in these dominions; or that the contagion, once rendered virulent by concentration, should spread also to the vaccinated and inoculated!

The same facts are exhibited by considering the state of vaccination and small-pox in Ceylon. We learn from the "Report of the Committee of Legislative Council for the examination of witnesses respecting small-pox and chicken-pox," that, excepting during the actual prevalence of a small-pox epidemic, the Ceylonese greatly neglect vaccination;* and even when they did subject themselves to it, it was frequently so very carelessly and inefficiently conducted that "twenty or twenty-five people were vaccinated from one pustule," (p. 23.) We learn, however, from the same "Report," that when vaccination was perfectly attended to, and all or nearly all the natives in the maritime provinces were vaccinated, small-pox was completely banished from the island. It is to be remembered that all the central portions of the island, or the Kandian Provinces, only came into the British possession in 1815, so that the above statement does not apply to them. This long period of freedom from the epidemic small-pox induced carelessness and additional unwillingness to be vaccinated, on the part of the natives, and for some

* Mr Henry Marshall, Deputy-Inspector-General of Army Hospitals, who spent many years of service in Ceylon, informs me that little confidence can be placed in the numbers returned as vaccinated. The Ceylonese had an idea that, in pressing on them the benefits of vaccination, it was done with the view of marking them, and subsequently exacting from all so marked some tax or labour service. They did not, therefore, apply to be vaccinated. The native vaccinators went to the bazaars, and vaccinated there all whom they could persuade to submit to it; but, as they rarely saw the persons again, they could not know how many were properly vaccinated. Besides, it was always believed that these native vaccinators returned the names of more than they had actually vaccinated, to make it appear they were working for the pay given them by the British Government.

years previous to 1819 vaccination was comparatively neglected. During that year 7874 cases of small-pox were reported to government as having occurred, of which number 2945 died. It is very unlikely, however, that all the cases which occurred came under the notice of government,* as we learn that the natives had the utmost dread of being taken to the hospitals; but from the instructive paper of Mr Henry Marshall, then staff-surgeon at Kandy, we learn that such was its virulence in the district over which he presided, that of 931 cases admitted into the small-pox hospital at Kandy, more than the half, or 525 died,—a mortality exactly double what it was the year previous to the introduction of vaccination.

Dr Kinnis, in his highly valuable "Report on Small-pox as it appeared in Ceylon in 1833-34," mentions that "during the thirty-three years which have elapsed since the first introduction of vaccination, terminating with December 1834, the whole number vaccinated has been 822,321." But the population of the island in 1833, the kingdom of Kandy excepted, was 1,126,808. This fact demonstrates that, even on the very improbable supposition that all the vaccinated cases were alive at that period, no fewer than 304,477 must have been unprotected, and consequently liable to small-pox. We know, however, that not exceeding one-half of the cases vaccinated could have been living in 1833, and that consequently a full half of the population must have remained liable to be attacked with small-pox. We need not therefore be astonished that small-pox still rages epidemically among the natives of Ceylon; but, instead of attributing it to any degeneration of the vaccine lymph, or to the protective power wearing out of the system, common sense teaches us to attribute it to its true cause—the neglect of vaccination.

M. Heim† a few years ago published a "History of the Varioloid Epidemic in Wurtemberg from 1831 to 1836," from which it appears that, in that small kingdom, no fewer than 1677 cases of small-pox and the varioloid disease were admitted into the public hospitals during that period. The same neglect of vaccination seems to prevail here as in the above-recorded instances, for we find that, of 643 cases of true small-pox, 457 had not been vaccinated.

I have not been able to procure any equally satisfactory facts relative to our own country; but, even with regard to it, we may procure some facts which show approximatively the extent to which vaccination is neglected, and consequently small-pox is kept up.

The following table, published by Dr Gregory of the Small-pox

* Mr Marshall, from his own observation, is convinced that not a tenth of the cases of small-pox came under the notice of Government. The Ceylonese believe that small-pox depends on the presence of an avenging deity. Whenever, therefore, a person is seized with it, they all forsake him and leave him to his fate. When it raged epidemically in 1819, even Kandy itself was thus deserted, and Mr Marshall, during his morning rides around the cottages in the outskirts of Kandy, found them completely deserted, and the unfortunate beings who had small-pox left to their fate in the outhouses, &c. In so far as the province of Kandy was concerned, returns were only made of those admitted into the small-pox hospital at Kandy; and it was the same over the other districts of the island.

† Bulletin Medicale Belge, Aug. 1839, p. 197.

Hospital, London, exhibits the mortality from that disease of the cases admitted to the hospital, during a period of fifty-six years.

Years 1780—9,	cases of small-pox	2954,	deaths	1031=34.90 per cent.
1790—9,	-	-	2322,	- 763=32.36
1800—9,	-	-	1574,	- 478=30.37
1810—9,	-	-	1188,	- 357=30.05
1820—9,	-	-	2225,	- 658=29.57
1830—5,	-	-	1590,	- 388=24.40

Of 2191 cases of these, whose state as to vaccination was ascertained, being the last cases admitted, it appeared that

1393 cases were not vaccinated, of which 571 died, or 41.1 per cent.
789 - vaccinated, - 46 - 5.8
9 - inoculated, - 2 - 22.2

This also demonstrates that the great proportion of those who fall victims to small-pox are those who are unprotected by vaccination, and are consequently liable to small-pox.

To Henry Marshall, Esq. Deputy-Inspector-General of Army Hospitals, I am indebted for the following statement, which shows the same fact. The statistics of recruiting for the whole British army, (English, Scots, and Irish,) during the year ending 31st March 1844, show that, of 11,514 men found fit for service,

8418 had distinct marks of vaccination,
2711 had marks of small-pox,
385 had no distinct marks of either.

This statement, therefore, shows that, of 11,514 men taken in a manner at random over the whole kingdom, more than a third had either already had small-pox or were still liable thereto. In fact, it shows that only two-thirds had been protected from small-pox by vaccination. But it proves more. It proves that of every 100 men of the ages of 18 to 20, (the usual ages of recruits,) who had not been vaccinated, small-pox had already seized ninety of them. So true is the observation of Duvillard, that, of 100 men of the age of 30, who have not been protected by vaccination, not exceeding four will be found to have escaped the small-pox. If these men, therefore, be taken as a fair average of the lower orders in this country, and their state relative to vaccination be considered as exhibiting the state of the lower classes generally with regard to vaccination, what a fearful apathy and disregard of the use of protective means against a loathsome distemper does it exhibit! And how can any one wonder that, with no more than two-thirds of the population vaccinated, small-pox should prove nearly as fatal annually as it did before the illustrious Jenner discovered the protective powers of the vaccine lymph. Before the introduction of vaccination it was calculated that small-pox cut off annually about 30,000 of the population of Great Britain. This was but a rude guess, and probably overestimated the actual mortality. But the Mortality Bills demonstrate that, even in 1838, no fewer than 16,267 were cut off by small-pox in England and Wales alone.

It is quite consistent with observation to conclude that all the cases of small-pox which occur among children under five are among the unvaccinated. This conclusion is arrived at by every

one who has written on the subject, and from my own investigations into the deaths of children from small-pox for several years past in Edinburgh, I am satisfied that the conclusion is quite legitimate. Indeed, one of the recorders of the Edinburgh burying-grounds has for some time past been making inquiries for me relative to this very point, and he assures me that not one of the cases of death from small-pox which he has lately recorded has occurred in a vaccinated subject.

Now, it is stated in Dr Watt's "Vital Statistics of Large Towns in Scotland,"* that in Edinburgh, from 1839 to 1841, no fewer than 82.683 out of every 100 deaths from small-pox were under five years of age; in Glasgow, 85.729 per cent. were under five years from 1837 to 1841; in Perth, 87.755 per cent. were under five; and in Dundee, 85.258 per cent. under five years of age. In the records of the Canongate burying-grounds, where the ages as well as the diseases of the deceased are recorded, I find that from 1780 to 1836, 1068 cases of small-pox are recorded; of which number only 36 were above five years of age. Or, in other words, 96.7 of every 100 were under five years of age, and only 3.3 above that age. It may also be stated that by far the greatest proportion of the cases under five years of age, I should say four-fifths, were under one year. The chief mortality, therefore, from small-pox in Scotland is in the unvaccinated; in fact, it is by them the disease is kept up.

The very same is true of England. In the Report of the Registrar-General for 1838, we find that of 8,706 cases of small-pox, in which the ages were ascertained, no fewer than 7,583 were under five years of age, or 85.9 per cent.

In Ireland, again, we learn from the "Report of the Commissioners appointed to take the Census of Ireland for the year 1841," that for the ten years ending 6th June 1841, no fewer than 58,006 deaths from small-pox occurred, of which 49,038 were under five years of age, or 84.5 per cent. From Dr Griffin's excellent "Inquiry into the Mortality occurring among the Poor of the City of Limerick,"† the same conclusion may be deduced. Of 393 cases of small-pox, 333 were under five years of age; 55 were between five and ten; and the remaining 5 were under fifteen years of age. Dr Griffin remarks that he could not ascertain whether any of these cases were vaccinated, but he did ascertain that 16 of the deaths arose from the children having been inoculated with small-pox.

From all these statements, then, the only rational conclusion seems to be that the small-pox is kept up and its ravages extended by the neglect of vaccination—a neglect to an extent of which none seems to have had any idea.

Being anxious to ascertain the actual state of our pauper population relative to vaccination and small-pox, I took the opportunity in December 1841, of making inquiries into the subject, when taking up the names of families requiring relief in two districts of the Old Greyfriars parish in Edinburgh. The following table exhibits the actual state of 73 families whom I visited as to this point.

* Transactions of the British Association, 1842.

† Quarterly Journal of the Statistical Society of London, Jan. 1841, p.316.

Names of Heads of Families.	No. of Family.	No. Vac.	No. had S.-Pox.	S.-Pox after Vaccin.	S.-Pox after S.-Pox	No. Un-protected.
Thomas Fullerton,	7	3	—	1	—	4
Daniel Ross,	4	4	—	1	—	—
Thomas Dillon,	4	2	—	—	—	2
Adam Innes,	4	3	—	—	—	1
Anne Clark,	5	4	1	—	—	—
Catherine Straiton,	2	2	—	—	—	—
Marion Forrest,	1	—	1	—	—	—
John Mackay,	2	2	—	—	—	—
Eliza Cameron,	1	—	1	—	—	—
Margaret Douglas,	2	—	2	—	—	—
Janet Wood,	3	—	3	—	—	—
Anne Watson,	3	1	1	—	—	1
Jean Angus,	1	—	1	—	—	—
Euphemia Frazer,	3	2	1	—	—	—
Alexander Carmichael,	5	4	1	—	—	—
John Luke,	4	3	1	—	—	—
William Slater,	2	2	—	—	—	—
John Falkner,	3	3	—	—	—	—
Samuel Gray,	5	4	—	—	—	1
Simon Frazer,	5	3	2	—	—	—
John Macdonald,	3	3	—	—	—	—
Jane Brown,	4	4	—	—	—	—
Neil M'Kechney,	6	5	—	—	—	1
Charles M'Donald,	5	3	2	—	—	—
Jane Millar,	5	4	1	—	—	—
John Adams,	5	1	4	—	—	—
John Ferguson,	3	1	2	—	—	—
John Jones,	2	1	1	—	—	—
Peter Macaulay,	6	5	1	—	—	—
William Kyler,	4	3	1	—	—	—
Thomas Hay,	6	3	2	—	—	1
Elizabeth Kelly,	1	—	1	—	—	—
Marjory Duffy,	3	2	1	—	—	—
James Duffy,	4	2	1	—	—	1
Anne Carline,	3	1	1	—	—	1
Mary Brown,	1	—	1	—	—	—
Mary Flin,	6	—	6	—	—	—
Thomas Collins,	3	—	3	—	—	—
John Victory,	3	—	2	—	—	1
Torrance Flin,	5	3	2	—	—	—
Robert Meldrum,	5	—	4	—	—	1
James Gartland,	5	2	3	—	—	—
Peter Branagan,	5	4	1	—	—	—
Widow Mackay,	1	—	1	—	—	—
Mary Smith,	2	1	1	—	—	—
Johnstone Kerr,	2	—	1	—	—	1
Peter Macgregor,	5	—	5	—	—	—
Rosa Fowler,	1	—	1	—	—	—
Betty Kelly,	3	—	—	—	—	3
Samuel Cockburn,	8	2	6	—	—	—
Charles Plifford,	3	—	—	—	—	3
James Queen,	4	2	2	—	—	—
	188	94	72	2	0	22

Names of Heads of Families.	No. of Family.	No. Vac.	No. had S.-Pox.	S.-Pox after Vaccin.	S.-Pox after S.-Pox	No. Un-protected.
Brought forward,	188	94	72	2	0	22
John Dinnon, .	3	1	2	—	—	—
Michael Maclaren,	6	1	5	—	—	—
John Cosgrove, .	5	3	2	—	1	—
Isabella Crosby, .	1	1	—	—	—	—
James Macguire, .	4	1	3	—	—	—
Helen Donnelly, .	1	—	1	—	—	—
Andrew Nasmyth, .	2	2	—	—	—	—
Janet Drummond,	1	1	—	—	—	—
John Tyac, .	5	1	4	—	—	—
Michael Kelly, .	3	—	3	—	—	—
Christian Wright,	2	1	1	—	—	—
William Evans, .	4	2	1	—	—	1
Andrew Dowie, .	3	1	2	—	—	—
Margaret Hamilton,	2	2	—	—	—	—
Isabella Donaldson,	1	—	1	—	—	—
James Kelly, .	7	2	4	—	—	1
Janet M'Queen, .	1	—	1	—	—	—
Sophia Stewart, .	1	—	1	—	—	—
Helen Macleod, .	1	1	—	1	—	—
Helen Millar, .	2	2	—	—	—	—
Eliza Beuse, .	1	—	1	—	—	—
Total,	244	116	104	3	1	24

From this table it appears that, of 244 individuals (members of 73 families) residing in the same parish in Edinburgh, only 116, or less than the half, were vaccinated; that 104 had already taken small-pox, and 24 were still liable to an attack thereof, being unprotected by vaccination, or by having had the natural small-pox.

The only other similar fact with which I am acquainted, as showing on a limited scale the actual proportion of vaccinated individuals among the poorer classes of this country, is that one published by Mr Marshall relative to the parish of Chelsea.* From his statement it appears, that 45 families applied for parochial medical relief between June 1838 and June 1839, on account of small-pox being among them. These 45 families yielded a total of 264 individuals, and of these 81 only were vaccinated; 30 died from small-pox in these families—27 of these with the natural small-pox, and 3 under a second attack of that virulent disease. No deaths occurred among the vaccinated.

Now, although it may be objected to Mr Marshall's statement, that it cannot fairly represent the state of the poorer classes in England, seeing that it applies simply to those who applied for medical relief when actually labouring under small-pox, the same cannot hold with regard to the table which I have given above. The above table shows the actual state of a considerable section of the popula-

* Lancet, 1838-39, p. 854.

tion of the Old Greyfriars parish, enumerating every family in that section ; and from personal inquiries in other parts of Edinburgh, I am satisfied that the lower classes in most parts of the city are in very nearly the same proportional state as to vaccination.

Seeing, then, that less than the half of our lower classes are not protected by vaccination from the ravages of small-pox, and seeing that this table, as well as the statistics of recruiting, demonstrates that almost all who are not so protected take that disease, need it surprise us that small-pox should continue its ravages among us? From the above table we see that, in every 100 individuals, 48 (strictly 47.54) only were vaccinated, 42 (42.21) had small-pox, and 10 (9.85) were ready to take it as soon as exposed to its contagion. Seeing, then, that this is the case, we can easily explain the continued prevalence and fatality of that loathsome disease among us. We see that 10 of every 100 of the lower classes are liable to take small-pox from being neither protected by vaccination nor by having had the natural disease. When, therefore, an epidemic makes its appearance among them, it finds so many subjects on which to wreck its violence, that its virulence increases more and more, until at last it acquires that intensity that it extends to those protected by vaccination or by having had a previous attack of small-pox itself. We know that almost every epidemic attacks a certain number of those who have been vaccinated, as well as of those who have had the natural or inoculated small-pox ; but it is extremely satisfactory to know that far fewer of those die who have been previously vaccinated, than of those who have had a previous attack of small-pox. This subject will be alluded to afterwards.

As the above conclusions, deduced from statistical facts, are new, and put the question of the cause of the prevalence of small-pox in a tangible and authentic form, it may be excusable to put them in the form of a table, so that they may be seen at a glance, and be more easily compared together.

Table of Proportion of Population vaccinated in different countries.

Countries.	Authorities.	Proportions of Vaccinations to 100 of Population.
Great Britain and Ireland.	Statistics of Recruiting.	73.0
Chelsea, (England).	Marshall.	30.6
Edinburgh, (Scotland).	Stark.	47.5
Austria, 1833.	Austrian Governm. Reports.	67.5
France, 1806-26.	Villermé.	54.0
France, 1843.	French Governm. Reports.	60.1
Marseilles.	Bousquet.	75.0
Sweden, 1816-35.	Registrar-General's Report.	69.2
Ceylon, 1802-34.	Kinnis.*	36.4

From this tabular view of the facts which are above stated re-

* This allows the half of those recorded as vaccinated between 1802 and 1834 to have been alive in 1834, and does not include the unvaccinated population of the kingdom of Kandy, which would reduce the proportion vaccinated nearly a half lower.

lative to the proportions vaccinated and unvaccinated in different countries, we see that vaccination is much more neglected than it ought to be, or than it ever has been believed to be. In our country, (which especially concerns us,) the statistics of recruiting show us that over the kingdom more than a third of the lower classes of the population are unprotected by vaccination; the Edinburgh table allows us to infer that in Edinburgh more than a half are unvaccinated; and the Chelsea tables prove that fully two-thirds of the lower classes in England have never been subjected to vaccination. Even estimating the number vaccinated at the very highest, we find that it does not exceed two-thirds of the population. With such a state of the population we need not be surprised that England and Wales should lose their ten or sixteen thousand annually from small-pox, Ireland its six thousand, and Scotland its one or two thousand. Indeed with such a state of the population, the wonder is that small-pox is not a more fatal malady. Seeing, however, that such is the probable state of our population with regard to vaccination,—seeing that almost all who are not vaccinated are sure sooner or later to be attacked with small-pox, it becomes the interest not only of an enlightened government, but of every individual of all classes of the community, to exert themselves to extend the benefits of vaccination to every subject of the realm. Should a virulent epidemic of small-pox break out among the lower classes who are in the above state with regard to vaccination, it would soon extend its ravages to many of the higher classes, and to not a few of those protected by vaccination itself. It is therefore the personal interest of all to urge on the lower classes to avail themselves of the benefits of vaccination; and were this done as effectually as it is in the army, we should soon see the small-pox completely banished from these islands. To the disgrace of Scotland the vaccination act has not yet been extended to it. And if we find that act has already done unquestionable good to Ireland and England in increasing the number of vaccinations and diminishing or putting an end to the pernicious custom of small-pox inoculation, which constantly keeps up the disease among the people, as well as carries off more than are lost from an attack of small-pox after vaccination, it cannot be doubted that its extension to Scotland would go far to save many a valuable life.

There seems, however, to be one thing mainly defective in the Vaccine Act, which will most unquestionably prevent it from improving in any material degree the condition of our population relative to increasing the numbers vaccinated. The whole real good it has done or can do, in its present state, is the rendering penal the practice of small-pox inoculation. Merely allowing the Poor Law Guardians to contract for vaccinating the paupers will never have the effect of increasing the number of vaccinations over the country; nor will even this contract for vaccinating the paupers reach the thousands who, as much as the poor themselves, require to have the

advantages of vaccination pressed upon them. The correctness of this opinion is evidenced by the numbers cut off by small-pox even in London itself during the last year—four years after the act was passed—no fewer than 1804 having died of that loathsome disease, very nearly as many as before vaccination was introduced.

Every one who reflects on the subject, but especially on the statistical facts brought forward for the first time in this paper as to the state of our population with respect to vaccination, must be convinced that some more efficient measures must be used in order to secure the people from the ravages of small-pox. This could only be done efficiently by passing an act obliging every medical practitioner, or midwife who attends the birth of a child, to see that child vaccinated, or give a satisfactory reason, such as the refusal of the parents, for its non-performance. In order to carry such a measure into effect it would be necessary to have a salaried officer under Government, to whom regular monthly, quarterly, or half-yearly returns should be directed to be made from all such practitioners and midwives, under a severe penalty; and this Government officer should be bound to return to the Secretary of State for the Home Department, and publish annually a list of the numbers of births and vaccinations, with such other particulars as might be desirable. This officer should also be director or superintendant of a central Vaccine establishment in the metropolis, where a constant supply of vaccine virus should be kept up, and transmitted to applicants in all parts of the kingdom. Three such officers would be required, and three such central Vaccine establishments—one in London, one in Dublin, and one in Edinburgh; and if we reflect that such means would undoubtedly have the effect of efficiently propagating the benefits of vaccination, and consequently producing an annual saving of from 15,000 to 20,000 lives, all will admit that an annual grant of L.5000 or L.6000, which would probably cover the expenses of such establishments, would be well bestowed.

Having thus, I hope, satisfactorily proved that the continued prevalence and fatality of small-pox, not only in our own country, but over all the kingdoms of Europe, is owing to the neglect of vaccination, it only remains shortly to show that

4thly, Vaccination affords as perfect a protection from small-pox as it is possible to obtain,—as perfect immunity from danger as if the person had once passed through the natural small-pox. When vaccination was first introduced into practice, Doctors Jenner, Pearson, Woodville, and others, inoculated with small-pox matter the persons who had been vaccinated, in order to test the efficacy of the antivariolous powers of the vaccine virus. Among all the persons thus treated not a single instance occurred of the person who was previously vaccinated taking the small-pox; and the numbers with whom this severe test of the protective powers of vaccination was tried may be judged of by the fact, that by 1800, upwards of 6000 had been

inoculated with small-pox after a previous vaccination, and all had resisted that disease.

Even the opponents of vaccination, however, are forced to allow that these are incontrovertible facts; but they assert that vaccination is not *now* that efficacious preservative which these experiments prove it *then* to have been. In fact, they demand for vaccination what a previous attack of small-pox does not even procure,—viz. complete exemption ever after from a subsequent attack of small-pox. I shall therefore very shortly show that a second attack of small-pox is not an uncommon occurrence, and that it is then a comparatively fatal malady, certainly more so than an attack of small-pox after vaccination. The “Report of the Section of the Provincial Medical and Surgical Association appointed to inquire into the present state of Vaccination,” renders it abundantly evident that a second attack of small-pox is far from being of rare occurrence. Thus Mr Crosse of Norwich reported that of 603 cases of small-pox which had been witnessed by him in that town during the course of his practice, no fewer than 297 had previously had small-pox, while only 91 had been previously vaccinated. The Vaccine Section state that their correspondents relate the occurrence of no fewer than 239 cases of small-pox after small-pox, of which 12 or 13 died. Mr Goolden, in a practice of forty years, has seen about 90 cases of second attacks of small-pox, of which 4 died; and he was acquainted with two families who had small-pox three times. Dr Thomson of Edinburgh met with 41 cases of a second attack of small-pox, and 30 similar cases were communicated by a friend;—of this number 3 died. 310 cases occurred after reputed vaccination, but of this number only 1 died; but it was not ascertained whether the disease was true small-pox or chicken-pox.

M. Bousquet states, that in Marseilles during the year 1825, out of a population of 40,000, about 2000 had previously had small-pox; yet of this number 20 were attacked the second time with that disease, and 4 died. The deaths were therefore in the proportion of 20 out of every 100 attacked, or 1 out of every 500 of those who had previously had small-pox. In the same population 30,000 were vaccinated, and of this number 2000 took small-pox, or modified small-pox, (varioid); of these only 20 died, or in the proportion of 1 out of every 100 attacked, or 1 out of every 1500 vaccinated. This fact then shows the infinite superiority of vaccination to a previous attack of small-pox in affording safety and protection from danger to life under a subsequent attack of small-pox, for while 1 out of every 5 died who had previously had small-pox, only 1 out of every 100 died who had been vaccinated.

In the Royal Military Asylum at Chelsea* there occurred, from 1803 to 1833, no fewer than 26 cases of small-pox after small-pox among the children in that institution; but only 24 cases of small-pox after vaccination. The superior protection to life which vaccination afforded over the natural small-pox was shown in the fact,

* Provincial Med. and Surg. Association Trans. vol. viii. 1840.

that while not one child died who had been previously vaccinated, no fewer than three died under the second attack of small-pox.

Not to multiply instances, M. Heim, in his account of the epidemic small-pox in Wurtemberg, from 1831 to 1836, states that 39 who had previously had small-pox took the disease a second time, and of these 14 died, or 35·8 of every 100 attacked; 147 who had perfect vaccine cicatrices were attacked, and of these 42 died, or 28·5 out of every 100 attacked.

And lastly, Dr Gregory, of the Small-pox Hospital, London, shows by the statement of the state of the patients relative to vaccination admitted into that hospital, that while those who had previously had small-pox died in the proportion of 22·2 out of every 100, those who had been previously vaccinated only died in the small proportion of 5·8 out of every 100. These facts will be rendered more distinct by embodying them in the following table.

Table showing the comparative Mortality of Small-pox after Small-pox, and Small-pox after Vaccination.

Authorities.	Small-pox after Small-pox.			Small-pox after Vaccination		
	No. of cases.	Deaths	Propor. of deaths to 100 cases.	No. of cases.	Deaths	Propor. of deaths to 100 cases.
Thomson, Edinburgh,	71	3	4·2	310	1	0·3
Chelsea Milit. Asylum,	26	3	11·5	24	0	0·0
Heim, Wurtemberg,	39	14	35·8	147	42	28·5
Bousquet, Marseilles,	20	4	20·0	2000	20	1·0
Gregory, London,	9	2	22·2	789	46	5·8
Total,	165	26	15·7	3270	109	3·3

From this table, then, it will be apparent that while those who take small-pox for the second time die in the proportion of 15·7 out of every 100, those who take small-pox after vaccination only die in the small proportion of 3·3 out of every 100—a proportion absolutely lower than the mortality of almost any other, even the mildest disease.

The above instances may suffice to prove that a second attack of small-pox is not a very uncommon occurrence, as well as that when it does occur it is a much more fatal malady than an attack of small-pox after vaccination. I have myself attended a few cases of second attacks of small-pox, as well as cases of small-pox after vaccination; but, as all recovered, the narration of these cases would not throw any additional light on the points under discussion.

Before leaving this subject, one circumstance may be alluded to which has come out of late years, since the alarms excited relative to the supposed inefficacy of vaccination have come under notice. The Prussian, Hanoverian, and some other continental governments, taking alarm at the spread of small-pox among their subjects, and mistaking, as I firmly believe, the true cause, commanded their standing

armies to be revaccinated. According to the official report* relative to the "Revaccinations in the Hanoverian army for the years 1837-8, and 9," it appears that revaccination succeeded only in 11 per cent., and was only partially successful in 27 per cent.,—completely failing in 62 out of every 100. It so happened that in the army there were a certain number of men, who, instead of being vaccinated, had had small-pox. They likewise were subjected to the general vaccination; and, as if nature wished to prove to disbelieving man that being *once* vaccinated, or having *once* had small-pox were identical in preventing a subsequent attack of small-pox, vaccination succeeded with them in the same proportions as with those who had been previously vaccinated.

M. Heim, also, in his "Historical and Critical Review of the Small-pox Epidemics, &c. in the Kingdom of Wurtemberg," states that individuals may be vaccinated in the very same proportions after small-pox as after vaccination; and in proof he gives the following proportional table deduced from his own observations, and from the actual results furnished by re-vaccinations in the Wurtemberg army.

Of 100 vaccinated after small-pox, 32 succeeded, 26 were modified, 42 failed.
Of 100 vaccinated a second time, 34 succeeded, 25 were modified, 41 failed.

As the physical constitution of men, and of course their liability to disease, vary in inhabitants of different countries, the only fair way of judging of the comparative protection offered by a first attack of small-pox and by vaccination, is by comparing the results furnished by inhabitants of the same country. Thus though unfair to compare the results of revaccinations in Wurtemberg with that of vaccinating small-pox subjects in Hanover, it is strictly correct to compare the results of revaccination with those of vaccinating small-pox subjects in the same country. And when we find that both at Wurtemberg and at Hanover the same ratio of proportion was maintained, we must also from this conclude that vaccination gives as perfect immunity from a subsequent attack of small-pox, as if the person had once passed through the small-pox itself. More than this we can never ask—more than this we can never obtain. If the protective powers of vaccination wear out of the system after a certain number of years, which I most unhesitatingly deny, so do those of an attack of small-pox itself. And if theorists imagine and endeavour to prove that a person ought to be revaccinated every twelve or twenty years, I hold it just as equally necessary that the person who has had small-pox be, after the same space of time, again subjected to that disease by means of inoculation, that he may not fall a victim to the disease, should he take it for the second time naturally. The latter proposition is so preposterous that I cannot imagine any one so obtuse as not to see its absurdity. And if it be so, certainly not less so is the proposal to revaccinate.

In conclusion, then, it may be remarked that the above facts es-

* Hanoverische Annalen, Heft ii. 1840.

tablish that the existing prevalence and mortality of small-pox is not owing to any failure in the protective powers of the vaccine virus, nor to its wearing out of the system after a certain number of years, but to the neglect of vaccination altogether ; and that vaccination affords a greater protection from a fatal termination, should the individual be subsequently attacked with small-pox, than if he had passed through the natural or inoculated small-pox themselves. It is highly desirable that attention should be paid to the facts above stated and to the conclusions drawn from them. From not being aware of these facts, many eminent physicians have by their writings, done much harm by inducing doubts as to the protective powers of the vaccine virus ; and as the public at large are very apt to discard altogether what they see learned men regard as only a temporary or doubtful preservative, perhaps no inconsiderable number of the cases of neglect of vaccination may be attributed to their writings being propagated among the public at large. Indeed I firmly believe that all the crude theoretical speculations relative to the supposed inefficacy of vaccination, as a preservative against small-pox, or its supposed wearing out of the system after a certain number of years, arise from ignorance of those very important statistical facts which I have collected together in this paper.

21 *Heriot Row,*
4th *March* 1845.

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