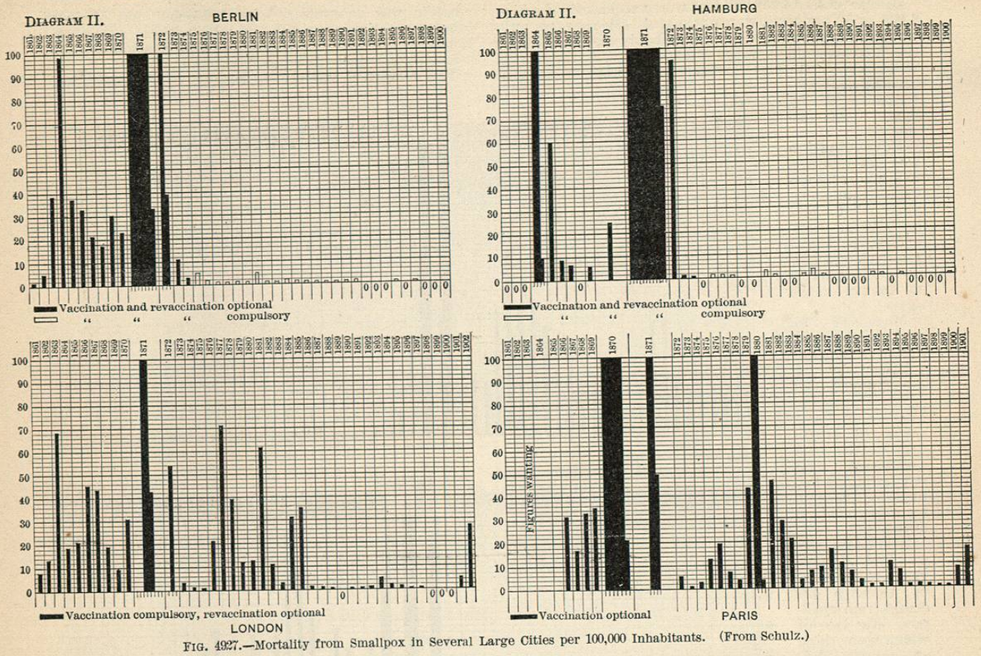

FIG. 4927.—Mortality from Smallpox in Several Large Cities per 100,000 Inhabitants. (From Schulz.)

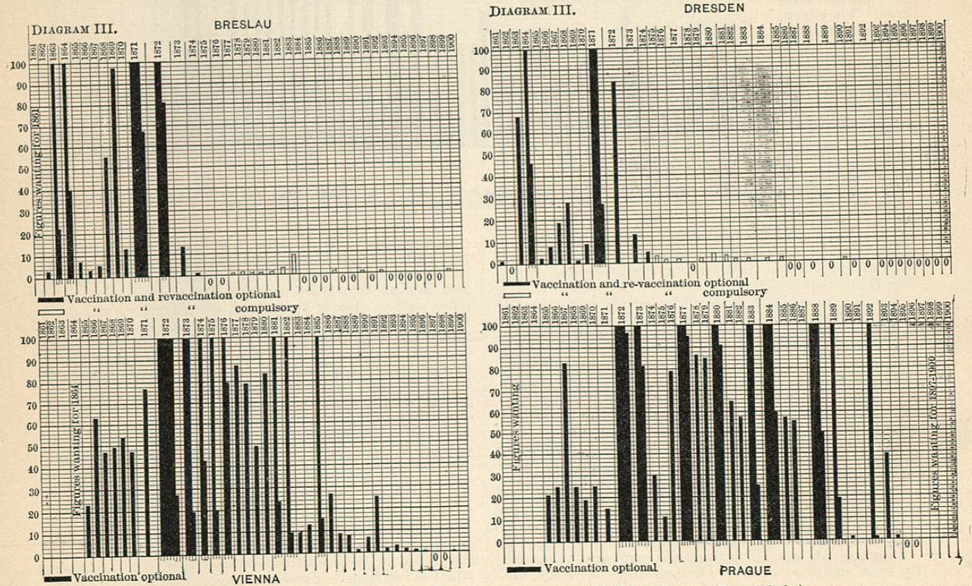

FIG. 4928.—Mortality from Smallpox in Several Large Cities per 100,000 Inhabitants. (From Schulz.)

the condition as to vaccination of 53,320 persons treated in 1886, 1887, and 1888, in 19 Hungarian hospitals. The second table presents the statistics of 5,518 deaths in the same hospitals and for the same period. A third table gives the statistics of 58,639 deaths in 10 Hungarian cities for the same years, from different causes.

Of the persons sick with different diseases in the hospitals, 11.75 per cent. were unvaccinated. If vaccination had no effect upon smallpox *morbidity*, then the unvaccinated would have shared to the rate of about 11.75 per cent. in the contemporaneous 1,912 cases of smallpox. In other words, there would have been 225 cases of smallpox among the unvaccinated. Instead of this the number of cases of smallpox among the unvaccinated was 726. The neglect of vaccination, therefore, increased the liability to smallpox three and one-fourthfold. In the same manner the author concludes that the danger of death from smallpox is six times as great among the unvaccinated.

He also estimates that skin diseases destroy two persons out of every million, while by vaccination two thousand are saved.

A severe epidemic of smallpox broke out in Montreal, in 1885, principally in the last half of the year, and destroyed 3,164, out of a population of 167,501. In the report of the local board of health for that year these are classified as follows:

	Population.	Deaths from smallpox.	Ratio per 1,000 of the population.
French Canadians	93,641	2,887	30.8
Other Catholics	29,627	181	6.1
Protestants	44,233	96	2.1

This classification was a fair index of the condition of the population of Montreal at the breaking out of the epidemic, the French Canadians being chiefly the unvaccinated portion, and the remainder the vaccinated.

"In the years 1873 and 1874, there died in the East Indies about 500,000, and in 1875 and in 1876 about 200,000 people from smallpox. On the other hand, among the European troops in the same country (120,000), there were only two deaths from smallpox. The immunity of the troops was attributed solely to the thorough and rigorous enforcement of vaccination" (Wernher, p. 263).

The contested points in regard to vaccination may be reduced to three:

1. Whether, in an equal number of vaccinated and unvaccinated, fewer of the former are attacked by smallpox than of the latter (a question of morbidity).

2. Whether, in an equal number of vaccinated and unvaccinated, fewer of the former die of smallpox (a question of mortality). To the question as to the ratio of the deaths from smallpox to the number of those taken sick with the disease, Körösi applies the term lethality.

3. Whether or not vaccination is of itself innocuous, and whether or not other diseases may not be introduced by vaccination (Körösi: "Neue Beobachtungen über den Einfluss der Schutzpockenimpfung auf Morbidität und Mortalität").

In summing up his observations upon the influence of vaccination upon the population of Buda-Pesth, Körösi collected the data of 20,574 cases of illness in four hospitals in Buda-Pesth and fifteen provincial hospitals of Hungary, subsequent to April 1st, 1886.

Excluding 223 children under one year of age, because many are not vaccinated in their first year, he found that out of 18,572 persons sick with different diseases, *exclusive of smallpox*, 16,135 were vaccinated, and 2,437 were not vaccinated. Of the 16,135 vaccinated, 1,306 died, or 8.1 per cent.; of 2,437 unvaccinated, 321 died, or 13.2 per cent. So that the lethality of the unvaccinated was 60 per cent. greater than that of the vaccinated, the disease, smallpox in this instance, being excluded from the calculation.

With reference to the effect of vaccination on the mortality from smallpox, he found that there were treated in all 1,113 persons over one year of age ill with smallpox. Of these 631 were vaccinated, of which number 42 died, or 6.66 per cent.; 468 were not vaccinated, of which number 231 died, or 49.68 per cent.

There were 17 doubtful cases, of which number 3 died. So that, with reference to smallpox, the lethality of the unvaccinated was 800 per cent. greater than that of the vaccinated. Körösi admits fairly that not quite the whole of this difference can be attributed to neglect of vaccination, since from all other diseases upon which neglect of vaccination has no effect there died 160 unvaccinated to 100 vaccinated. Taking this into account, we may still predict that under like conditions the unvaccinated will have nearly a sixfold greater liability to death when stricken with smallpox than the vaccinated.

Dr. Buchanan, the medical officer of the Local Government Board, gives the following summary of death rates from smallpox among the vaccinated and the unvaccinated for the year ending May 29th, 1881:

Death rate of people of subjoined ages.	Per million of each age of the vaccinated class.	Per million of each age of the unvaccinated class.
All ages	90	3,350
Under twenty years	61	4,520
Under five years	40½	5,950

At the date of the British census of 1881 the number of children under ten years of age in London was 916,784, which was divided into about 55,000 unvaccinated and 861,000 vaccinated. In the same year the deaths from smallpox were as follows: 782 among the 55,000 unvaccinated, and 125 among the 861,000 vaccinated, or 1 in 70 of the former to 1 in 6,968 of the latter, a difference of nearly one hundredfold in favor of the vaccinated class.

The difference in these two methods of inquiry should be noticed, since Dr. Buchanan considers the effect of vaccination upon the population at large, while Körösi considers the effect of vaccination upon the mortality from smallpox as compared with the number of cases.

From all these observations, and from many more of the same character which might be quoted, we find that the *mortality among the unvaccinated* (without reference to the question of age distribution, or to the quality of the vaccination performed) *is from five to seven times as great as it is among the vaccinated.*

When, however, the conditions of the latter class are more carefully examined, it is found that *among vaccinated persons infected with smallpox* the danger of the disease is chiefly determined by the character or quality of the vaccination.

Mr. Marson, who first observed and made known the value of this principle, stated that, if the vaccinated are divided into two classes—(1) those who have been vaccinated in the best-known manner, and (2) those who have been badly vaccinated—the fatality from smallpox, if it infects the former, is but 5 per 1,000, and among the latter 150 per 1,000.

Classification of cases according to the character of vaccination.	Mortality rate in each class. Per cent.
1. Unvaccinated	35.00
2. Said to have been vaccinated, but having no cicatrix	23.57
3. Vaccinated:	
(*a*) Having one vaccine cicatrix	6.80
(*b*) Having two vaccine cicatrices	4.70
(*c*) Having three vaccine cicatrices	1.95
(*d*) Having four or more cicatrices	.55
(*e*) Having well-marked cicatrices	2.52
(*f*) Having badly marked cicatrices	8.82
4. Having previously had smallpox	19.00

Mr. Marson's observations further established the fact that the *degree of modifying power is in the exact ratio of*

the excellence and completeness of the vaccination as shown by the cicatrices. This principle was shown by observations upon 15,000 cases of smallpox which came under his observation in the course of thirty years.

The preceding well-known table is introduced in support of the statement.

From these observations it appears that the average of vaccinated persons, if they contract smallpox, have about one-sixth of the chance of dying from this disease which is incurred by those who have never been vaccinated; some of them, on account of the poor quality of the vaccination, incur one-third of that risk, while, on the other hand, others, thoroughly vaccinated, incur less than one-seventieth part of it. As to the prognosis of any case of smallpox, then, the question is not merely whether the patient has been vaccinated or not, but also *how* he has been vaccinated (Seaton, in "Reynolds' System," vol. i.).

In the examination of nearly a half-million children in England, with reference to the quality of the vaccination, the following causes of imperfection were noticed:

(1) The frequency with which practitioners, instead of attempting fully to infect the system, had been satisfied with insertions of lymph sufficient to produce only one, two, or three ordinary vesicles; (2) the want of due attention to the selection of the lymph used in vaccinating; (3) carelessness and clumsiness in the performance of the vaccination, so that, if the operation did not wholly fail, it very frequently resulted in a less degree of effect than it had been the aim of the operator to produce; and (4) the great and unnecessary extent to which the use of preserved and conveyed lymph was substituted for the vaccination with fresh lymph.

These observations were made upon children, most of whom had been vaccinated by public vaccinators, but a large number of whom had been vaccinated by private practitioners; and it was the impression of the observer that the latter were not so well vaccinated as the former. This observation has been substantiated by more recent inquiries (Report of the Local Government Board, 1884). This report, in commenting upon the variable quality of vaccination, and upon the inquiries of Dr. Stevens upon this subject, says: "The 125 children under ten years of age who died of smallpox after an alleged vaccination, must be reduced to 117 by deduction of those who were discovered, on his personal inquiry, not to have been vaccinated at all, or to have been 'unsuccessfully' vaccinated; and this number 117 divides into 82 vaccinated by private practitioners, and 35 by public vaccinators. Now, the number of vaccinated children under ten years of age, in London, is made up in about equal numbers of those vaccinated by private practitioners, and of those vaccinated at the public expense. Among the privately vaccinated there were 82 deaths, and among the publicly vaccinated there were but 35.

"From these figures we may deduce the fact that public vaccination in London protects against smallpox much more than private vaccination.

"Children privately vaccinated comprise most of the children of the upper classes, who certainly run less risk of smallpox infection than those of the poor. The comparatively large mortality among those privately vaccinated, therefore, becomes the more striking. And, undoubtedly, there are medical men to be found who, having formed some opinion of their own about the sufficiency of one vesicle, cannot be induced to set aside that opinion in deference to the indisputable evidence to the contrary that every smallpox hospital holds up to them."

In the Prussian army there has not been a single death from smallpox since 1874.

In Germany smallpox has diminished, since the enactment of the law of 1874, to a degree never before known, so far as records reach, while in the neighboring countries it prevails. It is for this reason that the German Government publishes an annual statement in which the condition of cities in neighboring countries in regard to smallpox is compared with those of Germany. The following table presents the figures of 1896 as published in the annual German report upon smallpox [10].

DEATHS FROM SMALLPOX, 1896.

	Number of inhabitants.	Deaths from small-pox in 1896.	Proportion per 1,000 inhabitants.
In the German Empire.....	52,612,568	10	0.02
In 265 German cities.....	14,125,027	2	.01
In 57 Austrian cities.....	3,619,109	64	1.77
In 15 greater cities of Switzerland.....	600,259	1	.17
In 70 Belgian cities.....	2,107,594	12	.57
In 108 greater cities of France..	8,149,348	958	11.76
In 33 greater English cities.....	10,846,971	25	.23
In 12 greater cities of Holland..	1,362,056	20	1.47

Under the title of "the balance of vaccination," Körösi discusses the advantage secured as contrasted with the infinitestimal dangers of the practice. He says: "There died in Buda-Pesth 153 children from skin diseases in six years, of which number 30 had been vaccinated. If the chances of death increased thirteen per cent. with the chances of disease, then instead of these 30 cases in the course of six years, there would have been 34 cases; accordingly 4 cases would have been charged to vaccination; in other words, for each year 4 to 6 cases, in a population of about 350,000, and for 100,000 inhabitants and one year, about one-fifth of a case. Therefore, in a city of one million inhabitants there would die, of skin diseases as a result of vaccination, at most two children more, while, on the other hand, 2,000 would be saved from the smallpox. The balance gives a gain of 1,998 lives. In whatever light the case may be considered, cowpox vaccination will continue to produce many hundred times more good than evil. So, although the great blessings of vaccination are not bought for nothing, still they are bought at a very trifling cost. And we may say boldly that vaccination is one of the grandest preservative forces for lowering mortality, and raising the average length of life." (This testimony comes from a layman, and one of the highest living authorities upon the interpretation of vital statistics.)

3. *The Effect of Vaccination upon the Age Distribution of the Mortality from Smallpox.*—Smallpox, when it occurs unmodified by vaccination, as in the eighteenth century, is essentially a disease of childhood; it might almost be said, of infancy. M. Marc d'Espine says of it: "The elective age of smallpox is childhood and infancy." Some of the names of this disease in different languages, which have come to us from ante-vaccination periods, are indicative of this characteristic, as Kinderpocken, Barnkopper, and possibly the English name smallpox, *i.e.*, pox of *the small*. It is as essentially a disease of children as scarlet fever or measles. In the latter disease a regular declining series is presented when successive ages are considered. For these diseases no method of prevention is known, and hence the statistics of mortality express unmodified natural affinities of such diseases for the earliest periods of life. For smallpox, since the introduction of vaccination, this declining series is interrupted in a most remarkable manner. The interruption is purely artificial, and is the expression of the effect of vaccination in postponing the greater mortality to a later period of life; and hence the necessity of revaccination, a subject which will receive further consideration.

The adjoining table expresses in four series of figures what may be taken as the expression (at least approximately) of the natural affinity of certain diseases. The population under five is a minority of the population (seldom more than fifteen per cent.), but it furnishes by far the majority of deaths from the diseases named—two-thirds of all deaths by scarlet fever, four-fifths of all deaths by unmodified smallpox, and a still greater proportion of deaths by measles and whooping-cough. In a word, these are all distinctively infantile diseases; and the obviousness of this fact represents three conditions: First, that the susceptibility to those diseases develops

itself very early in life; secondly, that the susceptibility, when once acted upon by its corresponding exterior cause, becomes exhausted more or less absolutely for the remainder of life; thirdly, that the exterior cause or infection has been of sufficiently frequent recurrence among the population for those relations of susceptibility to show themselves.

For the meaning of the diseases being infantile is, not that any insusceptibility to contract them is acquired in the mere act of growing up, but that, because the susceptibility develops itself at the commencement of life, and because the exterior influence which acts upon that susceptibility is seldom absent, therefore all who have outlived the first years of childhood have commonly had each susceptibility exhausted by suffering the disease to which it relates. Hence if all occurring cases of any such disease be classified according to the ages at which they happen, the resulting series of figures must necessarily have its maximum at that age when the special susceptibility is first fully developed. From this point it must undergo a more or less rapid and uninterrupted decline; the *uninterruptedness* being determined by the fact that at each succeeding age there will be fewer and fewer susceptible persons, the *rapidity* being graduated by the frequency or constancy with which the exterior cause is in operation.

PROPORTIONATE DISTRIBUTION BY AGE OF 1,000 DEATHS IN GENEVA BY SMALLPOX (1580–1760), BEFORE THE DISCOVERY OF VACCINATION, AND OF THE SAME NUMBER OF DEATHS BY WHOOPING-COUGH, MEASLES, AND SCARLET FEVER, AS OBSERVED IN 1847.

Ages.	Smallpox.	Whooping-cough.	Measles.	Scarlet fever.
0– 1.....	202½	404½	155½	63¼
1– 2.....	191½	275	346¾	145
2– 3.....	190	138½	201½	171¼
3– 4.....	132¼	77¾	117	153
4– 5.....	88¾	47¼	68	123½
0– 5.....	805	943	883¾	656
5–10.....	155½	52½	91¾	254½
10–15.....	18¾	2¼	13½	54¼
15–25.....	13¾	½	7	12¾
Above 25.....	7	1½	4	22½
At all ages.....	1,000	1,000	1,000	1,000

A report of the German Vaccination Commission shows that during the ten years following the enactment of its compulsory law of 1874, Germany not only had a smaller death rate from smallpox than ever before, but even passed from a position of inferiority to England to one of distinct superiority in regard to its immunity from smallpox. Smallpox mortality in the cities of Germany has become a trivial matter, while in London, Paris, and Vienna there have been quite appreciable epidemics, having their principal incidence upon the younger adult class of the population.

The following statistics as to the incidence of smallpox at certain ages are from the Report of the Medical Officer of the Local Government Board of England for 1884. While the 86 deaths among children under ten, stated in the column headed "Vaccinated community," contrast strongly with the 612 in the preceding column of the unvaccinated, there is no doubt, as the medical officer states, that even this number 86 is far too high, and is indicative of *sham* vaccination.

A comparison of the mortality from smallpox of children under one year of age living under the provisions of different laws, some of which are vigorously enforced, others optional or partially enforced, and also of populations entirely without vaccination, as was the case in the eighteenth century, is very instructive. Dr. Robertson, of Edinburgh, made such a comparison, and found that under the optional system in practice in Scotland from 1855 to 1864, the number of deaths from smallpox of children under six months of age was about equal to that of children whose ages were six to twelve months.

When vaccination became compulsory this ratio was greatly changed, and the number in the second six months was about one-fourth as large as that of the first six months. It was inferred that vaccination made the difference. A third fact, however, strengthened this inference, and that was the ratio existing before vaccination was known. This was to be found in the carefully kept statistics of the Kilmarnock register already quoted.

RATIO OF DEATHS FROM SMALLPOX BETWEEN SIX AND TWELVE MONTHS OF AGE, TO ONE HUNDRED DEATHS FROM SMALLPOX UNDER SIX MONTHS, IN THREE SELECTED PERIODS.

Age.	1728–1763. Kilmarnock. Vaccination unknown.	1855–1864. Scotland. Vaccination optional.	1865–1879. Scotland. Vaccination compulsory.
Under 6 months.....	100	100	100
From 6 to 12 months.....	491	103	26

The first ratio may be taken as the normal one of natural smallpox. It is a disease nearly five times as fatal in the second as in the first six months of life. But when modified by optional vaccination in the second six months, the mortality is reduced from 491 to 103. And when vaccination becomes compulsory, as in the third period, the 103 is further reduced to 26.

The question may be asked, How far is this decrease in smallpox mortality to be attributed to causes other than vaccination? Improved hygiene and treatment may have exercised considerable effect upon the mortality, but they can have but little bearing upon the facts quoted in the last table. Such an enormous improvement, at the rate of nearly 20 to 1, could never have been due to mere measures of sanitation. Let the following table of the rate of improvement of certain infectious diseases illustrate this:

RATE PER ONE THOUSAND PER YEAR OF DEATHS FROM CERTAIN INFECTIOUS DISEASES IN KILMARNOCK IN 1728–64, AND IN ENGLAND AND WALES IN DIFFERENT PERIODS.

Disease.	Rate in Kilmarnock. 1728–64.	Rate in England.	Rate of decrease.
Measles.....	0.615	(1861–71) 0.4399	100 to 70
Whooping-cough.....	.7671	" .5273	100 to 68
Fever (including scarlatina)	3.4722	" 1.8474	100 to 53
Smallpox.....	4.1071	(1854–79) .208	100 to 5

Deaths from smallpox have therefore decreased 14 times more than those from measles, 13 times more than those from whooping-cough, and 10 times more than those from fever.

From the instructive comparison given by Dr. Vail, the following conclusions are drawn:

1. Smallpox was epidemic every four and one-quarter years (1728–64).

2. Its death rate per 1,000 per year was nearly 20 times as great as it now is. 3. Its death rate under five years of age was 35 times as great as it now is.

4. The mean age at death from smallpox was two and one-half years in the last century, and is now nearly twenty years.

5. The death rate from smallpox in the second half-year of life is now only a fourth of that in the first half-year, while formerly in the second half-year it was nearly 5 times as great as in the first half-year. 6. The smallpox death rate has improved about 12 times as fast as the death rate from measles, whooping-cough, and fever.

The fact that smallpox when allowed to pursue its natural course, unmodified by vaccination, is essentially a disease of childhood, is illustrated in a most forcible manner in the sketch of smallpox in Kilmarnock in the last century, already quoted.

Of the 622 persons who died of smallpox in that town between 1728 and 1764, 586, or 94.2 per cent., were five years of age and under. Seven only were over ten years of age, and the oldest was but twenty-six.

In the different epidemics which fell upon that community, the time from the height of the first epidemic to that of the second was but four years and eight months, and of the 45 children who succumbed in 1733, 44 were less than four years and eight months of age, the remaining one being seven years of age. Thus only one child that died in the epidemic of 1733, had been alive previous to the height of that of 1728. The disease had to secure its victims almost wholly from the population that had come into existence since its last visitation. One epidemic left almost no victims for its successors; in the same way, hardly any had been left to it by its predecessors. It called at every door, and nearly all who were not disease-proof came within its grasp.

Epidemic years.	Interval since height of former epidemic.	Total deaths, smallpox.	Deaths of children born since height of former epidemic.	Deaths among children who had passed safely through one epidemic.	Deaths among persons who had passed through more than one epidemic.
1728–29	Unknown	66			
1733	4 years 5 months.	45	44	1	
1736	3 years 5 months.	66	58	7	1
1740	3 years 7 months.	66	60	5	1
1744–45	4 years 8 months.	74	67	6	1
1749–50	5 years	84	79	4	1
1754	4 years 6 months.	95	84	11	
1757–58	3 years 2 months.	45	39	6	
1762	4 years 8 months.	66	53	11	2
Cases occurring between epidemics.		14	8	5	1
Total		621	492	56	7
Percentage			88.6	10.00	1.2

The principal point shown in this table is that, on an average, over eighty-eight per cent. of those who died in one epidemic had been born since the previous one; that ten per cent. who died had passed safely through one epidemic; and that only one per cent. had lived through more than one outbreak.

The next table shows that these epidemics, to nearly nine-tenths of their extent, did not practically occur in a

Section of Population Born since Former Epidemic.

Height of epidemic.	Born since height of former epidemic.	Died of various diseases, excluding smallpox.	Remaining to form a field for new epidemic.
May, 1733	614	90	524
October, 1736	476	82	394
May, 1740	501	89	412
January, 1745	506	68	438
January, 1750	634	107	527
July, 1754	648	131	517
September, 1757	445	41	404
May, 1762	690	110	580
Totals	4,514	718	3,796
Averages	564	89	475

population of 4,200, but in a population of 475 people. And the average number of deaths in this population was 60, or at the very high rate of 126 per 1,000 living in each epidemic year. Now the number of attacks in unvaccinated children under five years of age is two for every death. As many die as recover. Therefore, of every 100 children born in Kilmarnock, no less than 25 were seized with smallpox at the very first epidemic after their birth.

"These two tables show that, as regards smallpox, there were, in fact, three Kilmarnocks. One, a Kilmarnock of 3,700 persons, had no fear of its attacks. These had already met and battled with the disease fiend. On many were to be seen the marks of the conflict. Some were blind, some had lost their hearing, many were permanently injured in constitution, and very many were scarred and disfigured for life; and, for every one that conquered, another had fallen, never to rise again. There was indeed a second Kilmarnock under the green sod of the kirkyard. The Kilmarnock which had reason to dread the epidemic's approach was a Kilmarnock the least able to meet it. It consisted of a band of little children, numbering less than five hundred in all. Every such group that came into existence had to face, within four or five years of its birth, the most terrible physical enemy that it would ever meet; and, having fought the battle, some were added to the maimed and distorted who formed so large a portion of the population, and others were laid beside those who had been destroyed by former epidemics. One can barely imagine what must have been the feelings of a mother regarding these fearful visitations. Even where the town was free from the pestilence, there would be the constant foreboding of its all too certain coming; and when at last the first case occurred—when the doctor was called in, and pronounced the disease to be the dreaded pox—his words would be heard as a sentence of death to some member of almost every family containing little ones; and, as the news spread from house to house, with what a despairing clutch would each mother press her darling to her breast, and beg Almighty God to command the destroying angel to pass by her door! After the lapse of a hundred and fifty years, one can have little conception of the real meaning of a smallpox epidemic. But the old parish register has enabled us to apprehend something of its horror, and I venture to say that, if the antivaccinationists had their will, we would ere many years be again experiencing somewhat of the awful visitations which were so familiar in old Kilmarnock."

The following figures and diagrams show in a conclusive manner the fact that smallpox in the eighteenth century was beyond question a disease almost exclusively of young children. They also show in quite as conclusive a manner the modifying effect which vaccination has had upon the age incidence of smallpox mortality.

The figures for the smallpox diagram (eighteenth century) were made from an average of the records of several English and continental towns which are given in the foregoing pages. This average was as follows: Out of each 1,000 deaths from smallpox 805.5 were those of children under five years, 155.5 were those of children from five to ten years old, 26.5 from ten to twenty years, 10 from twenty to thirty years, 2.5 from thirty to forty years, and 25 over forty years. (See lower left-hand diagram in Fig. 4929. In these four diagrams the incidence of disease is measured by the horizontal length of the shaded portions, not by their area, since the age-periods from birth to twenty years are five years each, while the remaining periods are ten years each.)

Contribution of Various Ages to One Thousand Smallpox Deaths of all Ages.

Ages at Death.	Geneva, 1580–1760.	Kilmarnock, 1728–1764.	Pudsey, 1771–1813.	Chester, 1774.	Stockholm, 1774–1800.	London, 1848–1851.	Paris, 1842–1851.	London, 1884. Unvaccinated community.	London, 1884. Vaccinated community.	London, 1884. Total inhabitants.
0–10	961	988	982	1,000	961	815	397	612	86	343
10–20	26½	5	17	....	31	59	133	146	173	170
20–30	10	7	1	....	....	83	329	108	319	213
30–40	2½	....	....	....	8	32	110	72	221	142
40 and upward.		....	....	....	....	11	31	62	201	132
Totals	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000

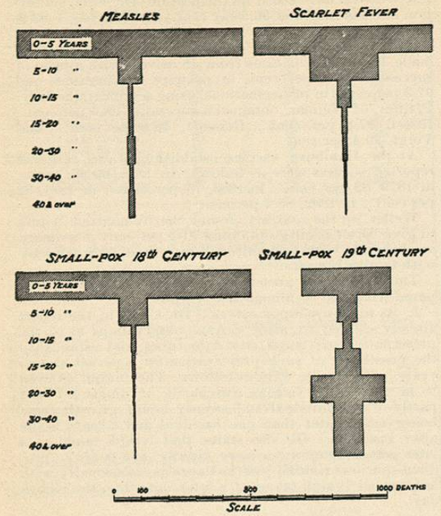

Fig. 4929.—Distribution of 1,000 Deaths From Certain Causes by Ages.

The figures for Massachusetts, 1863–1900, also show conclusively the cutting down of the smallpox death rate of infants and the increase in that of young adults (twenty to thirty years) in consequence of neglect of revaccination at the proper period.

Massachusetts.—Distribution of 1,000 Deaths from Smallpox, Measles, and Scarlet Fever, for Thirty-eight Years, 1863–1900.

Ages.	Smallpox.	Measles.	Scarlet fever.
0– 5 years	326.6	826.7	656.7
5–10 years	70.6	81.1	250.5
10–15 years	33.4	16.5	50.5
15–20 years	86.4	16.5	17.9
20–30 years	270.0	27.1	15.9
30–40 years	106.1	11.7	5.6
40–50 years	44.7	7.2	1.2
50–60 years	30.4	3.9	1.0
60–70 years	17.3	3.5	.5
Over 70 years	14.5	5.8	.2
	1,000.0	1,000.0	1,000.0

The following figures show the death rates per 100,000 living at each age-period from smallpox in a population in which vaccination is moderately enforced. They include the statistics of about 3,500 deaths from smallpox which occurred in Massachusetts in the thirty-eight years, 1863–1900.

Deaths from Smallpox in each Year Out of 100,000 Living at each Age Period. Massachusetts.

Under 5 years	15.0	40–50 years	1.8
5–10 years	3.3	50–60 years	1.8
10–15 years	1.7	60–70 years	1.6
15–20 years	4.2	70–80 years	1.7
20–30 years	6.1	Over 80 years	3.5
30–40 years	3.1		

Dr. Tissot, writing about the middle of the eighteenth century, said of smallpox:

"Smallpox is the most frequent, the most extensive of all diseases. Out of 100 persons there are not more than 4 or 5 exempted from it. *People generally take the smallpox in their infancy or in their childhood.*" ("Advice to the People with Respect to their Health," 1762, p. 156.)

The Duration of the Protective Power of Vaccination.—Gerstäcker, as quoted by Wolffberg, states (*Centralblatt für allg. Gesundh.*, 1888, p. 182) that the cardinal principle of the duration and efficiency of the protection afforded by vaccination depends essentially upon the intensity of the preceding vaccination, and upon those changes which—independent of every attempt at protection—the natural individual predisposition to smallpox undergoes in the course of life, although reduced to a definite lower standard by vaccination.

The Comparative Protection Afforded by Vaccination and by Smallpox.—Both Marson and Simon expressed the opinion, before the Parliamentary Committee of 1871, that the protection afforded by an attack of smallpox against a subsequent attack was greater than that afforded by vaccination (Replies 3,517–3,521; 4,220–4,224).

In the early years of vaccination it was quite a common practice to expose vaccinated people to the smallpox either by contact or by inoculation, for the purpose of testing the efficacy of the practice. The town of Milton, Mass., in September, 1809, voted to test the question upon twelve children who had been vaccinated in July of the same year. Twelve vaccinated children were therefore selected and inoculated with smallpox lymph. They were quarantined during fifteen days at a hospital provided for the purpose, and the following certificate was issued on their release:

Milton, October 25th, 1809.

The twelve children whose names are written on the back of this card were vaccinated at the town inoculation in July last; they were tested by smallpox inoculation on the 10th instant, and discharged this day from the hospital, after offering to the world, in the presence of most respectable witnesses, who honored Milton with their attendance on that occasion, an additional evidence of the never-failing power of that mild preventive, the cowpox, against smallpox infection; a blessing great as it is singular in its kind, whereby the hearts of men should be elevated in praise to the Almighty Giver.

Amos Holbrook, *Physician.*
Oliver Houghton, *Chairman of the Committee for Vaccination.*

[Card in possession of Massachusetts State Board of Health.]

As compared with the earlier practice of inoculation with smallpox lymph, vaccination has the great advantage over the latter that its protection is afforded without risk to life, without disfiguring the features, without causing loss of sight or of hearing, and without the risk of propagating a highly infectious, loathsome, and deadly disease among the community.

Bovine Vaccination.—The term bovine, or animal, vaccination is applied to that which is practised by the aid of vaccine lymph cultivated in bovine animals. Warlomont very truly says that the term *animal vaccination* is purely conventional; the vaccine lymph from an infant is just as much an animal product as is that from a heifer.

With reference to the origin of the practice, Dr. Warlomont states that an aged physician had, in his youth, seen his father, the village doctor, inoculate the teats of a cow with human vaccine, preserved through the winter in order to renew the stock of fresh lymph at the commencement of each vaccinating season. Such was a common practice, and it has been carried out for years in Germany, and especially in Bavaria. This method of practice has been called retrovaccination. It has also been practised to a considerable extent in the United States. Supplies of vaccine virus were largely obtained for use in the army by this method during the latter part of the Civil War (1861–65), and while this method has been vehemently opposed by some, it is also true that no evidence has been adduced to show that such vaccination, when properly transmitted from a healthy infant to the heifer, and thence, after one or more successive transmissions from animal to animal, is again transmitted to the human species, is less protective against smallpox