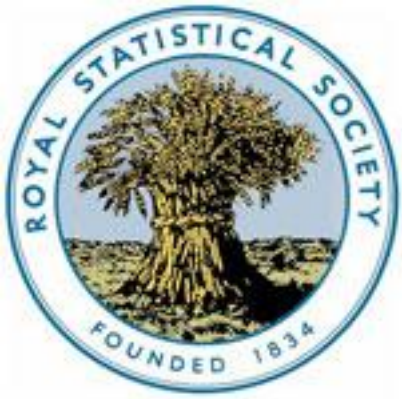

Statistics of Small-Pox and Vaccination, with Special Reference to Age- Incidence, Sex-Incidence, and Sanitation

Author(s): Alfred Milnes

Source: *Journal of the Royal Statistical Society*, Vol. 60, No. 3 (Sep., 1897), pp. 552-612
Published by: Wiley for the Royal Statistical Society
Stable URL: http://www.jstor.org/stable/2979712
Accessed: 27-06-2016 06:48 UTC

Statistics *of* Small-Pox *and* Vaccination, *with special* Reference *to* Age-Incidence, Sex-Incidence, *and* Sanitation.

By Alfred Milnes, M.A. (Lond.).

[Read before the Royal Statistical Society, 15th June, 1897.
A. E. Bateman, Esq., C.M.G., President, in the Chair.]

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I.—*Preliminary Observations.*

Being of those who hold to what may be regarded as the earlier faith of the Statistical Society, that the true function of the statistician is simply to collect facts as fully and marshal them as clearly as possible, wholly regardless of what the practical tendencies of such facts may be, it is with some little reluctance that I venture to draw the further attention of the Society to a question hotly debated in the arena of practical politics. Amongst the disadvantages of State interference and State regulation in matters which should be of purely individual concern, not the least is the engendering of so much heat that the single-minded pursuit of light becomes difficult to the verge of impossibility. This has been the case to a peculiar extent in respect of what is known as "The Vaccination Question," where a law, harshly administered and stubbornly resisted, has on both sides tended to overlay with special pleading what should have been a purely scientific investigation.

Whoever would understand the political phenomenon known as "The Anti-Vaccination Agitation"—and its magnitude would seem to indicate it as being at least worth understanding—must remember some one or two facts, facts obvious enough indeed, but constantly forgotten. And chief amongst them this, that every

opponent of the practice, every sceptic, without exception, as to its benefits, has in the first instance approached the question in a spirit at least of impartiality, and probably with all his prejudices strongly in its favour. Every man who approaches the question for the first time finds a considerable body of authority committed to one side of the controversy; and in controversy authority rarely fails to command as much weight as it deserves, while in controversies as to matters of health it has commanded as a rule much more. The qualifications of the investigators of this question will of course be as various as is the case with every other question of politics. Some, like Professor Crookshank and Dr. Creighton, have addressed themselves to the task in happy possession of every mental instrument that faculty and attainment could provide. But, be their equipment for the discussion great or small, all dissentients from the orthodox vaccine faith, down to the humblest, have at least this in common, that they conceive themselves to have arrived, by a route of perfectly impartial and disinterested investigation, at conclusions justified by reasoning sufficient to themselves. But secondly, it must be also remembered that in the presence of a compulsory law it is not possible, nor is it pretended, that this impartial attitude of mind could persist. When once the conduct, which is founded on and gives expression to such conclusions, is treated as criminal and visited with penalties, society has declared a war which substitutes struggle for investigation, and the stage of impartiality is past. Such a thought-history at least it is but bare justice to claim for myself. When, now nearly thirty years ago, my attention was first called to vaccination as a theory, I was unaware that it had been challenged, and supposed the benefits of the practice to have been established in the same sense as the circulation of the blood, or any other scientific fact. Not merely in absolute impartiality, but slowly and unwillingly, I arrived at my conclusion—and took the consequences. Of my competence for forming that conclusion those must judge who, being themselves competent, will do me the honour to read this paper "not to contradict and confute, " nor to believe and take for granted, nor to find talk and dis- " course, but to weigh and consider." I only submit that it is no fault of mine if I seem to be pleading a cause where I ought to be, and gladly would be, investigating a problem.

II.—*The Logical Position.*

If statistical investigation is to be used with a view to the support of a legislative enactment, it is obviously of the utmost importance that the logical characters of the argument should be

clearly apprehended. In the present position of the law the question may be regarded as presenting itself somewhat thus:—

Is vaccination a proven preventive of small-pox or of death by small-pox; and, on the issue so stated, does the evidence in its favour attain to so high a probability as to acquire that character of practical certainty whereby alone compulsory provisions can be justified?"

In the paper on "Two Hundred and Fifty Years of Small-Pox "in London" read by Dr. Guy before this Society in 1882, I find it written that to the vaccination question "There is, there can be, "no answer save such as is couched in the language of figures." I trust it is no great disloyalty to the principles of this Society to demur to such wholesale appropriation, and to protest that so many-sided a question can hardly be settled offhand by any single and isolated set of considerations. For such treatment implies that we start upon a question without having troubled ourselves to inquire either its nature, its limits, or the true conditions of its solution. It must never be forgotten that if the benefits of vaccination are as alleged, then we are confronted with a phenomenon absolutely unique. In no other case is it proposed or pretended by the inoculation of one disease to prevent another. We have then to seek for and estimate the evidence for a fact which, if true, is quite without a parallel. And this dominant feature of the case needs to be kept in view at every step in the investigation. So that, for the practical statistician who really wishes to arrive at the truth of the matter, the question as stated above will require modification, and will take some such form as:—

"Can statistical evidence in favour of the claims of vaccina-"tion be found of weight enough, and of a sufficiently unassailable "credibility, to override the inherent pathological improbability "of those claims?"

The method of this, as of most other statistical investigations, will be of course that known to logicians as concomitant variations. Since the labours of the late Professor Jevons, it has been a mere commonplace of logic that this method can never carry us beyond the region of probable argument. So that we have to ask whether we can accumulate sufficient statistical probabilities on the one side to counterbalance the underlying pathological improbability on the other.

And in the course of the search one precaution, too often neglected, should never be forgotten,—a vigilant application of the check by the method of the "control experiment." The subject matter of our investigation is vaccination and small-pox. If then we would avoid fallacy we are bound, whenever a change pertinent to our investigation occurs in the presence of vaccination, to

re-investigate with a view to discover whether the same change may not equally occur in its absence; and, whenever a change occurs in small-pox which seems to bear on the argument, to re-investigate so as to know how far the same change has occurred in other diseases of like kind, but to which no vaccinal methods have been applied. The neglect of this precaution in questions unconnected with any legal enactment is reprehensible enough, as a disloyalty to the cause of scientific truth; but to neglect it when arguing for the maintenance of penal statutes directed against men and women of blameless life, against whose character "mistaken," "misguided," and "ill-informed" are the worst epithets that even Mr. Noel Humphreys can suggest, is a direct contribution to the worst form of anarchy.

In the question with which we have to deal, the basis of comparison, with a view to establishing the concomitant variations, if any, will be fourfold—Time, Place, Age, and Sex.

It thus becomes clear that the proper periods for comparison will have to be ascertained, and this in its turn involves a knowledge of the history of past enactments and of their effects in respect of the vaccination of the people. A short sketch of these is the more necessary, as I believe that history to have been, as a rule, radically wrongly stated.

III.—*Vaccination Legislation.*

Before the year 1853 vaccination legislation has but one feature worthy of special remark. In the year 1840 was passed "An Act to Extend the Practice of Vaccination," and by this Act small-pox inoculation was made a penal offence. Now small-pox inoculation in this country dates, in its modern form, from 1721. Wherefore, rightly or wrongly, Parliament by this Act deliberately pronounced the medical profession guilty of a life-destroying error which had lasted for a hundred and twenty years. So that when in 1867 the edifice of legal compulsion of vaccination was completed by the passing of a measure in which this prohibition was again repeated, we have infallibility proclaimed and error admitted in one and the same parliamentary breath. It must never be forgotten that vaccination is not the first but the second method of small-pox prevention advocated by a practically unanimous profession; that the first of these is now a penal offence; and that some modesty of tone might well befit the advocacy of the compulsory enforcement of the second remedy by a profession which has thus admittedly indulged for more than a solid century in deadly error as to the first. Yet it is the first

thus penalised, and not the second at all, which presents analogy with the modern methods of treatment by "attenuated virus."

The first law for the compulsory infliction of vaccination was Lord Lyttelton's Act in 1853. Judged by its results upon the official figures, this would seem to have been the most effective of all the series of vaccination Acts. Complete records of the percentage of vaccinations to births are wanting, but the vaccinations "at the expense of the poor rates" which had amounted to 66·0 and 61·0 per cent. of the births in 1852 and 1853 respectively, rose to no less than 108·7 in 1854. And so far as statistics can bear on the justification of the maintenance of compulsion, the question will be as to how far the statistical results have verified the promises by which the compulsory enactment was originally obtained. As to the promises themselves, there can happily be no dispute. In moving the second reading of the "Vaccination "Extension Bill" on 12th April, 1853, Lord Lyttelton himself said, "It is unnecessary for me to speak of the certainty of "vaccination as a preventive of small-pox, that being a point "on which the whole medical profession have arrived at complete "unanimity." And in thus formulating *the promise which passed the law*, Lord Lyttelton did but echo the collective voice of the Epidemiological Society, which in its report on small-pox and vaccination, 1853, had written, "We are ourselves satisfied, and it "is the concurrent and unanimous testimony of nearly 2,000 "medical men with whom we have been in correspondence, that "vaccination is a perfectly safe and efficient prophylactic against "this disease." And in its turn the Epidemiological Society merely brought up to date the declaration to which, as early as 1800, John Ring, in that "Testimonial" to which he had secured the signature of nearly every London doctor, had proclaimed it "our opinion that those persons who have had the cow-pox are "perfectly secure from the future infection of the small-pox." Nor has the enormous mass of accumulated post-vaccinal small-pox down to our own day sufficed to diminish the arrogance, though it has somewhat changed the terms, of those official assurances which originally procured, and still maintain, the compulsory law. In 1881 the "Times" declared that so protective were vaccination and re-vaccination that "no one need have small-"pox unless he or she pleases." And the "Lancet," on 16th January, 1892, wrote in a leading article, "No one need die of "small-pox; indeed no one need have it unless he likes—that is to "say, he can be absolutely protected by vaccination, once "repeated." And Mr. Ernest Hart, editor of the "British "Medical Journal," wrote in the "Times" of 31st August, 1894, an assertion which though limited to the earlier ages of life, is as

uncompromising as any of its predecessors; "Vaccinated children "under 10 years of age are wholly and entirely immune from "small-pox and cannot be infected." Nor has the possibility of there being a debtor side to the account been forgotten. The denial of drawbacks has been neither less positive nor less emphatic than the assertion of benefits. "Against this vast "gain," writes Sir John Simon, "there is no loss to count." Such then were and are the promises and professions by which the compulsory law was obtained and is still maintained; and therefore, in an attempt to estimate statistically the merits of that law, it is with these promises and professions that the actual statistical facts must at every step be confronted, compared, and contrasted.

The next landmark in the history of vaccinal legislation is the law of 1867, and this is to this day the law under which all penalties are exacted against unbelievers. This is *the* vaccination law of England; yet vaccinists almost invariably ignore it as far as possible in favour of an Act, emendatory in details of administration and registration, passed in 1871; the real object being apparently to throw the year 1871, with its remarkable and fatal small-pox epidemic, into the earlier period of compulsion not efficiently enforced. It thus becomes of the utmost importance to determine, as a matter of simple historical fact, how vaccination was enforced under the 1867 Act, and before that of 1871 took effect in 1872. Fortunately evidence abounds of the uncompromising severity with which the law of 1867 was at once put in force. The 1871 Committee reports itself "glad to find that "wherever the guardians endeavour to carry out the law, it is "very generally, and indeed almost universally enforced." And if, as is often the case, the question is made to turn on the appointment of vaccination officers, the same Committee can be cited as reporting that "it appears that in the majority of the unions "such officers have been appointed." I will only cite a few of the results. In one of the years in dispute, the year 1869, Samuel Beck of Dorking was fined for a second child, though he produced in court as his "reasonable excuse" a first child injured by vaccination. In September George Riley, of Bury St. Edmunds, was fined for the sixth time—a treatment already six times as severe as the late Royal Commission would sanction. In this year William Johnson of Leicester was imprisoned—the well known "silver watch case" of Dr. Seaton. On one day of this year, 26th August, four fines were imposed at Ampthill with alternative imprisonment up to two months. On one other day, 13th September, thirty-nine summonses were heard in Dewsbury. That no element of reckless harshness might be wanting, a fine was

imposed at the Thames Police Court in spite of the production of a medical certificate of unfitness. In August Mrs. Anne Sipple was committed for seven days' hard labour—an illegal sentence—and confined in a stone cell with an infant of eighteen months, the child deprived of shoes and socks, and a diet of bread and water only for both. In November of the same year the leading case of Allen *v.* Worthy had decided an appeal in favour of the legality of those endlessly repeated prosecutions, which have been now unanimously condemned by the Commission in that Interim Report, which Mr. Noel Humphreys and other pro-vaccinist writers so studiously ignore. And before the passing of the 1871 Act, C. W. Nye of Chatham had served five out of the nine separate imprisonments which he underwent in vindication of vaccine law. This man Nye was a watch maker, with hands rendered delicate by his calling; and in prison he was set to wheeling stones for the repair of the building, until, to quote his own words, "the handles of every barrow that I wheeled were "stained with my blood." The object seems to have been to deprive him of a livelihood by crippling him in the exercise of his trade; but be that as it may, all such "criminal" treatment of anti-vaccinists has been unanimously condemned by the Commission. So that those who hold that vaccination was "not efficiently "enforced" before 1871, may at least console themselves with the assurance that never more in our history will it be *so* efficiently enforced as it was then. And the oft repeated statement that "no effectual means of enforcing the obligation existed until after "the Act of 1871 took effect," is quite curiously the reverse of the truth.

That these facts are by no means recited for the mere sake of re-opening old wounds, that they are on the contrary of the utmost importance in the search for statistical truth on the question, is at once manifest, when we introduce the correction which they indicate into the table presented to the Commission by Dr. Ogle, and printed on p. 114 of its First Report. The age-distribution of the population not being given for successive years in the Registrar-General's Reports, I confine myself to the "all "ages" column of the table in question for pointing the following contrast:—

TABLE I.—*Mean Annual Rate of Mortality per Million from Small-Pox at all Ages in Three Groups of Years, selected with reference to Optional and Obligatory Vaccination.*

Dr. Ogle's Division.			The Historical Division.	
Period.	Mortality.	Period Difference.	Mortality.	Period.
(1.) Vaccination optional, 1847-53	305	82, or 26·8%	305	(1.) Vaccination optional, 1847-53
(2.) Vaccination obligatory, but not efficiently enforced, 1854-71...	223	109, or 48·8%	188	(2.) Vaccination obligatory, but not efficiently enforced, 1854-67
(3.) Vaccination obligatory, but more efficiently enforced by vaccination officers, 1872-87.....	114	117, or 38·8% / 39, or 20·7%	149	(3.) Vaccination obligatory, but more efficiently enforced by vaccination officers, 1868-87

If the object were to show how different arrangements of the same figures will elicit from those figures an entirely opposite evidence, a better instance than this table could hardly be found. According to Dr. Ogle, small-pox during a period of vaccination but slightly obligatory declines by little more than a quarter; whilst real stringency further diminishes the remainder by nearly one-half. But in the light of the historical facts above cited we see that the decline during the period of little stringency approached to 40 per cent., whilst the fullest severity of vaccinal enforcement coincided in time with a further reduction of little more than 20 per cent. According to Dr. Ogle's division, the small-pox reduction during the second period approaches the double of that in the first; according to the historical division, that of the first approaches the double of that in the second.

IV.—*Statistics of Vaccination and Small-Pox.*

Having thus it is hoped settled the proper points of chronological division, it becomes necessary to confront the statistics of vaccination with those of small-pox, with a view to estimating their concomitance, if any. This we can do in—

TABLE II.—*Statistics of Primary Vaccination of Infants,* 1872-93, *from the Annual Reports of the Local Government Board; and of Small-Pox Deaths per Million, from the Annual Reports of the Registrar-General. Fatal Chicken-Pox included under Small-Pox.*

1	2	3	4	5	6	7	8	9
		Of the Children whose Births were Registered during the Year given in Col. 1, by the 31st January in the Year next but one following there were						
Year.	Births Registered during Year.	Successfully Vaccinated.	Certified as insusceptible of Vaccination; had Small-Pox; or Died Unvaccinated.	Vaccination postponed by Medical Certificate.	Remaining.	Percentage of Children not finally accounted for (including cases postponed).	Quinquennial Average of Default.	Quinquennial Average of Small-Pox Mortality per Million.
1872....	821,856	698,137	81,192	42,527		5·1		
'73....	826,508	704,666	81,540	4,264	36,038	4·8		
'74....	854,787	727,065	86,341	5,677	35,704	4·8	4·7	232
'75....	850,354	722,466	87,549	5,914	34,425	4·7		
'76....	887,694	763,277	85,885	5,528	33,004	4·3		
'77....	887,947	766,824	80,541	6,681	33,901	4·5		
'78....	891,743	760,982	88,820	6,475	35,466	4·7		
'79....	880,222	756,835	78,246	6,670	37,471	5·0	4·7	86
'80....	881,652	750,203	88,266	5,930	37,253	4·9		
'81....	883,744	765,162	78,569	6,302	33,711	4·5		
'82....	889,082	763,525	82,536	7,598	35,423	4·8		
'83....	890,780	762,080	83,060	8,110	37,440	5·1		
'84....	906,581	764,975	91,578	8,693	41,335	5·5	5·5	60
'85....	894,263	757,714	85,006	9,323	42,220	5·8		
'86....	903,846	754,059	92,072	10,187	47,528	6·4		
'87....	886,198	733,980	89,410	10,402	52,406	7·1		
'88....	879,813	719,103	85,187	12,282	62,701	8·5		
'89....	885,909	707,161	90,755	13,366	74,627	9·9	10·0	15
'90....	875,188	682,560	93,442	13,615	85,571	11·3		
'91....	914,079	693,117	98,166	13,823	108,973	13·4	13·1	17
'92....	890,695	663,657	94,499	13,278	119,261	14·9		
'93....	914,557	661,513	105,875	13,845	133,324	16·1		

This table introduces us to the question at a time when vaccination is at its high-water mark, when less than 5 per cent. of the children born escaped the performance of the vaccine rite. Incidentally this fact in itself is worth a moment's consideration, just to compare it with the first of the Local Government Board's "Instructions to Vaccinators under Contract," which opens with the injunction, "Vaccinate only subjects who are in good health." If this instruction has been loyally obeyed, and if at the same time the figures are correct, then of the $8\frac{1}{2}$ millions of children born between 1872 and 1881, we have it that, of those surviving, more than 95 per cent. passed through the first months of infancy "in good health;" in fact, that less than 5 babies in 100 have

anything the matter with them. Figures can indeed prove anything to the man whom they can convince of that. The fact of the matter of course is that the Local Government Board is year by year publishing, and what is worse approving, figures which bear witness to the utter disregard of the regulations which they themselves profess to put forward as a protection for the puny and ailing amongst the children of the nation. Here however there are consolations; and while I most earnestly lament the suffering and sorrow which lie behind these figures, I cannot but remember that they bear solid testimony to the real existence of that particular form of reckless maladministration, which more than anything else has revolted the feelings of the people.

But in even this respect the table bears witness to improvement, and shows that the labours of the anti-vaccinist party have not been thrown away. Col. 5 shows an increase in postponements of vaccination by medical certificate from 4,264 in 1873 to 13,845 in 1893, a ratio increase of 324 per cent., while births have only increased by 11 per cent. We have been educating our masters; and even medical men are less willing than they used to be to vaccinate any child under any conditions.

More important is the evidence afforded by this table as to the entire absence of quantitative concomitance as between the thorough vaccination of a population and the immunity of that population from small-pox. As the quinquennial average of vaccination default goes up, small-pox continues to go down. Comparing 1872-76 with 1887-91, we have it that when there was less than half the vaccination default there was more than fifteen times the small-pox mortality. Or, comparing the actually first with the actually last quinquennium in the table, 1872-76 with 1889-93, we find nearly four times the vaccination default accompanied by only one-thirteenth of the small-pox mortality. It is hardly necessary to go beyond the evidence of this table to show that some cause at once more pertinent and more potent than vaccination must have been at work to produce the striking fall in small-pox which set in about the year 1886. Vaccination and small-pox attained their maximum together, and together they have steadily declined.

For more detailed evidence as to the behaviour of small-pox during registration times, we may consult the following table :—

TABLE III.—*Annual Rate of Mortality per Million Living from Small-Pox in England and Wales. Fatal Chicken-Pox included in Small-Pox.*

[From 1838—1887 the figures are taken from Dr. Ogle's Table A, "Royal Vaccination Commission, First Report," p. 114.]

Year.	Mortality.	Year.	Mortality	Year.	Mortality.	Year.	Mortality.	Mortality, omitting Chicken-Pox.
1838....	1,064	1852 ..	401	1867....	116	1881....	124	119
'39....	589	'53...	171	'68 ..	93	'82....	54	50
		'54...	151	'69....	70	'83....	39	36
1840. ..	661	'55 ..	134			'84 ..	87	83
'41....	400	'56...	119	1870....	116	'85....	107	104
'42 ..	168	'57...	204	'71....	1,015	'86....	13	10
'43....	?	'58...	332	'72....	824	'87....	21	18
'44....	?	'59....	195	'73....	101	'88....	40	36
'45....	?			'74....	91	'89....	4	1
'46....	?	1860...	138	'75....	40			
'47 ..	246	'61...	66	'76....	103	1890....	4	1
'48 ..	397	'62...	80	'77....	178	'91....	5	2
'49....	264	'63...	289	'78....	79	'92....	19	15
		'64 ..	367	'79....	25	'93 ..	53	49
1850....	262	'65...	303			'94...	31	27
'51....	389	'66....	141	1880 ...	29	'95 ...	10	7

This table, without the last column, has recently been described as "Dr. Ogle's table, 'First Report,' p. 114." But in one important particular the description is inaccurate, as Dr. Ogle's table necessarily stops at 1887, and thus fails to contain what is probably its most instructive portion, the immense fall in small-pox during the last ten years, concurrently, as we have seen, with a great revolt against vaccination. Much ingenious sophistry has been brought to bear on this table with a view to show that compulsory vaccination has been causally connected with the change. The twelve years 1838-42 and 1847-53 have been taken as one member of the comparison, and the forty-two years 1854-95 as the other. The illogical character of this procedure becomes more specially manifest when we remember that small-pox is essentially an epidemic disease, and that by this method of treatment the great epidemic of pre-compulsion times is averaged over only twelve years, whilst the remarkable and fatal epidemic of 1871-72, when compulsory vaccination was at its height, is diluted out amongst forty-two. It is easy thus to arrive at an average per million rate of 408 for the first period and 126 for the second. But the real question is, what can epidemic small-pox do in the presence and absence respectively of fully enforced compulsory vaccination? To answer the question thus put we may compare two quinquennia, the one under voluntary the other under compulsory vaccination, and each commencing with an epidemic. Such will be the quinquennia 1838-42 and 1871-75,

whereof the respective averages will be found to be 576 for 1838-42, and 414 for 1871-75, a diminution of 26 per cent. Now this, so far as it goes, is a genuine diminution, and the vaccinist may endeavour to claim it to the credit of his nostrum. But the claim will be at once disallowed when we apply the method above alluded to of the "control experiment." To render the change attributable to vaccination, and to vaccination only, it must be unique, and no other fairly comparable disease must show on similar comparison a like diminution. The condition is at once seen to be unfulfilled when we apply the test to the fevers—typhus, typhoid, and simple and ill-defined. In 1838-42 these give an average per million mortality of 1,053, and for 1871-75 the similar average is 595, a diminution of 43 per cent. There is no evidence that vaccination is an indispensable antecedent to a small-pox change when the same change to a much greater extent occurs with the fevers wherein no vaccinal influence is claimed. The comparison can be more fully set forth thus :—

TABLE IV.—*Mortality compared, Small-Pox with the Fever Group (Typhus, Typhoid, and Simple and Ill-defined), for the Two Quinquennia* 1838-42 *and* 1871-75.

	1838-42.	1871-75.	Diminution Per Cent.
Small-pox	576	414	26·4
Fever	1,053	575	43·4

If it be objected that this is to compare two epidemics of an essentially epidemic disease on the one hand with two periods of diseases of a more endemic character on the other hand, I might be content to reply that such fault in the comparison ought to favour vaccination if that alleged prophylactic were of real value; for on such a supposition small-pox epidemics should have ceased, or should at least have shrivelled to the proportions obtainable from an incidence exclusively upon the unvaccinated residuum. But if it be desired to compare the various periods of a disease of specially epidemic character, we may obtain the desired comparison in respect of cholera. Now in the first decade of the resumption of registration, 1847-56, the annual average of cholera mortality per million was 478; in the last decade 1885-94 it was 16. And this comparison can be carried further.

From the figures of Table III above there has been derived the statement that "During the twelve years 1838-42 and 1847-53, "for which official records exist, prior to vaccination being made "compulsory, the average death-rate from small-pox averaged "408 per million. . . . . During the forty-two years of

"compulsory vaccination the annual death-rate from small-pox "averaged 126 per million . . . . showing an average decline of "more than two-thirds, or 69 per cent." In this statement the reasoning is suggested rather than set out, and it amounts to an implication that since the decline of small-pox followed, it was therefore caused by, the enactment of compulsory vaccination; and the form of this implied reasoning is that known technically as *post ergo propter*. To this apply once more the "control" observation, as thus—

TABLE V.—*Mortality of Small-Pox and Cholera compared, on Average per Million, for the Twelve Years* 1838-42 *and* 1847-53, *and the Forty-two Years* 1854-95.

	1838-42 end 1847-53 (Twelve Years).	1854-95 Forty-two Years).	Decline per Cent.
Small-Pox	408	126	69
Cholera	320	69	78

It is not contended, so far as I am aware, that it was vaccination which caused the decline in cholera; yet the same statistical treatment must equally fail or equally succeed in attributing the decline of both diseases to the same agency. For a conclusion which is held to be established by a percentage of 69, surely becomes yet more certain when the percentage rises to 78.

It thus becomes clear that we have no need to intract a special cause, vaccination, to account for a course of behaviour in small-pox which is not special to that disease.

Nor can the vaccinist derive comfort from further and more minute examination of the returns of small-pox. So far as primary vaccination is concerned the case as against epidemic small-pox is abandoned by the sincerest friends of vaccination themselves. "Primary vaccination," admits Dr. Gayton, "is a very fleeting "protection indeed" (Commission, *Q.* 1755); "it is not absolutely "protective up to any age" (*idem*, 1768); "it would not ward off "an epidemic" (*idem*, 1770). Nor is this a conclusion recently arrived at; on the contrary, though suppressed for political purposes, it has been well known from the beginning. As the reference has been challenged, it may be as well to place it on record that it is no less an authority than Sir John Simon himself in whose "Papers" we read of 2,000 cases of post vaccinal small-pox occurring in Marseilles as early as 1828, a quarter of a century before Lord Lyttelton described vaccination to the House of Commons as a certain preventive, and by that promise won the law. Of course the law when won did not stop the epidemics.

Three times since the passing of that Act have we gone through periods which may fairly be described as "epidemics," thus:—

TABLE VI.—*Epidemics of Small-Pox.*

Date.	Deaths from Small-Pox.
1857–59	14,244
'63–65	20,059
'70–72	44,840

	Percentage Increase of	
	Population.	Small-Pox Deaths.
Between 1st and 2nd epidemics	7	40·8
„ 2nd „ 3rd „	9	123·0

And as year by year, up to about 1886, the population was becoming more and more thoroughly vaccinated, so the percentage of vaccinated patients to total patients continued to increase. In § 80 of the Dissentient Report of the Commission it is recorded of the London Small-Pox Hospital, that "the percentage of cases "of vaccinated small-pox patients to the total admissions has "progressively increased with the increase of vaccination among "the general population, if not in an exact ratio at any rate in a "ratio approximating closely to it." And this position is enforced in the following table:—

TABLE VII.

["Dissentient Report," p. 173.]

Years.	Post-vaccinal Small-Pox per Cent. of Total.	Years.	Post-vaccinal Small-Pox per Cent. of Total.
1826	38	1864	84
'35–45	44	'78–79	93
'45–55	64	'85	93
'55–65	78	'88–91 (14 cases only)	100
'63	83		

So far as I am aware no claim has ever been set up that more that 90 per cent. of London is vaccinated. Yet more than 90 per cent. of London small-pox is admittedly vaccinated, so far as the small-pox hospitals give evidence. In which connection the common plea that it is only the severer cases that go to hospitals acquires, so far as it is truly urged, a significance unexpected by vaccinists. In the 1871 epidemic 91·5 per cent. of the cases admitted to the Highgate hospital had been vaccinated, and 96 per cent. in 1881. If of the population outside the hospital not more than 90 in 100 are vaccinated, while of the patients inside the hospital the vaccinated percentage is 96, the protective

influence of vaccination remains to seek. The teaching of these figures, moreover, becomes more and more emphatic as small-pox declines to such small limits as to permit of more minute knowledge of its details. For instance in the Metropolitan Asylums Board hospital ships in 1890, the returns were—

	Cases.	Deaths.
Unvaccinated	5	—
Vaccinated	19*	1
Re-vaccinated	2	2
Total	26	3

* One of these was certainly not small-pox, and three others were doubtful.

The vaccinal condition of the London population can never be of more than speculative ascertainment. The best estimate I can frame does not admit of more than 80 per cent. as vaccinated, taking the average for the last ten years. And in this experience at the hospital ships it will be observed that, small as are the numbers, they follow the law of probability very closely, with 80·8 per cent. of the total cases vaccinated. The incidence of the mortality in this small, but therefore highly ascertainable, group of cases is worthy of notice, as bearing on another aspect of the question.

So much for the comparison on a time basis—the concomitance is conspicuous by its absence.

Nor is comparison by place any better. The whole civilized world sends witnesses to failure. The British Army in India, without exception vaccinated as adults and in vast majority re-vaccinated, yet yields the following return:—

TABLE VII.—*Small-Pox amongst European Troops in India.*

Years.	Cases.	Deaths.
1880	17	4
'81	17	1
'82	44	4
'83	105	9
'84	78	8
'85	12	0
'86	22	1
'87	40	2
'88	111	10
'89	153	17
'90	36	4
'91	14	1
'92	18	3
'93	33	4
'94	13	3
Total	713	71

Here are men in the prime of life, all of them recently vaccinated, and most, if not all of them recently re-vaccinated, yet 713 of them take the disease whereof they have been warranted by Sir John Simon "able to betray no remnant of susceptibility "to infection;" and their fatality rate is just about twice as great as that recorded in the recent outbreak in unvaccinated Leicester Again, our Army in Egypt gives the following particulars:—

TABLE VIII.—*Small-Pox in the Army in Egypt.*

Year.	Strength.	Admissions.	Deaths.	Ratio per 1,000.	
				Admissions.	Deaths.
1832	6,198	3	—	0·5	—
'83	7,897	8	3	1·0	0·37
'84	6,468	25	1	3·8	0·15
'85	9,593	52	4	5·4	0·42
'86	11,062	51	3	4·6	0·27
'87	5,272	26	4	4·9	0·76
'88	3,346	14	4	4·2	1·19
'89	3,431	42	6	12·2	1·75

These men are all re-vaccinated, and all presumably healthy young adults. Yet we read in the Army Medical Report for 1889 that the figures above quoted for that year were obtained, "not "withstanding all the precautions taken in Cairo, and due regard "having been paid to vaccination and re-vaccination." We have here a death-rate of no less than 1,750 per million, or nearly 73 per cent. higher than the general English mortality in that remarkable and fatal small-pox epidemic of 1871, to which so much ingenious sophistry has been devoted in the endeavour to put it back into precompulsory times. But I have not heard of any attempt to put back the British Army of 1889 into times when "there was no effectual means of enforcing the obligation."

Other armies have the same tale to tell. There is no dispute in any quarter that re-vaccination on joining the colours has been the law for the German army (Prussian army before 1871) since 16th June, 1834. Now in the "Times" of 17th September, 1896, Lord Lister, President of the Royal Society, speaking at the annual meeting of the British Association, is reported to have said that small-pox "is absolutely unknown in the huge German army

" in consequence of the rule that every soldier is re-vaccinated on entering the service." The facts are thus—

TABLE IX.—*Small-Pox in the German Army*, 1834-87.

Year.	Cases.	Deaths.	Year.	Cases.	Deaths.	Year.	Cases.	Deaths.
1835.....	259	5	Forward	1,809	48	Forward....	3,187	77
'36.....	130	9	1853 ..	138	1	1870-71†	2,879	164
'37.....	94	3	'54	121	3	'71‡.....	828	34
'38.....	111	7	'55	12	—	'72	389	12
'39.....	89	2	'56	21	—	'73§.....	26	2
			'57	35	1	'73-74‖	22	1
1840.....	74	2	'58	64	—	'74-75....	26	—
'41.....	59	3	'59	58	2	'75-76....	20	—
'42	99	2				'76-77....	19	—
'43	167	3	1860	44	3	'77-78...	12	—
'44.....	69	3	'61	56	4	'78-79....	15	—
'45.....	30	1	'62	25	1	'79-80....	7	—
'46.....	30	1	'63	90	—			
'47.....	5	—	'64	120	1	1880-81....	23	—
'48.....	22	1	'65	69	1	'81-82....	16	—
'49.....	62	1	'66	91	8	'82-83....	9	—
			'67	188	2	'83-84....	7	—
1850.....	176	1	'68	97	1	'84-85....	7	1¶
'51.....	246	3	'69	108	1	'85-86 ...	6	—
'52.....	87	1	1870*....	41	—	'86-87....	7	—
Forward	1,809	48	Forward	3,187	77	Total	7,505	291

* January to June, 1870.
† July, 1870, to June, 1871.
‡ July to December, 1871.
§ January to March, 1873.
‖ 1st April, 1873, to 31st March, 1874.
¶ Unsuccessfully re-vaccinated on joining the colours.

In reply to a correction of this error published by Mr. Trobridge, F.S.S., Lord Lister has said that his statement would have been perfectly accurate if he had confined it to *fatal* small-pox. The table shows that the statement as amended would still have been wrong to the extent of nearly 300 deaths. But its evidence of the failure of the severest form of vaccination (ten insertions in each arm) is of more importance than its bearing on the statements of any one man, however deservedly eminent.

The above Table IX is taken from pp. 23 and 24 of the official *Beiträge zur Beurtheilung des Nutzens der Schutzpockenimpfung*, published in Berlin in 1888, and written, it is needless to state, in defence of vaccination. This work is particularly valuable for the full information it contains as to the vaccinal condition of German small-pox patients. I do not propose to enter here on the question of the German law of vaccination and re-vaccination, and the true date at which the enforcement of vaccination in Germany commenced. I content myself with recording my opinion that the ingenuity of sophistry has been vainly strained in the endeavour

to explain away the provisions of the German law of 1835 and the stern, uncompromising terms of the royal proclamation at the head of it. I am the less concerned to do so, inasmuch as such a line of argument impales its adherents on a dilemma whereof either horn is fatal. For the more widely vaccination was enforced upon and practised by the German people before and up to the great pandemic in 1871-72, the more dismal the failure of vaccination to protect that people as a whole; and the less widely spread the practice, the yet more dismal the failure to protect the vaccinated part of it. Under these conditions we find such results as these:—

TABLE X.—*Classification of Small-Pox in Five German Localities.*

Place.	Period.	Cases.	Vaccination Not Stated.	Unvaccinated.	
				Below Legal Vaccination Age.	Of Legal Vaccination Age.
Neuss	1865-73	248	0	0	0
Wesel	'70-73	523	1	4	4
Cologne	'71-73	2,361	79	22	12
Mulheim	'71-72	183	0	7	0
Krefeld	'71-72	118	1	1	0
Totals		3,433	81	34	16

Here we have a record of 3,433 cases, whereof, on any reckoning, only 50 were recorded as unvaccinated. But in an inquiry as to vaccination *law*, as distinguished from voluntary vaccination, it is clear that all cases below the legal age limit should be excluded, inasmuch as vaccinations below that age are voluntary vaccinations. The point however need not be pressed, since a total of 50 out of 3,433 gives only an unvaccinated proportion of 1·4 per cent. Practically, 99 out of every 100 of these patients had confessedly undergone a process which the Parliament of England consented to enforce by law, on the strength of the emphatic promise of "the certainty of vaccination as a preventive "of small-pox."

Coming back from this short excursion into foreign statistics, we find plentiful evidence from English cities of the powerlessness of vaccination, however thoroughly carried out, to protect a community from epidemics of great severity. The quality of the vaccination may be as high as its quantity, and the result still a futility. The quality is attested by the bonus system, under which a second payment is made to the public vaccinator over and above his ordinary fee, when he is on inspection found to reach a certain high standard of thoroughness, as estimated by magnitude of resulting scar. This is not the place to discuss the method of

such estimation; I content myself with simply expressing my conviction that it is pathologically absurd. But taking it seriously, I find that the bonus earnings of Sheffield under this regulation stand thus:—

TABLE XI.—*Awards of Annual Vaccination Bonuses at Sheffield.*

Year.	£ s.	Year.	£ s.	Year.	£ s.
1876.....	341 15	1881	202 7	1886.....	189 3
'77.....	181 16	'82	203 14	'87.....	190 8
'78.....	187 13	'83	183 5	'88.....	178 18
'79.....	172 3	'84	191 10		
'80.....	184 12	'85	196 –	Total	2,603 4

So that Sheffield, vaccinally one of the most faithful of places on earth, in thirteen *years* ending with 1888 earned vaccination bonuses to the amount of 2,603*l.* 4*s.*, and in the thirteen *months* ending March, 1888, she reaped her reward in 6,088 cases of small-pox; or a case for every half sovereign of bonus, and 882 over. Of these 6,088 cases, 5,035, or 83 per cent., were confessedly vaccinated. The compulsion of vaccination by law will never, it is safe to affirm, develop the vaccination of a city to a higher perfection, quantitatively and qualitatively, than that of Sheffield in 1888; and the experience of Sheffield demonstrates conclusively that such compulsion will never preserve a city from devasting epidemics. I am of course aware that much ingenious sophistry has been applied to the Sheffield returns on the basis of a census held by Dr. Barry, so as apparently to show a heavier incidence of small-pox on the unvaccinated than on the vaccinated portion of the community. But in this there was an underlying fallacy, inasmuch as the census was not taken until the epidemic was far advanced, and a great transference had taken place from the unvaccinated to the vaccinated classes of the inhabitants. By this method it is easy to represent an entirely equal incidence of small-pox on the two classes as if it were to any required degree excessive upon the unvaccinated class. To show how this can be done I take a simple imaginary example, thus:—

Let there be a village of 100 inhabitants, of whom 90 vaccinated and 10 unvaccinated, and suppose small-pox to break out there and last for a month, with a 10 per cent. incidence on each class. This would give—

Vaccinated 90, of whom 9 attacked, or 10 per cent.
Unvaccinated 10, of whom 1 attacked, or 10 per cent.

But during the month let 8 of the 9 remaining unvaccinated be persuaded or frightened into getting themselves vaccinated. A census of the village held during the last week of the month would then give—

Vaccinated 98, of whom 9 attacked, or 9·1 per cent.
Unvaccinated 2, „ 1 „ „ 50 „

And whoever will read carefully the cross-examination of Dr. Barry before the Commission, will see that the fallacy thus illustrated pervades the whole of the Sheffield report, and vitiates all the elaborate comparisons which, in the introduction thereunto, Sir George Buchanan drew between the vaccinated and the unvaccinated classes to the disadvantage of the latter. Of the great Sheffield investigation no certainly established result remains save the broad fact that a city wherein the force of compulsory vaccination could no further go, but wherein sanitation has been neglected, may suffer terribly from epidemic small-pox. And this is the evidence in which so many of these towns concur, the story of Warrington and of Willenhall, for instance, being but an echo of that told by Sheffield.

Hence we may well adopt the phrasing of the Dissentient Report, sec. 72, and conclude on this portion of our investigation that "it is superfluous to cite further evidence at this stage to "prove, what is no longer denied by anybody, that small-pox "attacks the vaccinated." But I must be allowed to repeat that this assertion which is no longer denied by anybody is itself *the diametrical contradiction of the promises which passed the law.* These promises are now a mere protested bill with a bankrupt acceptance whereunto no man with a shadow of scientific credit to lose will venture to put his hand.

V.—*Comparative Statistics of Vaccinated and Unvaccinated.*

So far then as any defence remains for a compulsory vaccination law it will perforce have to be founded on a comparison between the two classes, vaccinated and unvaccinated. And here at once a preliminary protest becomes necessary. These comparative statistics are all supplied by one of the two parties to the dispute, and the other party is allowed no opportunity of checking them; and even the party which supplies them so far as they are supplied, is permitted to supply or withhold them at its own sweet will. The result is shown in the huge proportions of cases "not stated" as to vaccination in the small-pox mortality returns. I submit that so long as the law interferes with small-pox and vaccination at all, it might at least do a little to secure for us some approach to statistical truth. If any medical man who filled up a small-pox death certificate without entering the vaccinal condition of the patient were liable to a fine of 20*s.* and costs, and to a month's hard labour without the option of a fine if that condition were afterwards shown to have been wrongly stated; if the Registrar-General were compelled to publish in his weekly returns the full

name and address of every alleged unvaccinated small-pox death; and if, for purposes of check, the vaccination registers were open to public search for a small fee of, say, 6*d.*; I believe in the course of very few years the whole face of these comparative statistics would be changed out of recognition. We find in the Registrar-General's 58th Report, p. xxv, that that official guardian of the purity of our public statistics secured 13 convictions in the year for "Offences against the Registration Acts," including 7 cases of "giving false information," yet so far as I ever could learn no prosecutions followed when the "unvaccinated" deaths at West Ham were exposed, nor when in 1892 General Phelps applied to the Birmingham statistics the crushing exposure of which the Royal Commission refused to receive evidence; nor even when in the same year I was able to bring home the exposure to head-quarters, and to show how Thomas Port, vaccinated in infancy and twice successfully re-vaccinated in the Royal Navy, and dead of confluent small-pox in the London Hospital Ships, had been made to appear in the Registrar-General's returns as a "no state-"ment" case, where I suppose he remains to this day. And even the official classification itself is totally at fault in having no column for *re-vaccinated* cases. These can never appear in the Registrar-General's returns as more than "vaccinated," and, as Thomas Port's case shows, they do not always get even so far as that;—an arrangement very satisfactory to those who persistently proclaim the complete immunity of the revaccinated. The magnitude of the statistical scandal—for it is nothing short of that—hence resulting can be indicated in the following table:—

TABLE XII.—*Small-Pox Deaths, Vaccinated, Unvaccinated, and No Statement, extracted and calculated from the Registrar-General's Fifty-eighth Report, p. lii.*

	1891.	1892.	1893.	1894.	1895.	Total for Quinquennium.
Total deaths	49	431	1,457	820	223	2,980
Vaccinated	3	55	150	153	33	394
„ per cent.	6·1	12·7	10·3	19	15	13·2
Unvaccinated	17	106	253	176	61	613
„ per cent.	34·6	24·5	17·3	21·4	27	20·5
No statement	29	270	1,054	491	129	1,973
„ per cent.	59·2	62·6	72·3	59·8	58	66·2

We thus find that the all-important evidence as to the vaccinal condition of patients dying from small-pox has been suppressed in no less than two-thirds of the total cases. Now for my own part I have met such an energetic eagerness on the part of the

medical profession to point a moral and adorn a tale with an unvaccinated death, that I find it quite inconceivable that a single one of the 1,973 unstated cases should have really escaped the performance of the rite. And on this supposition we should have for the quinquennium 1891-95, vaccinated deaths 2,367 out of the total of 2,980; a percentage of 79·4, and a sufficiently close approximation to my estimate, mentioned above, of not more than 80 per cent. of the population as vaccinated.

And much the same thing holds good when we examine the returns for the earlier ages exclusively. Extracting and calculating from the annual Reports of the Registrar-General for the quinquennium just concluded, we have—

TABLE XIII.—*Small-Pox Deaths amongst Children according to Registrar-General's Annual Reports, Quinquennium* 1891-95.

	Under 1 Year.		Under 5 Years.	
	Number.	Per Cent.	Number.	Per Cent.
Vaccinated	23	6·2	33	4·4
Unvaccinated	112	30·4	263	35·7
Not stated	233	63·3	441	59·8
Total	368	—	737	—

Here again we have the same suppression of the facts, but with less excuse. For it is simply preposterous to urge that the vaccinal condition of an infant under a year old cannot be discovered. Yet nearly two out of every three deaths at this tender age fail to be reported on in this essential particular. And again, by adding the not stated and vaccinated classes together we obtain a total of 256 for the ages under 1 year, and 474 for ages under 5, a percentage of 69·5 and 64·3 on the respective totals at those ages. Considering that the portion of the population living at these very early ages will include a considerable proportion of infants below the vaccination age, and that we can fairly infer from sec. 102 of the Dissentient Report that such infants constitute a not inconsiderable fraction of the total small-pox mortality among these early ages of the Registrar-General's Reports, these percentages of 69·5 and 64·3 are sufficient to dispense with the necessity of assuming any special influence of vaccination upon small-pox.

In another direction this table is no less significant.

To begin with, children under 1 comprise all the babies below vaccination age; wherefore in any number of children, taken as they come, of all ages up to 12 months, there will be a far larger proportion of unvaccinated than in a similar group of children at all ages up to 5 years. That is to say, the percentage of vaccinated

children under 1 is of necessity smaller than the percentage of vaccinated children under 5. Yet the table shows that the percentage of vaccinated small-pox mortality under 1 (6·21 per cent.) was getting on for half as much again as the similar percentage (4·4 per cent.) under 5; while on the other hand the unvaccinated mortality under 1 formed a smaller percentage of the whole (30·4 per cent.) than did the unvaccinated mortality under 5 (35·7 per cent.). The same figures have a bearing on the question of recency. For the vaccination of children under 1 must on the average be more recent than the vaccination of children under 5; yet it is the more recent vaccination which is the greater failure. And claiming as I do the whole of the "unstated" in this table as really belonging to the vaccinated, we find once more that the vaccinated supply nearly two-thirds of the small-pox deaths under 1 year of age. In five years we have on this computation 256 deaths of children under 1 year concerning whom the doctors either explicitly confess their vaccinated condition, or at all events do not dare to deny it. And then they talk of "absolute protection for a time;" and the Commission recommends us to be vaccinated every nine years. Why, if these poor little mites had had as many lives as cats, they might at this rate have commenced each life with a vaccination in the spring and ended each one with small-pox in the autumn, and have still had time to lose all the nine before arriving at the re-vaccination age as proposed by the Commission.

Then again the 23 admitted deaths of vaccinated children under 1 year have a peculiar significance just now, when Dr. Bond and the Jenner Society are protesting that to ensure "protection" we must be vaccinated again and again: we must renew "the premium of insurance." It would be interesting to know how many premiums of insurance ought to have been paid on behalf of these 23 poor little mites, who were *confessedly* born, cowpoxed, smallpoxed, and buried, all within a single circle of the seasons.

But these considerations have brought us into contact with the different ages at which small-pox either occurs or becomes fatal. And, so far, I have endeavoured to show that vaccination is not the cause of the favourable changes which have taken place in respect of small-pox. I now turn to the endeavour to find what that cause has really been; and I shall hope to show that a cause, at once true and sufficient, can be found in the complex of measures to which the collective name of "Sanitation" has been applied.

VI.—*Sanitation and Age-Incidence.*

It is this complex of measures which has furnished us with the ordinary and received methods of contending against the zymotics as a whole. But in the particular case of small-pox it

has been urged, and it is in fact the official view prevalent in our country to-day, that sanitation is either of no avail at all, or of so little as to render imperative the universal adoption of the special measure, or menagerie of measures, known by the name of "Vacci-" nation." That this is the official view is shown by the following considerations:—

The Registrar-General, in the 43rd Report for 1880, argues that the decline in small-pox cannot be due to sanitation entirely, on the ground that it has been greater than that obtaining in the case of other diseases, and greater in young lives, *e.g.*, children under 5 years of age, than at later ages, or all ages. And the same view the witness representing the department also endeavours to enforce in his evidence before the Commission. Dr. Ogle there says (*Q.* 351): "If it were true that the great fall of 72 per cent. " in small-pox was due to improved sanitation, which doubtless " has reduced mortality very considerably, we should expect, " naturally, that the fall would have been shared by persons of all " ages, but nothing of the kind is the case." And again (*Q.* 493): " Speaking roughly, I do not suppose you can attribute (to sani-" tation) more than you can to the decline in the general death-" rate." And Mr. Thorne Thorne, both generally, as in *Q.* 744, and in particular by his citation of the case of the s.s. "Preussen" (*Q.* 994 sq.), announces on behalf of the Medical Department of the Local Government Board, that "as far as we have been able to " gather there is absolutely no other explanation for this marked " reduction of small-pox mortality amongst children, except the " mere fact that children are nearest, in point of time, to the date " at which they were vaccinated." I propose therefore to now consider, in the light of statistical fact, the position that sanitation is of no practical avail against small-pox.

There is an initial difficulty as to terms. Within the scope of the word "sanitation" I include *all* the conditions of healthy living. I do not propose to confine it to the narrow sense in which it applies only to drainage.

Now to sanitation in this wider sense small-pox is very highly amenable, both (1) at all ages, and (2) at ages under 5. To show this we will compare the "expected" mortalities of a typically unhealthy locality such as Liverpool with those more favoured places—the "healthy districts" of the Registrar-General—where the entire annual mortality does not exceed 17 per thousand. This we can do for a period when small-pox was prevalent enough to fairly eliminate the dangers attendant on small numbers, by using the materials supplied in the Supplement to the Thirty-fifth Annual Report of the Registrar-General, pp. xxix, cxii and cxxviii. The result will be found in—

TABLE XIV.—*Influence of Sanitation on the Age Incidence of Zymotic Mortality. Comparison of Liverpool with "Healthy Districts" as to Expected Deaths per Million Born Alive.*

[Extracted from "Supplement to 35th Report of Registrar-General," pp. xxix, cxii, and cxxvii.]

1	2	3	4	5	6	7	8	9	10	11	12
	Expected Mortality per Million Born Alive in						Percentage that (A) is of (B).			Percentage of the said expected All Age Mortality borne by Children under 5.	
	HEALTHY DISTRICTS (A).			LIVERPOOL (B).							
	All Ages.	Under 5.	Over 5.	All Ages.	Under 5.	Over 5.	All Ages.	Under 5.	Over 5.	Healthy Districts.	Liverpool.
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
Cholera	2,244	399	1,845	16,489	4,255	12,234	13·6	9·3	15·0	17·7	25·8
Small-pox	2,359	602	1,757	8,141	5,175	2,966	28·9	11·6	59·2	25·5	63·5
Diarrhœa and Dysentery	21,217	9,354	11,863	61,446	51,911	9,535	34·5	18·0	124·4	44·0	84·4
Measles	6,912	5,257	1,655	26,973	25,514	1,459	25·6	20·6	113·4	76·0	94·5
Whooping cough	10,234	9,650	584	34,021	32,551	1,470	30·0	29·6	39·7	94·2	95·6
Fevers (typhus, &c.)	28,146	2,807	25,339	76,563	9,297	67,266	36·7	30·1	37·6	9·9	12·1
Scarlatina	21,403	11,373	10,030	38,302	26,818	11,484	55·8	42·4	87·3	53·1	70·0
Other zymotics	22,082	6,135	15,947	18,632	12,093	6,539	118·5	50·7	243·8	27·7	64·9
Diphtheria	10,292	4,184	6,108	4,416	3,395	1,021	233·0	123·2	598·2	40·6	76·8
Total zymotics	124,889	49,761	75,128	284,983	171,009	113,974	43·8	29·0	65·9	39·8	60·0

The teaching of this table is as follows :—

Supposing a million children to be born alive in Liverpool, and another million to be born alive in one of the "Healthy "Districts," and to be kept under observation through life and until death. Then, taking for example small-pox as subject of investigation, it would be found that in the Healthy District, on the basis of the rates observed up to the date of the table, 2,359 of the million will ultimately die of small-pox, as against 8,141 in Liverpool. This shows that the advantage of greater healthiness of living, or greater sanitation, does affect very considerably the small-pox mortality. In other words, that small-pox is highly amenable to sanitary influence. Nor is this all. For it will be found that of the total 2,359 small-pox deaths that may be expected in the Healthy District, only 602 will occur in children under 5 years of age; whereas in Liverpool, of the total 8,141 small-pox deaths, no less than 5,175 will occur before the completion of the fifth year. Or again, that while in the Healthy District the children's share of such small-pox mortality as there is amounts to only 25·5 per cent., in Liverpool, the children's share of the same mortality rises to no less than 63·5 per cent., So that, though the difference between the sanitary condition of Liverpool and a Healthy District causes the total general small-pox mortality of the latter to be only 28·9 per cent. of the similar mortality in the former, the Healthy District small-pox mortality under 5 suffers a far greater reduction still, being but 11·6 per cent. of the similar mortality in Liverpool. Whereby it is shown, in contravention of the official view, first, that small-pox is at all ages highly amenable to sanitary influence, and secondly, that its amenability is greater at the earlier ages than at the ages beyond childhood in the proportion of 59·2 to 11·6. From an inspection of the columns for the comparative percentages at all ages and at ages under 5, we find that, as compared with other diseases—

(1.) In respect of amenability to sanitary influence, small-pox is excelled at all ages collectively by cholera and measles only;
(2.) And at ages under 5, by cholera alone.

And further, the table shows the fallacy of the argument adduced by Dr. Ogle in *Q.* 351, that sanitation cannot have been the cause of a reduction in mortality from a given disease unless that reduction has been shared by persons of all ages. *In every one of the diseases contained in the table the children's share of the mortality is less in the Healthy District than in Liverpool;* whilst in no case save that of small-pox alone is it even alleged that there is

or can be any other cause of the difference beyond the greater healthiness of living in the one place than in the other. Wherefore not only does sanitation change the general mortality, but it changes the infant mortality to a vastly greater extent than it does the adult mortality. And this in practically all the zymotics, whether taken individually, or collectively as a group, with the results totaled.

Or, to put the same thing another way, if we could suppose a million of persons *of all ages* to be removed from the conditions of life which prevail in Liverpool, and transferred to such conditions as rule in the "Healthy Districts," the chance of escaping death by any of the zymotics would be greatly increased for all ages, but would be increased by far the most for the ages under 5 years; and this for all zymotics, but most for cholera, small-pox, and measles.

If, in the face of such an investigation, it be still maintained that the influence of vaccination as distinct from sanitation is to be seen in the diminution of the children's share of whatever small-pox mortality is going, I reply that, to estimate such an argument, we must compare the change which has taken place in the age-incidence of small-pox with the similar change, if any, in the case of other comparable diseases, and with the like change, if any, in the unvaccinated class of small-pox patients. Such is probably the only manner in which the principle of the "Control "experiment" can be applied to the question. This brings us to consider:—

VII.—*Comparative Changes of Age-Incidence in the Zymotics.*

Here the first question will of necessity be: With what other diseases shall small-pox be compared?

Now it is obvious that, for the purpose of comparing diseases on the basis of changes in their age-incidence, we must find other diseases which affect patients of all ages. On this head I agree in full with Dr. Ogle in his evidence before the Commission (*Q.* 518), that "Fever is the only one of the zymotic headings that "you can take, because it is the only one which affects all ages to "any extent." I compare, therefore, small-pox with Typhus and with Typhoid in the annexed Table XV.

TABLE XV.—*Children's Share of the Mortality from Small-Pox, Typhus, and Typhoid, respectively, in Quinquennia. Percentage of Deaths under 5 to Deaths at all Ages for Four Successive Quinquennia.*

[Extracted from the Registrar-General's Annual Reports, "England: Causes of Death."]

	1871–75.		1876–80.		1881–85.		1886–90.		Percentage Diminution of Percentage (*i.e.*, Decrease per Cent. of Children's Share) comparing 1st with 4th Quinquennium.
	Numbers.	Per-centage.	Numbers.	Per-centage.	Numbers.	Per-centage.	Numbers.	Per-centage.	
Small-pox..	14,834* / 47,695	= 31·1	2,440 / 9,726	= 25·0	2,451 / 10,433	= 23·4	363 / 1,846	= 19·6	36·9
Typhus	617 / 9,517	= 6·4	259 / 4,238	= 6·1	106 / 3,015	= 3·5	31 / 904	= 3·4	46·8
Typhoid	7,617 / 43,679	= 17·4	5,562 / 34,651	= 16·0	2,678 / 28,788	= 9·3	1,895 / 25,221	= 7·5	56·8

* Table 31 of the Forty-third Report yields a total of 47,696 small-pox deaths at all ages for this quinquennium, on account of the inclusion of chicken-pox therein. This does not affect the percentage.

The figures as given above exclude from both numerator and denominator the chicken-pox deaths for 1875, thus exactly following the Registrar-General's actual figures in each annual Report, the change to the present rule of omitting chicken-pox having first taken effect in the Forty-fifth Report.

Subsequently to 1875 the chicken-pox deaths are uniformly excluded.

But this table contains two difficulties:—

(A.) In 1871-74, the deaths from "chicken-pox" are included in those from small-pox, thus much increasing the children's share of the small-pox mortality for the quinquennium 1871-75 as compared with the latter quinquennia, wherein chicken-pox is omitted. To remedy this defect we might either simply deduct the chicken-pox from the 1871-74 figures, or we might replace the chicken-pox in the subsequent quinquennia. Which is the proper correction?

In all the tables I have set out in this paper, fatal chicken-pox has been included in small-pox. I am glad to note that Mr. Noel Humphreys has adopted this course in some of the tables in his recent paper, and only wish he had done so in all. For as it is held by all authorities that chicken-pox is never fatal, it follows by mere logical conversion that nothing that was fatal was chicken-pox. How then ought we to describe these so called chicken-pox deaths? I consider the answer to be contained in Sir Thomas Watson's "Lectures on the Principles and Practice of Physic," vol. ii, p. 805, where he says: "These mild and irregular forms of

"variola, both parents and medical men, wishing, I suppose, to "believe nothing in disparagement of the protective power of "vaccination, are apt to consider and to call chicken-pox." I am glad that the responsibility thus falls on this distinguished and eminent physician, whose vaccinal orthodoxy was beyond suspicion, of thus ascribing the chicken-pox deaths to their *vera causa* in small-pox, and of also assigning them, for reason given, to the vaccinated class of small-pox mortality. It is pleasant to have an acknowledgment from such a quarter that vaccination has been saved by the sacrifice of pathology.

We shall have then to amend Table XV by including the deaths from chicken-pox for all the years contained in it.

(B.) The other difficulty arises from the somewhat curious treatment of remittent fever by the Registrar-General.

It would appear from the note appended to Table XV of the Fifty-third Report, p. 38, that from 1869 to 1880, deaths from remittent fever under 5 years of age were classed under typhoid; thus increasing, for the years which include our first and second quinquennial period, the infant share of typhoid mortality. To render the comparison fair, therefore, the deaths from remittent fever of children under 5 should be reckoned in also for the last two quinquennia. This we can do by fetching them back out of the class of "Malarial Diseases" to which they have been assigned, and restoring them to typhoid as before. When these amendments have been made in the table it will present the appearance shown in Table XVI.

TABLE XVI.—*The same Table corrected for Chicken-Pox and Remittent Fever.*

	1871–75.		1876–80.		1881–85.		1886–90.		Percentage Diminution of Percentage (*i.e.*, Decrease per Cent. of Children's Share) comparing 1st with 4th Quinquennium.
	Numbers.	Per-centage.	Numbers.	Per-centage.	Numbers.	Per-centage.	Numbers	Per-centage.	
Small-pox	14,929 / 47,696	= 31·3	2,938 / 10,243	= 28·6	3,002 / 11,025	= 27·2	820 / 2,320	= 35·3	− 12·7
Typhus	617 / 9,517	= 6·4	259 / 4,238	= 6·1	106 / 3,015	= 3·5	31 / 904	= 3·4	46·8
Typhoid	7,617 / 43,769	= 17·4	5,562 / 34,651	= 16·0	3,312 / 29,423	= 11·2	2,146 / 25,472	= 8·4	51·7

It is not supposed that the reading of this table, which I proceed to consider in this its finally amended form, will present any

difficulties. The comparison is strictly as to the children's share of whatever mortality there is, whether much or little, from the three diseases selected for examination—the selection, it may be repeated, being in accordance with Dr. Ogle's own opinion that these diseases are of the only kind you can fairly take. It appears that in the five years ending with 1875 there were 47,696 deaths from small-pox at all ages, whereof 14,929 were of children under 5; a percentage share amounting to 31·3 per cent. falling to the lot of these children. In the five years ending 1890 the total small-pox mortality has enormously diminished, the deaths in that period only totaling to 2,320 for all ages. But the children's share of this diminished mortality is not diminished; on the contrary, it is a little larger than before, there being 820 of these deaths to go to the account of children under 5, a percentage share of 35·3 per cent. The diminution of the children's share of small-pox as between the first and the last period in the table is therefore a minus quantity; that is to say, it is an increase. The actual increase, or difference between the two percentages, is 4; and 4 is 12·7 per cent. of 31·3. Turning now to the incidence of typhoid, we find that of 43,769 deaths at all ages in the five years ending 1875, 7,617 were of children under 5—a children's share amounting to 17·4 per cent. Whereas in the last quinquennium of the table there were 25,472 deaths at all ages, and of these 2,146 in children under 5, a children's share of 8·4 per cent. And if 8·4 be subtracted from 17·4, the difference will be 9; and 9 is 51·7 per cent. of 17·4. So that, comparing the first with the last quinquennium, the children's share of the current typhoid mortality is found in the interval to have diminished by 51·7 per cent. Thus diseases to which no vaccination has been applied, and the only modifying influence upon which has been "sanitation" in the broad sense above assigned to the word, have altered in the matter of their incidence upon the younger lives not less than small-pox has done.

So that if it be argued that the reduction of small-pox cannot be due to sanitation because it has taken place chiefly in the young lives, and that this change of age-incidence, being peculiar to small-pox, must be due to a cause (vaccination) which is also peculiar to small-pox, I reply that the diminution in the young-life share of the mortality from small-pox has of late years been of doubtful actuality, and that it is certainly not peculiar to small-pox, having in fact taken place to a no less extent in other diseases; and that, no vaccination having been applied to those other diseases, it becomes clear that vaccination is not an indispensable cause of change in the age-incidence of the mortality from any disease.

I therefore submit, as conclusions from these tables:—

(1.) However you reckon the doubtful elements, it remains true that the children's share of fever mortality has more largely declined than their share of small-pox mortality.

(2.) When proper corrections are made, it is shown to be at least doubtful whether the children's share of small-pox mortality has of late years decreased at all.

(3.) Even allowing it to have decreased, the decrease is not due to vaccination, since a like decrease to a greater extent has taken place in diseases to which no vaccination is as yet applied.

As a further indication of the importance of the proper treatment of chicken-pox I submit the following:—

TABLE XVII.—*Share of Small-Pox Mortality borne by Children Under 5, as affected by the inclusion or exclusion of the Chicken-Pox Mortality.*

	Small-Pox Deaths including Chicken-Pox.		Chicken-Pox.		Small-Pox Deaths excluding Chicken-Pox.		Percentage that B is of A.	Percentage that Y is of X.	Difference between Chicken-Pox in and Chicken-Pox out.
	A. All Ages.	B. Under 5.	All Ages.	Under 5.	X. All Ages,	Y. Under 5.			
1856–60	19,270	11,010	233	214	19,037	10,786	57·1	56·6	0·5
'61–65	23,007	12,477	262	216	22,745	12,231	54·2	53·7	0·5
'66–70	11,779	6,403	312	297	11,467	6,106	54·3	53·2	1·1
'71–75	47,696	14,929	376	350	47,320	14,579	31·3	30·8	0·5
'76–80	10,243	2,938	517	498	9,726	2,440	28·6	25·0	3·6
'81–85	11,025	3,002	592	551	10,433	2,451	27·2	23·4	3·8
'86–90	2,320	820	474	457	1,846	363	35·3	19·6	15·7
'91–95	3,515	1,313	535	511	2,980	802	37·3	26·9	10·4

This table shows how, as the total of small-pox declines, the importance of chicken-pox increases, in virtue of its increased influence on the age-incidence percentages. This makes it the more to be regretted that in Mr. Noel Humphreys's paper, his Table IV should include chicken-pox in the first period only. The table in question is thus doubly discounted in its accompanying statement that in the last decennium, 1885-94, the rates for small-pox further fell, for ages under 5, and 5—10, from 128 and 63 of the former decennium to 50 and 15 respectively. First, because no proper

allowance is all the time being made for chicken-pox; and secondly because the fall, whatever it really was, was coincident with a rise in the vaccinal default from about 5·5 per cent. to the 16·1 per cent. of 1893. In the light of these facts I propose to consider a little further the conclusions above arrived at.

The last conclusion (3) can further be strengthened directly. Not only has the children's share of small-pox mortality not declined to a greater extent than is the case with other diseases to which vaccination does not apply, but—

> Taking the children's share of small-pox mortality in times when all were unvaccinated, and comparing it with their share of such small-pox as is still unvaccinated, it will be found that the decline in this exclusively unvaccinated class has been as great as in the vaccinated and unvaccinated taken collectively.

We are assured that before vaccination times, 80 per cent. of small-pox mortality was contributed by children under 5. Numerous authorities could be cited for this assertion. It may be enough to refer to—

> McVail, "Vaccination Vindicated," pp. 17 and 18.
> McVail, "Small-pox in Kilmarnock in the last Century," in the Local Government Board Report for 1884.
> Sir John Simon, Appendix to First Report of the Royal Vaccination Commission, p. 76.
> Mr. Thorne Thorne, quoting the passage last referred to, when replying to Q. 820.

And we are further assured that this 80 per cent. has been reduced to "about 30 per cent." (*Cf.* McVail, *op. cit.*, p. 18.)

This assertion as to the reduction of the children's share of the mortality from small-pox may be taken as about correct for the time at which it was made. Taking the figures for the quinquennium 1886-90, and including in every member of the comparison fatal chicken-pox under small-pox, we should obtain a total of 2,320 small-pox deaths, whereof 820 were under 5 years of age, a percentage of 35·3. These figures include the small-pox deaths of all classes, the vaccinated, the unvaccinated, and the "not "stated." But we can next proceed to compare these inclusive figures with the figures for the exclusive class of unvaccinated, and the result is shown in Table XVIII, wherein it is set forth that of the 452 unvaccinated small-pox deaths in that quinquennium, 146 were under 5 years of age. This gives a percentage of 34·3. So that the reduction in the children's share of unvaccinated small-pox has been for this quinquennium fully up to the general average of reduction.

TABLE XVIII.—*Comparison of the Total Children's Share of the Small-Pox Mortality of all Classes (Vaccinated, Unvaccinated, and "Not "Stated"), with the Share of the Unvaccinated Small-Pox Mortality borne by Unvaccinated Children, for the Quinquennium* 1886-90. *Fatal Chicken-Pox included in Small-Pox.*

Age-Periods.	Small-Pox Deaths, 1886-90.			
	All Classes.		Unvaccinated only.	
	Numbers.	Percentage.	Percentage.	Numbers.
Under 5 ..... / All ages.....	820 / 2,320	= 35·3	34·3	= 146 / 425

Since calculating out the above table the publication of the Registrar-General's Fifty-eighth Report has completed another quinquennium which may be combined with 1886-90 to make the decennial return for 1886-95, the last ten years of registration. The table will then stand thus:—

TABLE XIX.—*Extension of Table XVIII to the Decennium* 1886-95.

Age-Periods.	Small-Pox Deaths, 1886-95.			
	All Classes.		Unvaccinated only.	
	Numbers.	Percentage.	Percentage.	Numbers.
Under 5..... / All ages.....	2133 / 5835	= 36·5	42·7	= 444 / 1038

Thus a change which is held to demonstrate the indispensable value of vaccination, is shown to have taken place to a hardly less extent amongst the unvaccinated than in the whole category of small-pox, taking vaccinated, unvaccinated, and not stated together.

Or otherwise:—While the general children's share of small-pox mortality has declined from 80 per cent. to 36·5 per cent., the unvaccinated children's share of unvaccinated small-pox mortality has declined from 80 per cent. to 42·7 per cent.

But it may be argued that these later years give but small figures to argue on, and that chicken-pox ought not to be included. I reply, firstly, that in England and Wales these latter years are also the least vaccinated of any since 1871, and that the smallness of the figures for the small-pox deaths of unvaccinated children shows that it is not the dangerous thing to neglect vaccination that it is said to be. And secondly, we can go to the returns of unvaccinated small-pox since 1881, and omitting all notice of vaccinated small-pox altogether, and bringing the figures up to

the date of the last returns, simply compare the thus-obtained results with those of pre-vaccinal times. Table XX will enable us to do this, and to show that in a class where vaccination, not having been applied, can contribute nothing to the phenomenon, the children's share of small-pox mortality has been reduced to practically half of what that share is alleged to have been in the eighteenth century.

TABLE XX.—*Unvaccinated Small-Pox Deaths*, 1881-95.

Year.	A. All Ages.	B. Under 5.	Percentage, B of A.
Prior to vaccination	?	?	80
1881.....	1,068	407	38·1
'82.....	325	109	33·5
'83.....	162	61	37·6
'84.....	595	252	42·3
'85.....	795	330	41·5
'86.....	43	18	41·8
'87.....	111	33	29·7
'88.....	269	95	35·3
'89.....	2	0	—
'90.....	0	0	—
'91.....	17	9	52·9
'92.....	106	38	35·8
'93.....	253	131	51·7
'94.....	176	85	48·2
'95.....	61	35	57·3
Totals	3,983	1,603	40·2

Again, it may be urged that small-pox affords the only case in which the infant and child mortality has declined concurrently with an increasing mortality for adults. It was

Decrease in Children + Increase in Adults

that was described as a unique condition, pointing to a unique cause, which could only be vaccination.

I believe it will be admitted on all sides that this contention may be fairly as well as conveniently, expressed thus:—A disease which succeeds in killing more adults would have killed more children too, but for a disturbing cause, vaccination.

In reply I deny that the position is unique. It is not true that small-pox is the only disease which, having killed more adults, has yet failed to kill more children:—whence it follows that the assumption that small-pox, of which the conditions are true, must of necessity find the causation of those conditions in vaccination, remains a mere assumption, unsupported by proof. There is another epidemic disease, against which no inoculative prophylactic has as yet been adopted, which has nevertheless behaved in the same way. This is influenza, the age-incidence of

whose mortality is compared with the similar age-incidence of small-pox mortality in Tables XXI and XXII. The sources and the method of such comparison are as follows:—

Within the limits of civil registration there have been two distinctively epidemic occurrences of influenza, viz., in 1847-48 and in 1890-91. The age-incidence of these two visitations is very fully set forth in a table on page xx of the Fifty-fourth Report of the Registrar-General, and there marked as Table G.

TABLE XXI.—*Deaths Registered as due to Influenza, per Million Living at each Age.*

Age-Periods.	1847-48.	1890 91.
Under 5	713	306
5—	80	55
10—	49	46
15—	51	115
25—	79	197
35—	139	347
45—	284	595
55—	809	1,060
65—	2,372	1,985
75—	5,510	3,355
85—	11,243	4,821

The figures show at a glance that whilst there has been a considerable diminution of the mortality under 10 years of age per million living at that age, yet at every age between 15 and 65 the mortality has greatly increased. If we now take as basis of comparison the returns for small-pox in the two periods 1847-53 and 1872-87, returns which are given in the well known "Table "L" of the Registrar-General's Forty-third Report, and which are put in as evidence on page 114 of the First Report of the present Vaccination Commission, we find that the same thing is indeed true of small-pox; but that the adult increase is much more marked in the case of influenza. To show this in detail, I add, in Table XXII, a comparison of the two diseases—

TABLE XXII.—*Small-Pox and Influenza:—Change of Age-Incidence compared.*

Small-Pox.				Influenza.		
Mortality of		Increase or Decrease Per Cent.	Age-Periods.	Increase or Decrease Per Cent.	Epidemic of	
1847-53.	1872-87.				1890-91.	1847-48.
1,617	242	— 85	0— 5	— 57	306	713
337	120	— 64	5—10	— 31	55	80
94	69	— 26	10—15	— 6	46	49
109	122	+ 12	15—25	+ 125	115	51
66	107	+ 62	25—35	+ 149	197	79
			35—45		347	139

We there see that while both diseases show a diminution of the infant and child mortality, and while, also, both show adult increase, this increase, for ages 15 to 25, is 125 per cent. for influenza, and only 12 per cent. for small-pox; and while the small-pox mortality for the ages 25 to 45 has increased by 62 per cent, the same ages show for influenza an increase of 149 per cent.

Thus the phenomenon in question is not unique. It occurs in the absence as well as in the presence of vaccination; and there is therefore no evidence pointing to vaccination as its cause.

This investigation on the basis of age-incidence can be further combined with that on the basis of locality. Such a combination has been attempted in the Majority Report of the Royal Commission, followed by Mr. Noel Humphreys in his recent paper, Table VI. That table I here reproduce, as thus:—

TABLE XXIII.—*Child Mortality from Small-Pox in relation to the Neglect of Vaccination in Six Towns which have recently suffered from Small-Pox Epidemics.*

["Final Report," pp. 50 and 176.]

1 Towns.	2 Date of Epidemic.	3 Total of Small-Pox Deaths.	4 Percentage of Deaths under 10 to Total Deaths from Small-Pox.	5 "Unaccounted for" as to Vaccination.
Warrington	1892–93	62	22·5	4·8
Sheffield	'87–88	589	25·6	4·5
London	'92–93	182	36·8	9·9
Dewsbury	'91–92	110	51·8	32·3
Gloucester	'95–96	443	64·5	67·6
Leicester	'92–93	21	71·4*	68·1

* Excluding the deaths of 3 patients in a scarlet fever ward in close proximity to the small-pox hospital, this proportion would be reduced to 66·6 per cent.

Now, to look at this table is to conclude that the unvaccinated children of Leicester suffered more than three times as severely as the vaccinated children of Warrington, and nearly three times as severely as the vaccinated children of Sheffield. But this conclusion is not justified, as the following considerations, for the suggestion of whose argument I am indebted to my friend Mr. Alexander Paul, will, I think, fully show. In the first place, the age-incidence argument is only a fair one when the figures are taken over a large space and a long time. It is not logical to compare thus single outbreaks in particular localities. If in one town small-pox break out in a school, and in another in a factory, the age-incidence will be very different whatever the vaccinal states of the populations concerned. And here, in Warrington, the small-pox hospital was near the great forges, and spread the disease

among adults; in Leicester it was close to the scarlet fever wards, and spread it among children. And more than that, it is clear that the ratio of children's deaths to total deaths may be increased in two ways; either by increasing the number of children who die, or by diminishing the number of adults. For the ratio in question is expressible by a fraction thus:—

$$\frac{\text{Children}}{\text{Children} + \text{Adults}'}$$

and every schoolboy knows that the value of this fraction will be increased *either* by increasing the number of children *or* by diminishing the number of adults. For instance, let small-pox break out in two towns, A and B, of equal population; and let there die in much vaccinated A, 10 children and 990 adults, making the fraction to be—

$$\frac{10}{10 + 990} = \frac{10}{1{,}000} = 1 \text{ per cent.}$$

And in little vaccinated B let there die 10 children and 10 adults. This gives:—

$$\frac{10}{10 + 10} = \frac{10}{20} = 50 \text{ per cent.}$$

Now, although the children's share is fifty times as great in B as in A, yet the total severity of epidemic is fifty times as great in A as in B. And we should have thought that nobody but a Royal Commissioner, or a Registrar-General's official subordinate, would appeal to the contrast between A and B to enforce the moral as to the dire consequences following from the neglect of vaccination. Yet this is exactly what the Commission does in its comparison of the six towns in the table above quoted. For they have reasoned on the children's share of the *deaths* without a checking inquiry as to the children's share of *attack*. This checking comparison we can find in—

TABLE XXIV.—*Children's Incidence of Attack compared with their Incidence of Mortality.*

In.	Percentage borne by them of Total Small-Pox Illness.	Percentage borne by them of Total Small-Pox Deaths.
Warrington	9·83	22·58
Sheffield	12·42	25·60
London	15·21	36·82
Dewsbury	21·64	51·82
Gloucester	35·67	64·52
Leicester	30·53	71·43 (or 66·60)

So that the high proportion of children's deaths in Leicester

seen to have been due to the high proportion of children's attacks. Now further check the above by this table:—

TABLE XXV.—*Actual Numbers on which the above Percentages are based.*

	Under 10.		Over 10.	
	Attacked.	Died.	Attacked.	Died.
Warrington	65	14	596	48
Sheffield*	581	128	4,096	368
London	358	67	1,995	115
Dewsbury	219	57	793	53
Gloucester	706	280	1,273	154
Leicester	109	15	248	6

* The Sheffield figures are estimated on comparison of Dr. Barry's report with the figures given by the Commissioners.

Thus so far as age-incidence is concerned the whole argument against Leicester is made to turn on the *fewness* of the six deaths over the age of 10. Are we then to conclude, that if only Leicester had lost by small-pox a hundred times as many adults as she did, that the value of vaccination would have been shown, on the strength of this age-incidence argument, to have been a vanishing quantity?

The fact is that the combination of age-incidence and locality only supplies us with a further vindication of the thesis that vaccination has nothing to do with the observed phenomena. This is admirably shown in the table set forth in Sec. 148 of the Dissentient Report, thus—

TABLE XXVI.—*Age-Incidence of Small-Pox in various Districts of Scotland in the Epidemic Year* 1871.

	Total Deaths.	Deaths under 5.	Deaths under 5. Per Cent. of Total.
Principal towns (population above 25,000)	886	195	22·0
Large towns (population from 10,000 to 25,000)	143	32	22·3
Small towns (population from 2,000 to 10,000)	209	55	26·3
Mainland rural districts	183	25	13·6
Insular ,,	11	0	0·0

It thus appears clearly that the more generally healthy the conditions of the district, the smaller is the children's share of whatever small-pox the district had.

Reference to this table as being contained in the Dissentient Report makes it incumbent on me to protest in the very strongest

terms against the assertion in the paper of Mr. Noel Humphreys, that "in the Minority Report of Dr. Collins and Mr. Picton, no "explanation of this change of age-incidence is attempted." Of that Minority Report Secs. 139—148 are devoted to the explanation whose existence Mr. Humphreys thus denies.

It therefore remains to find a cause for this shifting of age-incidence of a disease. It is submitted that that cause will be found in sanitation, using the term in the wide sense above attached to it.

The official position, as has been shown above, is—"It cannot "be sanitation which produces change in age-incidence, since "sanitation applies to all ages alike, and would affect all alike "with a similar change."

I reply that this reasoning is: (1) not what we should expect on estimation of the probabilities; (2) not justified by observed statistical fact.

To meet it let us seek some common cause quite apart from small-pox and vaccination, and consider its effects at various age-periods. Such a common cause is locality. *Where you live* is a common cause applied to all ages alike; surely then, if we compare a notoriously unhealthy neighbourhood of London with a suburb of high sanitary repute we ought, according to the medical theory, to find a difference between the mortality of the two which is constant for all age-periods. Let us then compare two different parishes of London, the one, Whitechapel, an east-end parish with a teeming population mostly very poor, and the other Hampstead, a suburb in the north-west, for the most part on high ground, and possessing probably the purest atmosphere of any suburb at a similar distance from the city proper. The result appears in the following table:—

TABLE XXVII.—*Annual Average Death-Rate per Million Living in Decade* 1881-90.

[From Registrar-General's Supplement to Fifty-fifth Report, pp. lxiv and lxxxiv.]

	All Ages.	Under Five.
Whitechapel	19,800	84,845
Hampstead	12,200	48,550
Difference	7,600	36,295
Difference per cent...	62·2	74·7

The result of this comparison is that the differences shown between the all-age and the child-age mortalities are *not* the same.

Hampstead has a superiority of 7,600 deaths per million living at all ages, but a superiority of no less than 36,295 per million amongst little children under 5. And the common cause "*Where you live*" does *not* affect all ages alike. On the contrary, as common sense would suggest, and as no statistician should require to be told, to the common cause applied alike to all ages the tenderly susceptible infant ages react with vastly greater celerity and certainty.

In this Table XXVII the correction for hospital mortality has been made as indicated in the footnotes to p. lxiv of the Supplement to the Registrar-General's Fifty-fifth Report. In the corresponding page of the Supplement to the Forty-fifth Report, dealing with the preceding decennium, the Registrar-General made the corrections himself, and for that decade the corresponding comparison would stand thus:—

TABLE XXVIIa.—*Annual Average Death-Rate per Million Living in Decade* 1871-80.

[From Registrar-General's Supplement to Forty-fifth Report, pp. lxx and lxxxviii.]

	All Ages.	Under Five.
Whitechapel	23,600	95,830
Hampstead.....	16,600	57,210
Difference	7,000	38,620
Difference per cent...	42·1	67·5

And an alternative interpretation, for greater clearness, may be applied to the table in this form, thus: If a population living in Hampstead, and as Hampstead lives, were compelled to move into Whitechapel, and there to live as Whitechapel lives, its general mortality would increase from 16,600 per million per annum to 23,600, an increase of 42·1 per cent.; but its infant mortality would experience a much greater rise, namely, from 57,210 per million living under 5 years to 95,830, an increase of 67·5 per cent.

Wherefore it is obviously by no means true that wherever a change in mortality is observed to affect infants more than adults, a cause peculiar to infancy is indicated. And hence when we find infant small-pox to have declined more than general small-pox, there is no need to thence infer any peculiar benefit in infant vaccination. The fact simply indicates the peculiar susceptibility of infants to improvements in the general art of healthy living.

(2.) The second answer to the official position, viz., that it is

not justified by actual statistical results, may be narrowed down to the actual recorded experience of the leading zymotics.

We find, on comparing Liverpool with the "Healthy Districts," that, as we pass from the former to the latter—

(*a.*) Zymotic mortality as a whole lessens.
(*b.*) Of such zymotic mortality as remains, the children's share lessens.
(*c.*) The susceptibility to sanitary interference of a particular disease shows itself, therefore, not only by diminution of absolute mortality, but also by diminution of the children's share of remaining mortality.
(*d.*) In this sense small-pox is highly amenable to sanitary interference; not less but more amenable than almost every other zymotic.

In support of this final assertion (*d*), the accompanying diagram is submitted, showing the "Influence of Sanitation on the Age-"incidence of Zymotic Mortality." This presents another aspect of the comparison already instituted in Table XIV between Liverpool and the "healthy districts" of the Registrar-General, and is extracted from the elaborate tables given on pp. 29, 112, 128, of the Supplement to his Thirty-fifth Report. These tables give the expected mortality from various causes per million born alive, under each of the contrasted circumstances, and at each age-period. From these tables have been ascertained—

(1.) For each disease, and under each circumstance respectively, the total expected mortality per million born alive, at all ages.
(2.) The same for ages under 5.
(3.) The percentage which such mortality under 5 bears to such total mortality; *i.e.*, the children's share of the total expected mortality from each disease, under each circumstance respectively.

These last percentages, for Liverpool and the "healthy dis-"tricts," are recorded in Cols. 11 and 12 of my Table XIV. And the difference between these two columns will give the difference in the children's share due to the difference in the mode of life. And the diagram shows this difference at a glance. For the amount of the children's share in Liverpool is shown by the *whole* shaded area for each disease, in percentages, each smaller square counting for 1 per cent. The extent of the similar children's share for the "healthy districts" is shown in the light shading. Therefore the black area shows the excess of the children's share in Liverpool above the similar share in "healthy districts." And

INFLUENCE OF SANITATION ON THE AGE-INCIDENCE OF ZYMOTIC MORTALITY.

Comparison of LIVERPOOL with "Healthy Districts" as to the share borne by Children under 5 in the Expected MORTALITY per 1,000,000 born alive from the undermentioned DISEASES.

Calculated from the Tables on pp. xxix, cxii, cxxviii, of the Supplement to the 35th

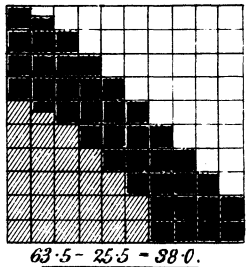
REPORT OF THE REGISTRAR-GENERAL.

▨ = *Children's share in the Healthy Districts.*

The two Shades together = Children's share in Liverpool.

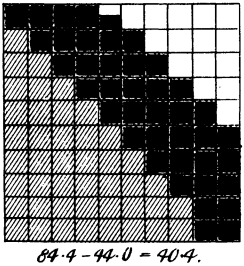
■ *alone = Excess of Children's share in Liverpool over their share in the Healthy Districts.*

SMALL-POX.



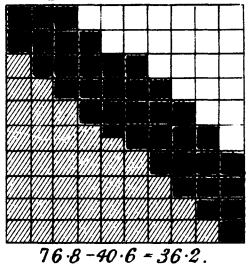
63·5 - 25·5 = 38·0.

DIARRHŒA.



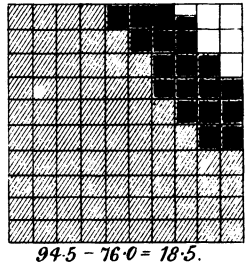
84·4 - 44·0 = 40·4.

DIPHTHERIA.



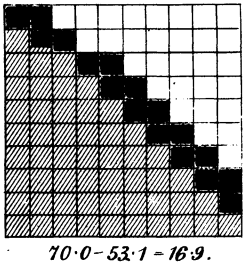
76·8 - 40·6 = 36·2.

MEASLES



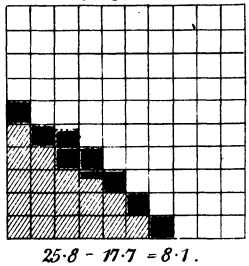
94·5 - 76·0 = 18·5.

SCARLET FEVER.



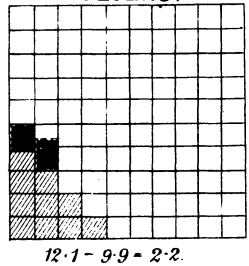
70·0 - 53·1 = 16·9.

CHOLERA.



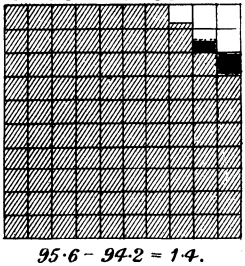
25·8 - 17·7 = 8·1.

FEVERS.



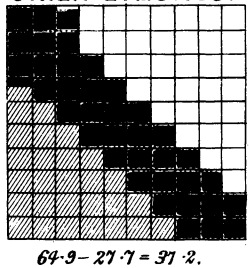
12·1 - 9·9 = 2·2.

WHOOPING-COUGH.



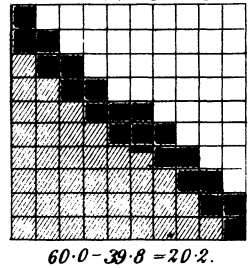
95·6 - 94·2 = 1·4.

OTHER ZYMOTICS.



64·9 - 27·7 = 37·2.

ALL ZYMOTICS.



60·0 - 39·8 = 20·2.

thus the black area becomes a measure of the extent to which sanitation can influence the children's share of expected mortality.

On this method small-pox is compared with seven other zymotics separately; then with the remaining diseases of the zymotic group; and lastly, with all the diseases of that group in sum. And the conclusion is that, judged by the extent of the influence of sanitary circumstance on the distribution of the expected mortality amongst the age-periods under and over 5 years—

Small-Pox shows an amenability to Sanitary Interference greater than that of any other Zymotic save only Diarrhœa.

Thus the statement so often made that sanitation can preserve from typhoid but is useless against small-pox is wrong in every respect, but peculiarly wrong in respect of age-incidence. In an unhealthy district the children's share of the small-pox mortality, taking Liverpool as an example, will run to 63·5 per cent.; in healthy districts that share is only 25·5 per cent.; and the difference, 38 per cent., measures the influence exerted by sanitation on the age-incidence of the disease. And this figure, 38·0, is larger than the corresponding figure for any other disease, save only the 40·4 for diarrhœa.

It may possibly be objected that, when comparing the figures for small-pox in recent quinquennia with similar figures for other diseases, the greater change is shown to belong to those others, whereas the comparison between Liverpool and "Healthy "Districts" shows the greater change as occurring in small-pox; and that there is here an apparent discrepancy which requires explaining. I conceive that the explanation, so far as any is needed, lies in the fact that there is of necessity a kind of "Diminishing Return" in the reduction of the children's share of a zymotic mortality, and that while, so long as any small-pox is left there will probably always be a children's share thereof, there is no reason to despair of the reduction of the all-age small-pox mortality to zero. That, therefore, comparing the large figures of Liverpool with the smaller returns for "Healthy Districts," the contrast between the shares would naturally come out much greater than the similar contrast in the children's shares of the much smaller mortality of the last few quinquennia.

VIII.—*Sex-Incidence.*

Another element in the controversy as to whether the incidence of small-pox is or is not a matter of vaccination as distinguished from sanitation, is its incidence on the two sexes.

There can be no doubt that re-vaccination is preponderatingly

incident on the male sex. Amongst the causes of this preponderance we may reckon:—

1. The services;
2. Life assurance.

Of these,

(1.) The army and the navy both insist on vaccination or re-vaccination in England. And in Germany, the army vaccination law of 16th June, 1834, combined with the conscription, practically insured a most rigorous vaccination, with no less than ten insertions in each arm, for the whole of the able-bodied adult males in that country. (*Cf.* the Second Report of the Commission, *Q.* 6967, *et seq.*)

And the civil service is another energetic vaccinating agency, incident in vast majority on males. And these influences tend towards the re-vaccination of *young adults.*

(2.) *Life assurance* applies in great preponderance to the heads of families, the male bread-winners. And I am assured on the high authority of Mr. G. F. Simons, who was for something like forty years in the service of the National Provident Life Assurance Association, and retired not long ago from the position of its chief clerk, that at least forty-nine males take out policies of life assurance for one female.

Now infantile vaccination, on the other hand, is applied, under the pressure of the compulsory law, to both sexes alike.

Hence, if vaccination be the arbiter of small-pox incidence, we shall expect to find an equality in respect of small-pox at early ages, which equality will give place amongst adults to a considerable preponderance of small-pox amongst females, the lesser vaccination of these latter leaving them more exposed than the more highly protected males.

But the facts are just the other way. From the Supplement to the Forty-fifth Report of the Registrar-General, pp. cxii and cxiii, I extract the accompanying Table XXVIII of the incidence of small-pox on the two sexes at various age-periods, and for the three decennia 1851-60, 1861-70, and 1871-80.

TABLE XXVIII.—*Annual Mortality from Small-Pox and from Fever (Typhus, Typhoid, and Continued) per Million Living at all Ages and at Twelve Groups of Ages, among Males and Females, in Three Decennia.*

[From Supplement to Forty-fifth Report of Registrar-General, pp. cxii and cxiii.]

Age-Period.	Decade...	Small-Pox.			Fever.		
		1851-60.	1861-70.	1871-80.	1851-60.	1861-70.	1871-80.
All.....	Males	242	182	267	907	896	494
	Females....	202	145	207	909	875	477
0—	Males.....	1,047	661	538	1,401	1,230	644
	Females....	1,021	648	516	1,434	1,266	658
5—	Males.....	271	150	301	937	881	486
	Females....	243	140	267	1,077	966	550
10—	Males.....	70	56	136	687	622	390
	Females....	76	56	139	878	798	487
15—	Males.....	105	91	206	858	787	513
	Females....	81	80	189	1,026	911	573
20—	Males.....	174	181	377	850	823	579
	Females ...	91	95	230	781	722	445
25—	Males.....	119	136	300	673	704	436
	Females ...	68	70	183	627	641	387
35—	Males.....	69	98	211	619	793	395
	Females....	37	50	128	597	706	362
45—	Males.....	53	63	145	779	903	437
	Females....	23	32	81	647	784	369
55—	Males.....	34	48	86	1,043	1,159	503
	Females....	14	25	58	888	959	418
65—	Males.....	27	38	61	1,563	1,469	629
	Females....	10	15	34	1,276	1,151	488
75	Males.....	20	30	48	1,709	1,494	593
	Females....	10	15	26	1,413	1,203	425

In this table, therefore, the figures are given for three decades, and for the sake of comparison and contrast, the similar figures are given for the great fever group, that is, for typhus, typhoid, and simple continued fever. In each decade the results, though dealing with very different quantities, remain practically the same so far as the comparison of sex-incidence is concerned. In each decade, up to the age of 15, the figures show a very slight preponderance of male over female small-pox mortality. So far the influence of vaccination has been applied to both sexes alike; and both sexes appear to suffer from small-pox, if not to an identical degree, yet to degrees separated by so small a difference that they may well be treated as identical. But from and after the age of

15 this remarkable similarity in the figures for the two sexes ceases. So much so, that for some age-periods, such as that between 35 and 44 years, the incidence of small-pox on males is just about twice as severe as the corresponding incidence in the case of the other sex. The fevers also show preponderance of male over female mortality, for this same period, but a much slighter preponderance than is the case with small-pox.

It would thus appear obvious that the incidence of small-pox is a question of the exposure to the infection, and not a question of vaccination or the want of it. So long as the opportunities of exposure to the infection remain for both sexes practically alike, as during infancy and school age they undoubtedly do, so long also the incidence of the disease remains pretty much the same for both. But as soon as an age is reached at which the more stay-at-home habits of the females tend to diminish the opportunities of infection as compared with those of the males who go more abroad, so soon also do the females begin to contribute far less than an equal share to the small-pox mortality. And the fact of the greater vaccination of the male sex taken as a whole is of no avail whatever as a counteracting agency. More exposure means more small-pox, and less exposure means less small-pox, no matter what the vaccinal conditions. Wherefore it follows that to remove small-pox we ought rather to remove chances of infection than have recourse to vaccination. In other words, where vaccination fails isolation and sanitation will suffice.

To render this point of sex-incidence still clearer, if possible, I have constructed the accompanying diagram, showing the sex-incidence of the small pox mortality from 1854 to 1887. The materials are to be found in the table of such incidence at various ages, given in the fifty-first Report of the Registrar-General, p. xxi.

In this diagram the curve for the *male* death-rate from small-pox is drawn in a continuous line; that for the corresponding *female* rate in a dotted line. Hence whenever the continuous line in the diagram lies above the dotted, there is recorded an excess of male over female mortality, the amount of such excess being represented by the vertical distance between the two curves. It will be seen that, with a single exception, the continuous curve lies in the upper position throughout the whole of its course through the various age-periods. That exception concerns the ages between 10 and 15; but the difference between the 80 females and the 76 males is hardly of noticeable importance. At the ages from 20 years and upwards the males have an incidence of small-pox mortality which approaches to double the corresponding figures for females.

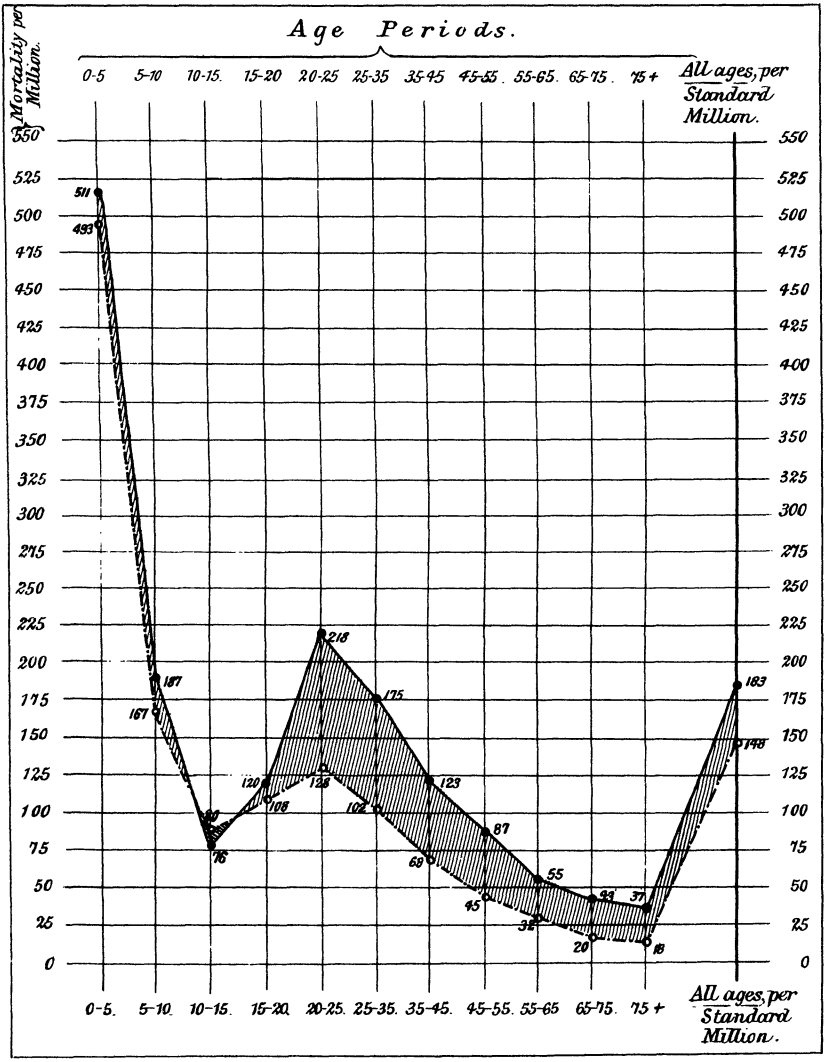
AVERAGE ANNUAL SMALL-POX DEATH-RATE PER MILLION, LIVING AT SUCCESSIVE, AND, PER STANDARD MILLION, AT ALL AGES. 1854-87. MALES AND FEMALES COMPARED. FROM REGISTRAR-GENERAL'S 51ST REPORT, TABLE F., PAGE XXI.

Males - - - ———

Females - - - .—.—.—

Hence,

Shaded area { = *Excess of Male over Female* } *Mortality.*
{ = *Excess of Female over Male* }



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From the experience of Germany we can obtain striking confirmation of these observations on sex-incidence. Here we have to deal with a much more certain and ascertainable amount of young adult revaccination. It is of course a mere historical commonplace that the citizen army, co-extensive with the healthy adult male population, dates in Prussia from the Treaty of Tilsit in 1807. To evade the provisions of that treaty, by which the Prussian army was limited to 43,000 men, the device was hit upon of combining universal conscription with short service, whereby every male not incapacitated by ill health had to serve his time with the colours. The connection of this fact with the present controversy is due to the vaccination law of 1834, whereby every recruit was vaccinated or re-vaccinated with ten insertions of lymph in each arm. It is often contended that there was no law in Germany for compulsory revaccination prior to 1875. If so, then the military, that is to say the male adult, population would be distinguished from the civil, or female, adult population by the vastly greater extent and thoroughness of their revaccination. But again we find that in Germany also the adult males have more small-pox, and more fatal small-pox, than the females of similar age. The statistics on this point are not very full. But there would appear to be enough to establish at all events the absence of any female pre-eminence amongst the German small-pox of the great pandemic. For instance, in respect of Bavaria, to which the above principles apply fully, it was given in evidence before the Commission (Second Report, Table K, p. 238) that of the total Bavarian small-pox deaths in 1871-72 no less than 52 per cent. were males. Nor has it ever, so far as I am aware, been observed that small-pox in Germany has shown, either in the incidence of its attack or by its actual mortality, any marked preference for the female portion of the adult population. Yet such preference should have been shown to a very marked degree indeed if the conscriptional army vaccination and re-vaccination of Germany were to produce a result in the least degree commensurate with its thoroughness and its wide diffusion.

Thus, so far as we have the opportunity to observe the facts, it appears as a rule that the greater risks of infection appertaining to the male sex result in a greater actuality of small-pox, and that the greater vaccination of the males is powerless to destroy their pre-eminence in the incidence of the disease. The conclusion would thus appear hardly avoidable that the right way to contend against small-pox is by measures such as general sanitation in the broad sense above attached to the term, and isolation, which operate by diminution of the chances of infection, rather than by vaccination.

IX.—*Variation by Localities.*

Of this almost endlessly many-sided question there is now but one other aspect to which I can refer, the absence of local quantitative concomitance between the decline of small-pox and the advance of vaccination. To this allusion has already been made in a general sense; but I believe the investigation can be rendered more precise by aid of some returns given in the Medical Officer's Supplement to the Twenty-second and Twenty-third Reports of the Local Government Board, wherein is set forth a comparative view of the incidence of small-pox and some other zymotics in eighty-one such towns under notification, being the eighty-one such towns for which the Registrar-General publishes quarterly returns of mortality. Observing the wide variation and capricious incidence of small-pox in these places, I have endeavoured to compare the facts as to the incidence of small-pox upon them with the amount of their default under the Vaccination Acts for the last ten years, the small-pox figures referring only to the two years recorded in the table referred to, the years 1892-93. Selecting all the places where the total of small-pox cases exceeded 100 for the two years in question, and all the places where the similar total was less than 5, the small-pox incidence of attack per 10,000 of population, the small-pox incidence of mortality per 10,000 of the population, and the fatality of small-pox per cent. of cases were all calculated from the table referred to. The percentage of "children not "finally accounted for, including cases postponed," was then taken out for each year, 1882-91, and the average of such percentage default calculated for each of the places under consideration. These results are collected in Table XXIX.

This done, the places with much and the places with little small-pox were next treated separately, in Tables XXX and XXXI, where the names are arranged in the order of the incidence of attack on the respective populations. It will at once be seen that the column for vaccinal default is of quite irregular arrangement. In Table XXX, Warrington, with only 5·24 of default, is at the top of the list, Sheffield, with about the same default, is at the bottom, while Leicester, with the highest default of all, is below the middle. The same result shows in Table XXXI, where the total of small-pox is very small, and where Eastbourne, with a very high default, is absolutely free from small-pox, and where Hartlepool, the highest for small-pox, has almost the lowest default of all. So that it would appear that, be the total of small-pox incident on a locality large or small, such incidence is entirely independent of the vaccinal condition of such locality.

This view it is endeavoured to further enforce in Table XXXII.

Here the localities treated are arranged in four ways, in accordance with (1) the attack rate, (2) the mortality rate, (3) the fatality, and (4) the vaccinal default. It is submitted that if the vaccinal condition were the only determining cause of the observed variolous phenomena, or even if it were a predominently influencing cause, there would be found a close correspondence, approaching to identity, in these four arrangements. But the truth is the reverse of this. Warrington, which heads the list both for attack and mortality, and for fatality ranks very high, is as low in vaccinal default as Hartlepool, which has neither mortality nor fatality to be reckoned. And so throughout the table. There is no approach to quantitative concomitance to be found between the arrangements of the fourth column and that of the first three.

X.—*Conclusion.*

I have here confined myself to the issues which in my opinion concern the question of the maintenance, amendment, or abolition of the present vaccination law. I have endeavoured to show that statistical inquiry breaks down at every point the claims originally urged on its behalf. Other claims set up of later years in favour of the operation as a mitigator or temporary postponing agency as against small-pox are in my view no less false than these I have endeavoured to meet, and my statistical grounds for that conclusion would be, on some other occasion, very much at the service of this Society, should any care to hear. But claiming no infallibility on the question itself—holding that the claim to statistical infallibility is infallibly the claim of a statistical quack, I yet submit with some confidence that a case, *even if mistaken*, which can be supported as I have tried to support it, and by others far more powerfully than by me, is one which should be met, and one which, whether we like it or not, will sooner or later have to be met, by weapons quite other than those of the criminal law. To have argued thus before the Royal Statistical Society may indeed have been an error, but it is an evil thing for England that it should also be a crime.

TABLE XXIX.—*The Small-Pox and Vaccinal Condition Compared for the*

[From the "Medical Officer's Supplements to the

Year.	Locality.	Population in 1891.	"Children not finally Accounted for (including Cases Postponed) per Cent. of Births," for Ten Years 1882-91.										
1882	Eastbourne	34,969	8·2	7·4	6·2	5·0	4·9	4·0	3·4	1·3	7·0	30·2	4·5
'83	Southampton	65,325	11·5	8·5	7·3	6·1	5·7	6·2	4·4	1·5	6·1	43·8	3·8
'84	Colchester	35,559	15·2	8·2	7·3	4·5	4·0	9·5	6·4	2·4	5·5	47·9	4·3
'85	Norwich	100,970	24·1	7·1	5·6	4·5	4·4	10·6	6·2	4·3	6·8	53·1	4·7
'86	Bristol	221,578	23·8	7·7	7·6	5·3	5·1	18·1	14·3	4·6	7·6	69·1	4·8
'87	Gloucester	39,444	33·2	6·6	9·1	6·9	4·3	58·8	12·7	5·3	8·6	72·2	5·7
'88	Walsall	71,789	21·4	10·2	7·3	5·6	5·5	20·5	11·0	4·9	8·7	77·0	4·5
'89	Birmingham	478,113	54·4	10·5	9·0	5·6	8·3	83·2	13·0	5·8	9·1	79·8	4·3
1890	Aston Manor	68,639	66·1	10·6	11·1	11·7	8·7	83·2	13·5	5·8	10·1	78·7	4·4
'91	Leicester	174,624	65·8	11·0	11·1	18·8	7·8	84·7	19·2	8·3	13·5	79·9	4·1
Average	Liverpool	517,980	32·17	8·78	8·44	11·02	5·87	37·08	10·31	4·44	8·30	63·07	4·51
	Warrington	52,743											
	Salford	198,139											
	Manchester	505,368											
	Oldham	131,463											
	Preston	107,578											
	Halifax	89,832											
	Bradford	216,361											
	Wakefield	33,146											
	Sheffield	324,243											
	Middlesbrough	75,532											
	Darlington	38,060											
	Hartlepool	21,271											
	Merthyr Tydfil	58,080											

Years 1892 *and* 1898 *of Twenty-Four Localities under Notification.*

Reports of the Local Government Board."]

Cases Notified, 1892-93.	Attack Rate per 10,000.	Deaths.	Mortality per 10,000.	Fatality per Cent.	Average Annual Default of Vaccination per Cent. of Births, 1882-91.
0	—	0	—	—	32·17
164	25·1	10	1·5	6·0	8·78
0	—	0	—	—	8·44
3	0·3	0	—	0	11·02
169	7·6	17	0·7	10·0	5·87
3	0·7	0	—	0	37·08
768	106·9	67	9·3	8·7	10·31
1,021	21·3	71	1·4	6·9	4·44
126	18·3	1	0·1	0·7	8·30
320	18·3	21	1·2	6·5	63·07
252	4·8	22	0·4	8·7	4·51
636	120·5	73	13·8	11·4	5·24
186	9·3	23	1·1	12·3	9·00
741	14·6	50	0·9	6·7	3·88
490	37·2	79	5·0	16·1	42·12
3	0·2	0	—	0	7·68
500	55·6	52	5·7	10·4	32·43
1,024	47·3	119	5·5	11·6	12·26
364	109·8	33	9·9	9·0	4·00
145	4·4	13	0·4	8·9	4·86
112	14·8	9	1·1	8·0	3·39
3	0·7	0	—	0	8·52
3	1·4	0	—	0	5·52
1	0·1	0	—	0	2·66

TABLE XXX.—*Small-Pox and Vaccination—Default compared by Localities.*

(a.) *Districts with more than* 100 *cases in* 1892-93.

District.	Population in 1891.	Cases Notified, 1892-93.	Attack Rate per 10,000.	Deaths.	Mortality per 10,000.	Fatality per Cent.	Average Annual Default of Vaccination per Cent. of Births, 1882-91.
Warrington	52,743	636	120·5	73	13·8	11·4	5·24
Wakefield	33,146	364	109·8	33	9·9	9·0	4·00
Walsall	71,789	768	106·9	67	9·3	8·7	10·31
Halifax	89,832	500	55·6	52	5·7	10·4	32·43
Bradford.....	216,361	1,024	47·3	119	5·5	11·6	12·26
Oldham	131,463	490	37·2	79	5·0	16·1	42·12
Southampton	65,325	164	25·1	10	1·5	6·0	8·78
Birmingham	478,113	1,021	21·3	71	1·4	6·9	4·44
Aston Manor	68,639	126	18·3	1	0·1	0·7	8·30
Leicester.....	174,624	320	18·3	21	1·2	6·5	63·07
Middlesbrough	75,532	112	14·8	9	1·1	8·0	3·39
Manchester.....	505,368	741	14·6	50	0 9	6·7	3·88
Salford.....	198,139	186	9·3	23	1·1	12·3	9·00
Bristol.....	221,578	169	7·6	17	0·7	10·0	5·87
Liverpool	517,980	252	4·8	22	0·4	8·7	4·51
Sheffield	324,243	145	4·4	13	0·4	8·9	4·86

TABLE XXXI.—*Small-Pox and Vaccination—Default compared by Localities.*

(b.) *Districts with less than* 5 *cases in* 1892-93.

District.	Population in 1891.	Cases Notified, 1892-93.	Attack Rate per 10,000.	Deaths.	Mortality per 10,000.	Fatality per Cent.	Average Annual Default of Vaccination per Cent. of Births, 1882-91.
Hartlepool	21,271	3	1·4	0	—	0	5·52
Darlington	38,060	3	0·7	0	—	0	8·52
Gloucester	39,444	3	0·7	0	—	0	37 08
Norwich	100,970	3	0·3	0	—	0	11·02
Preston	107,578	3	0·2	0	—	0	7·68
Merthyr Tydfil	58,080	1	0·1	0	—	0	2·66
Colchester	35,559	0	—	0	—	—	8·44
Eastbourne.....	34,969	0	—	0	—	—	32·17

TABLE XXXII.—*All the Localities Dealt with in Tables XXIX—XXXI.*

Arranged in order of

Attack Rate per 10,000.	Mortality per 10,000.	Fatality per Cent. of Cases.	Vaccinal Default per Cent. of Births.
Warrington	Warrington	Oldham	Leicester
Wakefield	Wakefield	Salford	Oldham
Walsall	Walsall	Bradford	Gloucester
Halifax	Oldham	Warrington	Halifax
Bradford	Halifax	Halifax	Eastbourne
Oldham	Bradford	Bristol	Bradford
Southampton	Southampton	Wakefield	Norwich
Birmingham	Birmingham	Sheffield	Walsall
Aston Manor	Leicester	Walsall	Salford
Leicester	Salford	Liverpool	Southampton
Middlesbrough	Middlesbrough	Middlesbrough	Darlington
Manchester	Manchester	Birmingham	Colchester
Salford	Bristol	Manchester	Aston Manor
Bristol	Liverpool	Leicester	Preston
Liverpool	Sheffield	Southampton	Bristol
Sheffield	Aston Manor	Aston Manor	Hartlepool
Hartlepool	None	None	Warrington
Darlington			Sheffield
Gloucester			Liverpool
Norwich			Birmingham
Preston			Wakefield
Merthyr Tydfil			Manchester
Eastbourne			Middlesbrough
Colchester			Merthyr Tydfil

Discussion *on* Mr. Milnes's Paper.

Mr. Noel Humphreys said that he was much surprised that the author had carefully avoided all but the most incidental reference to the remarkable epidemic of small-pox in Gloucester, and he doubted whether the subject of the paper could be statistically treated with success without such reference. Mr. Milnes did not profess to cover the whole statistical ground, but it should be noted that he had not referred to the Small-pox Hospital statistics, which showed a marked contrast between the mortality of vaccinated and unvaccinated cases, or to the remarkable difference in the type of disease between vaccinated and unvaccinated cases. Neither had he referred to the efficiency of re-vaccination in providing comparatively absolute protection to nurses and doctors in small-pox hospitals. With regard to the statistics dealt with in the paper, the following criticisms suggested themselves: the author sought to make a point, and to draw a lesson from the assertion that "vaccination and small-pox attained their maximum together, and together they have steadily declined." Now that statement was not only inaccurate but it was misleading. The amount of default of infant vaccination referred to would have to be maintained for a large number of years before it would materially affect the proportional vaccination of the whole population. It was impossible to discuss in detail Mr. Milnes's comparison between the rates of mortality of different diseases; but he could not help demurring to Mr. Milnes's contention that the decline of small-pox could not be due to vaccination because fever and cholera had declined concurrently with small-pox. Fever and cholera were acknowledged to be mainly caused by insanitary local conditions, but it could not be urged that small-pox was caused by foul drains or bad water. Mr. Milnes had blamed the Registrar-General for not publishing statistics of vaccination which he did not possess, and which the law did not require to be recorded. No one regretted more than he himself, from a statistical point of view, that this information was not given more generally, and he should welcome any change in the law which would promote this result. Mr. Milnes also complained that there was no column in the Registrar-General's reports for re-vaccinated cases of fatal small-pox; but he need hardly say that if such cases occurred, which was doubtful, they were not so certified in the death register. With reference to the assertion that small-pox mortality was governed by sanitation rather than by vaccination, the author in the latter part of the paper admitted that small-pox prevalence and fatality was really a question of exposure, but he evidently did not see the bearing of this admission from a statistical point of view with regard to the relative mortality from small-pox in healthy districts and in Liverpool. No doubt it was in great

measure a question of exposure, and the residents in a seaport town like Liverpool were exposed to many times greater risk than those living in the rural districts chosen to represent the healthy districts. The same remarks applied to the comparison between the proportional small-pox mortality in the urban and rural districts of Scotland.

With regard to a table which the author had done him the honour to extract from a paper which he (Mr. Humphreys) had recently submitted to this Society, it was constructed for the purpose of showing that there was a constant relation between the proportion of child mortality from small-pox and the default of infant vaccination. Mr. Milnes, with the assistance of his friend Mr. Alexander Paul, had laboured very industriously to discredit the obvious lesson taught by this table, and had arrived at the conclusion that the higher proportion of children's deaths in Leicester was due to the high proportion of children attacked. This was probably a trustworthy conclusion, and one that was equally trustworthy as an explanation of the high proportion of child mortality in Gloucester. Mr. Milnes and his friend, however, did not assign any more satisfactory explanation of the large proportion of children attacked by small-pox in Leicester and Gloucester than the recent neglect of infant vaccination.

With regard to the author's inferences from the sex-incidence of small-pox, it appeared to him that the assertion that there could be no doubt that re-vaccination was preponderatingly incident upon the male sex was a gratuitous one. It was true that re-vaccination was compulsory in the case of soldiers, but there was ground for believing that the evidence of doctors would show that the re-vaccination of females exceeded that of males, and that females had not the same objection to re-vaccination often shown by males. No doubt the question of exposure to infection was an important one, and as males were more liable to exposure than females in common lodging houses and elsewhere, this might account for the higher rate of mortality from small-pox among males than among females.

Dr. WALTER HADWEN said he belonged to Gloucester, and had gone into the question of the epidemic at that place very carefully. The whole question could be settled by looking at the map which the Medical Officer of Health for the city had recently published in his report, from which it would be noted that small-pox was practically restricted to the southern half of Gloucester. As regarded the question of unvaccinated children and what relation that bore to this geographical fact, the Medical Officer of Health declared at the commencement of the epidemic there were 12,000 unvaccinated children under 10 years of age in the city. Of that number there were some 700 cases of small-pox, and of these only 23 were vaccinated. At that time of course they were all practically unvaccinated. When however the number of unvaccinated children was reckoned with the number of vaccinated children to the balance of all children, and it was remembered that for the past ten years there had been 96 per cent. of vaccination default,

it worked out that practically the vaccinated and the unvaccinated children had had an equal small-pox attack rate. Further, he begged to call in question the accuracy of the Medical Officer of Health's statistics. When their own statistics were brought out, which they would be shortly, it would be seen that the vaccinated children of Gloucester had suffered more than the unvaccinated. Of the total 1,980 cases of small-pox of all ages said to have occurred in the city, 1,172 were officially acknowledged to have been vaccinated. Another point was this: they had been told that sanitation had no effect upon the disease, but seeing that the small-pox in Gloucester was restricted to the southern part of the city, and bearing in mind that all Gloucester was equally unvaccinated, it certainly looked as if there must be some cause other than vaccination which could have affected the result. Throughout the whole of south Gloucester there had been complaints for years with regard to its sanitary condition. In two streets, Alma Place and Terrace and New Street, an eighth part of all the small-pox cases in Gloucester were situated. The houses in these streets had only four small rooms in them, and the sanitary conditions were simply shocking, the drainage and water supply being scandalously defective. He had no doubt that the epidemic was caused by these conditions. To show that such was the case, they had the fact that the city surveyor had petitioned that throughout the length of the Barton district, where the small-pox cases largely occurred, the old sewer should be taken up and replaced by a new one laid at a lower level in order that there might be a better fall for the side streets. With regard to the mortality amongst children, it was certainly largely due to the shocking neglect which took place in the hospital. Two, three, and four children were placed in a bed together; instead of 2,000 or 3,000 cubic feet of air per patient, they were reduced to 600 or 700; they had no water applied to their bodies or even faces whilst confined to bed, in many cases for weeks, and there was an utter absence of treatment in every shape and form. Out of 429 deaths in Gloucester, 200 occurred in the hospital; this was practically half the small-pox mortality. In the hospital this number of deaths occurred out of only 730 cases received as compared with 1,250 odd cases outside. To show what the condition of the treatment was, he might mention that there were a couple of what were called "quacks" who treated patients: one by ointment only, and the other by water treatment, and from well authenticated cases it appeared that one had about 10 per cent. of deaths and the other only 2 per cent. He had obtained the names and addresses of the whole of these cases. The total death-rate including the latter had reached the enormous total of 26·3 per cent. Excepting the fatality under the insanitary conditions of the old London Small-Pox Hospital, to which only the worst cases were admitted, this was the highest small-pox death-rate on authentic record.

Mr. Shirley Murphy said the first point that interested him was the proportion of vaccinated and unvaccinated persons admitted into the London hospitals. Mr. Milnes was of opinion that those proportions were practically what they were in the

outside population, and he drew his deductions from the statistics of the Highgate Small-Pox Hospital. This would not be a fair sample of the London population, for the reason that the Highgate Hospital did not receive children under 7 years of age; and secondly, it drew its patients from a different class of population from that of the other small-pox hospitals of London. If he wished to draw conclusions from hospital statistics, he would rather take the proportions of unvaccinated to vaccinated in the hospitals of the Metropolitan Asylums Board. He found that in 1890-95 there were 4,839 cases admitted into the hospital ships, of which 68·1 per cent. were vaccinated. If with the vaccinated cases were included all those with reference to which no information could be given as to the state of vaccination, it raised the proportion to 77·4 per cent. Mr. Milnes would probably argue that this number approached his figure of 80 per cent., which he considered as the proportion of vaccinated in the population. He (Mr. Murphy) was not able to agree with that, though, without discussing the point further, he would ask, why not draw your inference from what was taking place among the young children of the population? During the same period 789 children under 10 years of age were admitted into the hospitals, of which 15·5 per cent. were vaccinated. If among the vaccinated were included those as to whom there was no evidence as to vaccination, this percentage was raised to 20·5. Could any one assume that these figures represented the proportion of the vaccinated under 10 years of age in the London population? With regard to vaccination in the Prussian army, the facts appeared to be taken from a book which he (Mr. Murphy) held in his hand. But Mr. Milnes must at the same time have seen in this book the diagram which related to what took place in the French and Austrian armies, and was given for the purposes of contrast. That diagram represented that the deaths from small-pox in the Prussian army had disappeared, whereas it had continued to a later date in the Austrian and the French armies. He thought that when statistics were presented to a society like the Statistical, this fact should not have been omitted. Referring to the large proportion of deaths from small-pox concerning which there was no statement as to vaccination, he agreed with Mr. Milnes that it was important to have the facts as to vaccination, whichever way they might tell, plainly put before the country. He pointed out that in London a large number of deaths occurred in hospitals, where the cases were under more accurate observation, so that the proportions of vaccinated and unvaccinated deaths could be better ascertained. He found, taking fifteen years from 1881 to 1895, that whereas in the whole country 56·4 per cent. of the deaths were included under the heading "no statement," in London the proportion was only 35·4 per cent. He had applied the London proportions of "vaccinated," "unvaccinated," and "no statement" deaths to the deaths from small-pox in the country generally, and found that if the proportions had been the same for the whole country as in London, 3,351 deaths under the heading "no statement" would have to be distributed among the vaccinated and unvaccinated in

the following proportions: 1,460 would go to the vaccinated, and 1,891 to the unvaccinated. He could not read into the omission to state on the death certificate the condition as to vaccination, the desire not to state the facts, but if they were stated they would probably range themselves very much in the proportions stated. In London, on this point, they had fuller statistics than those of the Registrar-General. The fact that small-pox cases were usually sent to the hospital ships, enabled a more exact statement to be made as to the condition of vaccination than if the people remained in their own homes. The deaths in the Asylums Board Hospitals fell into the following proportions: Of the vaccinated at all ages 25·9 per cent., of the unvaccinated 53·6, and of the no evidence 20·5. This had reference to deaths that occurred in the period 1891-95. Dealing with those under 5 years of age, the Registrar-General in his report had given for the same period 7·2 deaths among the vaccinated, 80·8 among the unvaccinated, and 12 per cent. "no statement." But when he (Mr. Murphy) examined the Asylums Board returns, he found that out of 120 deaths under 5 years of age, in only two instances was there no evidence as to vaccination, the whole of the remaining 118 being unvaccinated children. One might go a step further and take the deaths under 1 year of age. In the same period, as shown by the Registrar-General's reports, there were 51 deaths at this age in London. These were divided into 5·9 vaccinated, 78·4 unvaccinated, and 15·7 no statement. Then turning to the Asylums Board Returns, he found that of 43 deaths occurring in the Asylums Board Hospital, all were unvaccinated. He was sorry that time did not permit him to touch upon other important matters.

Mr. G. U. YULE said that the criticisms he wished to make were of a much more general character than those brought forward by most of the previous speakers. Owing partly to the method adopted, partly to the insufficiency of the statistics, the cases that Mr. Milnes adduced to show that there was no relation between vaccinal default and small-pox, were equally incapable of exhibiting any relation between "sanitation" (or anything else) and small-pox. The discussion was in fact futile.

Consider the question of method. Mr. Milnes himself argued that small-pox rates were a function of a great variety of causes, that he grouped under the general term "sanitation" (in a much extended sense). If, then, it were desired to investigate the effect of varying rates of vaccination, the variations of sanitation should first be allowed for, and the *residual* differences in small-pox rates observed. In the case of ordinary death-rates, for example, correction had to be made for age and sex-distribution before using the rates for comparative purposes, *e.g.*, by reducing the rates to the basis of a "standard population." Similarly Mr. Milnes should have reduced his rates to the basis of a "standard sanitation" for the purpose of studying the effects of vaccination, and *vice versâ*, or have got over the difficulty in some equivalent manner. In not a single case was this attempted; the

author had entirely failed to grasp the situation implied in his own arguments.

Take the question of sex-incidence (Table XXVIII of the paper). Assuming Mr. Milnes's statements on the greater prevalence of re-vaccination among males to be correct, it did not follow in the least, as he stated, that male mortality above the age of re-vaccination should be less than female. The ratio between the two would depend on the value of the ratio in the entire absence of re-vaccination. This was unknown; but if there was more re-vaccination among males in the last period (1871-80) as compared with the first (1851-60), all that might be expected would be a decrease in the ratio of male to female mortality above, say, the age-group 10—15. This was precisely what had happened, as evidenced by the following table deduced from Mr. Milnes's by working out the ratios. The sex-ratio had decreased in the last column, as compared with the first or second, at every age-group without exception from 15—20 upwards. No similar change had occurred in the fever figures, which were given for comparison :—

TABLE I.—*Ratio of Male to Female Small-Pox and Fever Mortality—Female taken as* 100.

Age Period.	Small-Pox.			Fever.		
	1851-60.	1861-70.	1871-80.	1851-60.	1861-70.	1871-80.
All	120	126	129	100	102	97
0.....	103	102	104	98	97	102
5.....	112	107	113	87	91	88
10.....	92	100	98	78	78	80
15.....	130	114	109	84	86	89
20.....	191	191	164	109	114	130
25.....	175	194	164	107	110	113
35.....	187	196	165	109	112	109
45.....	231	214	179	120	115	118
55.....	243	192	148	118	121	120
65.....	270	253	180	123	127	129
75.....	200	200	185	121	124	145

Again, take the discussion of incidence on various localities. Tables (Nos. XXX, XXXI) were there given of only 16 sanitary districts in which more than 100 cases of small-pox occurred during the two years 1892-93, and of only 8 in which fewer than five cases occurred, with particulars of small-pox attack-rate, mortality, and vaccinal default. To these tables he (Mr. Yule) had added a fourth column giving the percentage of the population living two or more to a room, estimating these "overcrowding" figures from the data obtained by the census of 1891. This "overcrowding" might be called a measure of "sanitation" in Mr. Milnes's much generalised sense—and a most important measure, it might be imagined, in the case of a highly contagious disease like small-pox. The whole of Mr. Milnes's paragraph on his tables

could, however, be re-written on Table II below with a slight alteration—the substitution of "sanitation" or "overcrowding" all the way through for "vaccinal default."

TABLE II.—*Small-Pox in various Localities.*

(*Tables XXX and XXXI of the paper, with columns of Overcrowding added.*)

Sanitary District (Urban).	Attack Rate per 10,000, 1892-93.	Mortality per 10,000, 1892-93.	Average Annual Default of Vaccination per Cent. of Births, 1882-91.	Overcrowding (per Cent. of Population Living Two or more to a Room).
(Table XXX.)				
Warrington	120·5	13·8	5·24	11·71
Wakefield	109·8	9·9	4·00	27·92
Walsall	106·9	9·3	10·31	15·83
Halifax	55·6	5·7	32·43	31·06
Bradford	47·3	5·5	12·26	25·23
Oldham	37·2	5·0	42·12	17·71
Southampton	25·1	1·5	8·78	6·86
Birmingham	21·3	1·4	4·44	21·99
Aston Manor	18·3	0·1	8·30	12·96
Leicester	18·3	1·2	63·07	4·33
Middlesbrough	14·8	1·1	3·39	27·53
Manchester	14·6	0·9	3·88	14·49
Salford	9·3	1·1	9·00	15·35
Bristol	7·6	0·7	5·87	14·09
Liverpool	4 8	0·4	4·51	17·63
Sheffield	4·4	0·4	4·86	18·67
(Table XXXI.)				
Hartlepool	1·4	—	5·82	43·29
Darlington	0·7	—	8·52	25·62
Gloucester	0·7	—	37·08	7·47
Norwich	0·3	—	11·02	8·30
Preston	0·2	—	7·68	8·08
Merthyr Tydvil	0·1	—	2·66	22·24
Colchester	—	—	8·44	5·71
Eastbourne	—	—	32·17	6·81

"It would at once be seen that the column for sanitation was of quite irregular arrangement. In Table XXX, Warrington, with overcrowding 12 per cent., was at the top of the list; Sheffield with 19 per cent. was at the bottom; Leicester, with far the lowest overcrowding of all, was near the middle. The same result was shown in Table XXXI, where Gloucester, with 7·5 per cent. of overcrowding, had no less attack-rate than Darlington with 26 per cent. So that it would appear that be the total of small-pox incident on a locality, large or small, such incidence was entirely independent of the sanitary condition of such locality."

Now Mr. Milnes's words and his (Mr. Yule's) stood on exactly the same footing. They were both sound statistical arguments or they were both sheer nonsense. Of course both arguments were

baseless. You could not take vaccination alone or sanitation alone, in the first place, but must consider both together by some method more effective than looking down a list; and in the second place the material handled was much too small. Two years (1892-93) were an absurdly short period on which to average the rates for a rare and sporadic disease like small-pox—the rates were in no way representative of the localities—and 16 towns were far too small a group on which to base conclusions.

Precisely the same kind of fallacy occurred in Table VI, where a list of the numbers of deaths in three successive epidemics (1858, 1864, and 1871) was given, and the great increase in mortality seriously pointed out as evidence of the insufficiency of vaccination.

But would Mr. Milnes maintain that there was a great decrease in "sanitation" between the first epidemic and the last? If not, the figures could no more be held to prove the inefficacy of vaccination than they could be held to disprove the value of sanitation.

Again, in the paragraphs round Tables XXIII—XXVI, Mr. Milnes argued that the large percentage of children's deaths in the list of six towns given was no evidence of severity of epidemic or of danger caused by lack of vaccination. He subsequently concluded, from figures referring to Scotland, that "It appears clearly the more generally healthy the conditions of the districts the smaller is the children's share of the mortality." He (Mr. Yule) could not agree that this "appeared clearly" from the figures given, but taking it for granted, he naturally tried to apply it in part explanation of the phenomena in five of the six towns, omitting London, which could hardly be treated as a single district. The figures were as follows, using overcrowding again as a measure of sanitation:—

TABLE III.

	Percentage of Children's Attacks on Total.	Percentage of Children's Deaths on Total.	Overcrowding (Percentage of Population Living Two or more to a Room).	Percentage Default, 1883-91.
Warrington	9·83	22·58	11·7	5·24
Sheffield	12·42	25·60	18·7	4·85
Dewsbury	21·64	51·82	42·0	?
Gloucester.....	35·67	64·52	7·5	37·08
Leicester	30·53	71·43 or 66·60	4·3	63·07

The result seemed scarcely satisfactory for Mr. Milnes's theory, Gloucester and Leicester had far and away the lowest overcrowding of the whole list.

As he (Mr. Yule) had stated at the beginning of his remarks, Mr. Milnes's figures, as he gave them, frequently did not exhibit any clear relation between small-pox rates and vaccination, but neither did they exhibit any clear relation between small-pox and anything else. Method and statistics were merely incapable of elucidating anything whatever.

There was a curious lapse on Mr. Milnes's part on p. 567 Speaking in September, 1896, Lord Lister remarked that small-pox

was then "absolutely unknown in the huge German army." To confute this statement, Mr. Milnes triumphantly brought forward statistics that stopped short at 1887, *i.e.*, nearly a decade before the time to which the statement referred.

Dr. E. J. EDWARDS said that as reference had been made to the German army, he might perhaps be permitted to make one further reference. The statistics gave only one death in the German army in twenty years, and it must not be forgotten that in all Germany, with a very large population, which had re-vaccination by the law of 1874, the deaths per million had remained fairly stationary, and at a minimum. There was only one country in Europe till recently which had been properly vaccinated, and that was Germany. Now Italy too had a good vaccination law since 1888, and the results obtained therefrom were already very gratifying. The deaths per 100,000 living in 284 chief communes during ten years 1881-90 averaged 35 each year, but during four years 1891-94 averaged only 6 each year.

There was a remarkable diminution in number after the Act had been applied a few years. He thought it was high time that the medical profession in this country recognised the fact that no country could be called a well vaccinated country which had only primary vaccination; more men and women died in such a country from small-pox than before vaccination was discovered.

Mr. ALFRED MILNES in reply regretted that there had not been time in which to properly criticise his paper, or to allow of his replying to such criticism as had been made. As it was, he would only ask the indulgence of the Members for a reply on two points. He had been asked why he had not dealt with the subject of Gloucester. He felt that that was a subject which could best be dealt with by Dr. Hadwen, who knew Gloucester thoroughly, and he thought the short statement which that gentleman had given would fully explain the state of the case. The real reason why he did not treat of Gloucester in the paper was, to put it frankly, that neither side could trust the other as to the figures connected with Gloucester. He did not believe one word of the teaching which claimed to rest on certain figures which had been quoted upon the subject of Gloucester, simply because he had been there and knew what the state of sanitation was. And secondly, when he was blamed for not taking up the question of the Austrian, Prussian, and German armies, he might remind them that the date of compulsory vaccination in the Prussian army was 1834 and not 1872. The law of compulsory vaccination in Germany, or rather in Prussia, for the whole population dated from 1835, as was apparent from the law, still existing in print, and of which he had a copy. Nor must it be forgotten that the Austrian armies were close to the confines of those countries of south-eastern Europe, where insanitation prevailed to the most horrible extent. The whole question of small-pox or no small-pox was one of exposure and not a question of vaccination at all.