ON THE

MORTALITY

OF THE

PEOPLE OF ENGLAND.

By T. R. Edmonds, *Esq.*, *B.A.*, *London, late of Trinity College, Cambridge.*

Any attempt to facilitate the investigation of the laws of human mortality will probably obtain the favourable regard of the medical profession. My present object is not only to make such an attempt, but also to communicate an entirely new collection of facts deduced from the *English Population Returns* just completed. The *ages* of the living contained in the population returns of 1821, combined with the ages of the dying contained in the returns of 1831, just published, will be found to add greatly to our knowledge of the laws of human mortality.

About one hundred years ago the first attempts were made to investigate the laws of human mortality, and to determine the relation between the living and the dying at each year of age. The results obtained were very distant approximations to the truth, because the materials then existing were incomplete. All ancient tables of mortality are founded upon the ages of the dying only, combined, generally, with a presumed knowledge of the total number of deaths, and of the total number of the living population at all ages. Nothing was known as to the distribution of the living population in decennial, or in any other intervals of age. In the absence of this essential information, the authors of those tables were compelled to make suppositions which were probably greatly at variance with the facts. Until the publication of the Swedish observations, towards the end of the last century, nothing was positively known respecting the relation of the dying to the living, at distinct intervals of age, for any population. In Sweden many enumerations have been made in which the ages of the living in quinquennial intervals are distinguished. The only similar enumerations which have been made in any other country, are those made by Dr. Heysham, about the year 1785, for the town of Carlisle, and those made for all England in the year 1821. The English population returns of 1831 contain no information respecting the ages of the living. The Swedish, the Carlisle, and the English, are the only observations extant which can be supposed to indicate correctly the *relative* mortality at different ages. If the absolute mortality of the total of either of these populations were known, then the absolute mortality at each interval of age would also be known. But the fact is, that no considerable degree of confidence can be placed in the correctness of the total numbers of living and of dying either at Carlisle or in Sweden; whilst in England the acknowledged errors for populous places are of enormous magnitude. It is only in France and in the Netherlands, where correctness is secured by a good system, enforced by heavy penalties, that any great confidence can be reposed on statements of the absolute mortality of the total population.

It is very generally believed that the mortality of the principal nations of Europe has diminished considerably during the last fifty years. In former times it was supposed that the annual mortality varied from one in twenty-five for large towns, to one in thirty-five for the general population of a country. At the present time a common statement is, that the mortality for large towns is one in thirty, and for the general population one in forty. The mortality of the English population is supposed to have experienced the greatest diminution; and statements have been made in parliamentary papers, that the mortality has been so low as one in fifty-five. I believe, however, that no lower estimate than one in forty-five for the total English population can be traced to any good authority. Such an estimate has been made by Mr. Milne, and has served him for the foundation of an attempted proof of the applicability of the Carlisle Table, to the mortality of all England. The proof was inconclusive, because it was assumed in the absence of any evidence that the proportion of deaths below and above five years of age, was the same for England as it had been for Carlisle. It is only within the last four or five months, that the error of this assumption has been demonstrated by the publication of the ages of the dying population of England. According to the Carlisle Table, the deaths in England during the seven years 1818-24, under and above the age of five years, should have been in the proportion of forty-nine to fifty-one, whilst the proportion really was that of thirty-five to sixty-five. Consequently, if the total number of deaths has been correctly assumed by Mr. Milne, the mortality in all England was nearly thirty per cent. greater than that indicated by the Carlisle Table, at all ages greater than five, and thirty per cent. less than the Carlisle rate at all ages under five years.

To persons interested in the study of

the laws of human mortality, there is no fact on record so remarkable as the comparatively low mortality in infancy of the English population. The observations on the English population are apparently at variance with the observations on the mortality of every other population. The existence of a principle which will reduce to harmony these apparently conflicting results is evidently probable, and ought to be sought for. I believe that I have discovered this principle; and I commenced a long series of laborious calculations founded upon this principle, six years before the publication of the present direct evidence of its truth. Three years ago I published a theoretical table under the designation of "Mean Mortality," which, for the period of infancy, bore no resemblance to any existing table. This is now the only table which bears any resemblance to the tables of mortality which can be founded upon the English observations. The principle alluded to having been already explained in No. 605 of THE LANCET, it may be sufficient here to state that it rests on the discovery of three numbers, which regulate in a very simple manner all variations in human mortality. The following are the numbers:—32.39, 2.99, and 7.97: the first measures the annual *decrease* per cent. in infancy, the second indicates the rate at which the mortality increases during the existence of the procreative power, and the third indicates the annual increase after the cessation of that power. The "procreative period" generally extends from the age of thirteen to the age of fifty-five years; but these limits are subject to small variations in different populations, and in the same population at different times. In constructing the table of "Mean Mortality," I diminished by one year the usual length of the period of infancy, or the period over which the number 32.39 presides, which simple change has been sufficient to reconcile the English with other observations.

In every table of mortality, taking quinquennial intervals of age, which are the smallest divisions that can afford any useful information, the minimum mortality occurs at the third interval, or between the ages of ten and fifteen years. The mean age at which the minimum is first attained, is generally eight or nine years. Supposing, what is very probable, that the time of attaining this minimum precedes the age of puberty by a fixed number of years (say four), it will be evident that no two individuals will arrive at this epoch precisely at the same age. For any useful practical purpose, there is, however, nothing to prevent the assumption of a certain mean age of attaining this minimum, provided the theoretical results for periods of five years agree with the results of observation.

	Absolute Mortality per cent. per annum.			Relative Mortality.		
Between ages	0—5	5—10	10—15	0—5	5—10	10—15
Sweden, 21 years.....1755-75	9.01	1.42	.66	13 65	2.15	1.00
Ditto, 20 years 1776-95	8.50	1.36	.61	13.93	2.23	1.00
Carlisle, 9 years..... 1779 87	8.23	1.02	.54	15.24	1.89	1.00
Glasgow, 6 years 1821-26	7.73	1.29	.62	12.47	2.08	1.00
England and Wales, 7 years, 1818-24	5.32	.73	.55	9.67	1 33	1.00
London, 18 years 1813-30	10.66	1.39	.67	15 91	2.07	1.00
Stockholm, 9 years..... 1755-63	24.81	2.73	.98	25.32	2.79	1.00
Theoretical Tables.						
Mean mortality when minimum is attained at the age of 9 years	10.18	1.37	.65	15.66	2.11	1.00
Mean mortality when minimum is attained at the age of 8 years	6.73	.99	.65	10.35	1.52	1.00
Mean mortality when minimum is attained at the age of 7 years	4.47	.77	.65	6.88	1.18	1.00
Northampton ditto ..... 9 years	14.73	1.95	.92	16.01	2.12	1.00
Stockholm ditto ..... 9¾ yrs.	21.62	2.77	.97	22.29	2.86	1.00

In all tables of mortality founded upon previous observations, the mean age of attaining the minimum mortality, varies from 8¾ years for general populations, to 9¾ for the population of cities. In England this age varies from 7¾ to 9 years. The above table exhibits nearly all the facts publicly known, respecting the rate of

mortality below the age of fifteen years. There exist many other concordant observations for this period of age; but they cannot be referred to as facts, because the ages of the contemporary number living were not observed. I have also given the results of five theoretical tables, which will serve to indicate how easily the facts are reconcilable with the new principle. The numbers in the columns of "Absolute Mortality" are interesting, being generally deemed correct. But a much higher degree of confidence is due to the proportional numbers in the columns of "Relative Mortality," with which alone we are at present concerned, as indicating the mean age of attaining the minimum. It will be seen that the mortality in Sweden and Carlisle under the age of five years, was nearly *fifteen* times the minimum, whilst in all England it was less than *ten* times the minimum.

In order to ascertain the mortality of an extensive population, the generally recommended mode of proceeding is, to demand the number and ages of all the dying during a certain period, together with the number and ages of all the living, from one or more enumerations. It is not desirable that the ages of the contemporary dying and living should be distinguished into smaller intervals than five years; and for ages greater than fifteen, decennial intervals of age are generally sufficient. Returns upon this principle have been obtained from Sweden at various times, from Carlisle in 1785, and from all England in 1821. This plan of proceeding would be perfect if the returns made were accurate. In the case of England, however, it has never been pretended that the absolute numbers returned make any approach to accuracy. The totals are admitted to be unknown, and it is only on the correctness of the proportional distribution at each age, that any degree of confidence can be reposed. This obvious defect might, however, have been provided against, and the absolute mortality would now have been ascertained, if the living population of 1831 had been distributed in decennial intervals of age, as was done in the English population returns of 1821. The correctness of the absolute mortality deduced, would then have been entirely dependent on the knowledge of the rate of increase of the total population, which is generally admitted to have been correctly ascertained. The absolute mortality deduced from decennial enumerations of the living in decennial intervals of age, is subject to only one source of error, that from migration. This however is of no importance when the ages of the dying are also given; because the relative mortality at each age being then known, nothing more is required than to fix the absolute mortality at any one age, say between sixty and eighty years, where there is little or no migration. The data from which the law of mortality of the English population can now be deduced, consist of an enumeration of the living in 1821, together with the number of deaths during the seven years 1818-24, the ages of the living and dying being distinguished in quinquennial intervals below the age of twenty, and in decennial intervals above that age. The scale of relative mortality indicated by these data may be converted into a scale of absolute mortality, by the use of some common multiplier, depending upon the estimate which may be made of deficiency in the deaths. I believe that the materials will be found sufficient to determine the absolute mortality in all England, within 10 per cent. of the truth.

If it be assumed, in the absence of any direct or indirect evidence to the contrary, that the increase of the English population is due entirely to the excess of births over deaths, it may be satisfactorily shown that the true deficiency in the deaths amounts nearly to twenty per cent. The increase of the population of England and Wales during the ten years 1821-31, amounted to 1897 in thousands. The corresponding number of births entered in the parish registers was 3753, of deaths 2463; giving an excess of births over deaths of only 1290 instead of 1897, the real increase of population. The difference, 607, arises from the excess of unentered births over unentered deaths. In the population returns of 1831, there is a direct statement, founded upon large numbers, that the unentered births exceed the unentered deaths in the proportion nearly of two to one. It follows, therefore, that ($2 \times 607 =$) 1214 was the number of unentered births, and 607 the number of unentered deaths, which leave the required excess 607. The true number of deaths being then 3070, and the unentered being 607, the deficiency is represented by twenty out of a hundred. The mean population of England and Wales during these ten years was 13,087 in thousands, excluding the sailors and soldiers in foreign countries supposed to be 149, or one-half of the total number. The annual deaths will therefore amount to 2.35 per cent. on the total population, or one out of 43.

The following table exhibits two scales of the absolute mortality in England and Wales during the seven years 1818-24; one consequent on the assumption that the registered deaths are deficient 20 per cent., and the other consequent on the

assumption that the deficiency is only 4 per cent. For purposes of comparison, there are also stated the results of two published theoretical tables, and the results of the Carlisle observations of Dr. Heysham.

MORTALITY IN ENGLAND AND WALES DURING SEVEN YEARS 1818-24.

Between Ages.	Mortality per cent. per annum if registered Deaths deficient 20 per cent.			Theoretical Tables.		England and Wales if Deaths deficient 4 per cent.	Carlisle 1779-87.
	Males.	Females.	Both Sexes	Mean Mortality.	Village Mortality.		
0—5	5.70	4.95	5.32	6.73	7.48	4.44	8.23
5—10	.75	.71	.73	.99	1.02	.61	1.02
10—15	.53	.57	.55	.65	.54	.46	.54
15—20	.75	.82	.78	.75	.62	.65	.64
20—30	1.03	1.10	1.06	.93	.78	.89	.75
30—40	1.24	1.32	1.28	1.25	1.05	1.07	1.06
40—50	1.62	1.60	1.61	1.68	1.40	1.34	1.43
50—60	2.50	2.26	2.38	2.40	2.01	1.98	1.83
60—70	4.74	4.36	4.55	4.83	4.05	3.79	4.12
70—80	10.72	10.29	10.50	10.04	8.46	8.75	8.30
80—90	23.82	23.05	23 44	20.18	17.16	19.52	17.56
90—100	39.33	39.85	39.59	39.85	33.45	32.99	28.44
Above 100	73.33	63.50	68.41	—	—	57.01	—
All ages.	2.35	2.20	2.28	—	—	1.90	—

The mortality in infancy having been already discussed, it will be sufficient here to remark, that for ages under fifteen, the absolute and relative results of the theoretical table of "mean mortality," much more nearly resemble the facts occurring in England, than do the results of any other published table. Below the age of fifteen, the Carlisle observations are totally irreconcilable with the English observations, upon any possible assumption of deficiency in the deaths. At ages greater than fifteen, the results of theory differ from the apparent facts in two cases only out of nine, viz., between twenty and thirty, and between eighty and ninety years of age; the difference in each case being about 12 per cent. The difference in the latter case may be disregarded, because it opposes all other observations, and because it might be accounted for on the supposition of a decreasing population between the ages of eighty and ninety years, of which there exists strong evidence. The difference between the theory and the reported fact is thus reduced to one point out of eight. But the numerous observations made in Sweden, and the single observation made in Carlisle, agree with the theory in this disputable eighth point; whence it may justly be concluded as highly probable that the apparent fact in England either had no existence, or depended upon some accidental circumstances of rare occurrence. In constructing the theoretical table of "Village Mortality" from the Carlisle observations, I acted upon a principle of this nature; and the above comparative table affords the most decided confirmation of the correctness of my proceeding. In my "Village Table" I found it necessary to deviate from the facts in two cases only, viz., between fifty and sixty and between ninety and one hundred years of age. In both these cases it will be seen, that my predicted numbers have been verified by an accurate coincidence with the facts now reported to have existed in England. Supposing the registered deaths to be deficient only four per cent. from the truth, the "Carlisle" and the "Village" tables will each nearly represent the mortality occurring in England above the age of fifteen years. But whilst the "Carlisle" disagrees with the fact for all England in *three* instances, the "Village" table disagrees in *one* instance only. It may be useful here to remark, that the extraordinary irregularities in the annual decrements of Mr. Milne's Carlisle table, have no foundation on facts, but are really in opposition to the facts upon which the table is professed to be founded. The Carlisle observations of Dr. Heysham fur-

nish nothing more than the knowledge of the rate of mortality for decennial intervals of age. These decennial rates increase in the most uniform manner; whence the proper conclusion is, that the *annual* rates also increased uniformly, as they do in my "Village Table," and as they do *not* in Mr. Milne's Carlisle table.

TABLE *showing what would have been the proportional Number of Deaths at each interval of Age, if the Carlisle Table had been applicable to the Mortality of England and Wales during the Seven Years* 1818-24.

Between Ages.	Living of both Sexes in England and Wales in 1821.	Rate per cent. per ann. at Carlisle in 1779-87.	Consequent proportion of Deaths in each interval.
0.... 5	1,566,268	8.23	12,890
5....10	1,376,315	1.02	1,404
10....20	2,218,134	.59	1,309
20....30	1,657,118	.75	1,243
30....40	1,243,169	1.06	1,318
40....50	983,306	1.43	1,406
50....60	694,364	1.83	1,271
60....70	480,693	4.12	1,980
70 ...80	239,680	8.30	1,989
80....90	65,902	17.56	1,157
90...100	5,533	28.44	157
0....100	105,304,482		26,124
		Above five years	13,234

From the above it will be seen that according to the Carlisle Table, the deaths in England under and above five years of age, should have been in the proportion of 1289 to 1323, or as 49.3 to 50.7. But the proportion really was that of 5217 to 9750, or of 34.9 to 65.1.

If the rate below five years be reduced from 8.23 to 4.52, then the deaths under and above 5 years will be in the proportion of 35 to 65 according to the facts.

There is a serious discrepancy between the results of the English population returns, and the general mass of evidence accumulated respecting the relative mortality of the two sexes. The majority of other observations agree in showing, that the mortality of the female sex is less than that of the male sex, at every age of life, in the proportion of ten to eleven. According to the English observations, the mortality of females is *greater* than that of males between the ages of ten and fifty years, in the proportion of eleven to ten. Such an extraordinary result diminishes greatly the confidence which might otherwise be reposed in the correctness of the materials, and warrants our regarding as of little value, the apparent deviation of the fact from the theory between the ages of twenty and thirty years. It is rather remarkable that the published observations on the annuitants of the British government, should be invalidated by presenting an extraordinary result of an opposite nature. According to these observations, female life is more valuable than male life, in a degree much superior to that indicated by any other observations.

Whether the mortality of the English population has been increasing or decreasing during the last fifty years, or whether the present mortality is greater or less than that now existing in France, are questions not capable of solution by any direct evidence. The only new and important fact established by the English population returns is, that the relative mortality in infancy is much less than was before supposed to exist in any country. But there is no direct evidence whereby to determine whether or not this comparatively low mortality in infancy has always existed in England and in France, or in any more temperate climate than that of Sweden. The argument for the diminution of the mortality in England, founded upon a diminished ratio of burials contained in the parish registers, cannot be regarded as of any weight, unless it be assumed, which is highly improbable, that the portion of burials out of the church-grounds has not been increasing during the last fifty years. The mortality of the French population during the seven years 1818-24, has been ascertained to be 2.49 per cent. per annum. The mortality of the English population during the same period was

2.28 per cent., upon the assumption that the deaths contained in the parish registers were deficient 20 per cent. from the total number. If the English population had been distributed according to ages, in the same manner as a stationary population, the annual rate would have been 2.37 per cent., which is the number to be compared with 2.49 of the French population regarded as stationary. There does not seem to exist any ground for supposing the circumstances of the English population to be more favourable to life than those of the French population.* There exists even one strong reason for entertaining a contrary supposition. It is a fact universally admitted, that the town population of any country suffers a rate of mortality considerably higher than that suffered by the rural population. If the mortality of the rural population of two countries be the same, the general mortality will be greatest in that wherein the proportion of town population is the greatest. In England, for example, the proportion of town popuiation is very considerable, and is nearly twice as great as that of France. If, therefore, it be assumed, that the general mortality of England is even equal to that of France, it is a necessary part of that assumption, that the rural population of England suffer a considerably lower rate of mortality than do the rural population of France. This is an assumption unsupported by any numerical, political, or physiological evidence. That the mortality of England nearly resembles that of France, is rendered probable by the fact, that the mortality of the French army at home during peace, differs in no significant degree from that of the English army similarly situated.

One of the most valuable results of the four English population returns, is the indication of the rate of increase of the po-

* STATEMENT OF FACTS ON WHICH THE MORTALITY IN ENGLAND AND WALES IS FOUNDED.

Between Ages.	Living in 1821.		Deaths in Seven Years 1818-24.		Mortality per cent. in Seven Years, if no deficiencies.	
	Males.	Females.	Males.	Females.	Males.	Females.
0 — 5	791579	774689	282196	239482	35.65	30.91
5 — 10	693858	682457	32653	30173	4.71	4.42
10 — 15	603613	569366	19910	20244	3.30	3.56
15 — 20	509586	535569	23773	27391	4.67	5.11
20 — 30	†755780	901338	53626	61701	6.45	6.85
30 — 40	593662	649507	46142	53417	7.77	8.22
40 — 50	482329	500977	48873	50214	10.13	10.02
50 — 60	342204	352160	53513	49671	15.64	14.10
60 — 70	231509	249184	68528	67918	29.60	27.26
70 — 80	115032	124648	77085	80138	67.01	64.29
80 — 90	29587	36315	44051	52318	148.89	144.07
90 —100	2253	3280	5538	8169	245.81	249.05
Above 100	60	129	275	512	458.33	396.90
Ages specified of	5151052	5379619	756163	741348	14.68	13.78
Ages omitted of..	683114	765090	25096	27157	—	—
Half of Sailors and Soldiers	159650	—	—	—	—	—
Probableomissions	—	—	204301	179935	—	—
Total	5993816	6144709	985560	948440	16.44	15.44
Between 10 and 50	3104620	3156757	192324	212967	6.19	6.75

(† The rate of mortality of Males between 20 and 30 years of age, is derived from adding to the number living one-tenth part, which is nearly one-half of the Sailors and Soldiers who encountered risk of death in England.)

pulation. The increase for the last thirty years on the total population has amounted to 15 per cent. every ten years nearly. This ascertained rate of increase agrees with the supposition made in these returns, that the births have been increasing at the rate of 1½ per cent. per annum, or 16 per cent every ten years. Upon these materials I have founded a comparison of the numbers resulting from my theoretical table of "Mean Mortality," and the number of females ascertained to be living in each decennial interval of age in the year 1821. I have supposed the births to have increased 16 per cent. every ten years for the fifty-five years 1766-1820; and I have also supposed the births before that period to have been stationary, which is equivalent to supposing the population above fifty years of age to be stationary. In making this latter assumption, I have the support of Dr. Price, one of the highest authorities on the subject, who expressed a decided opinion that the population of England about the year 1765, was either stationary or decreasing.

Between Ages.	Fact.	Hypothesis.	Stationary Population according to Table of Mean Mortality.
	Females living in 1821.	Births, including 16 per cent. every ten Years.	
0— 10	10,000	10,000	10,000
10— 20	7,583	7,591	8,805
20— 30	6,186	6,035	8,120
30— 40	4,457	4,666	7,284
40— 50	3,438	3,477	6,296
50— 60	2,417	2,459	5,165
60— 70	1,710	1,746	3,668
70— 80	855	856	1,797
80— 90	249	199	418
90—100	23	11	23
0—100	36,918	37,040	51,576
Ages omitted if ..	5,251	—	—

From the above it will be seen, that the hypothetical results are almost coincident with the facts at every age. Between twenty and forty the total numbers agree; the apparent excess of living between the ages of twenty and thirty, is an event which might be expected to follow from the known disposition of females between thirty and forty to understate their ages. Above the age of eighty years the population was apparently decreasing. But the numbers are so small, and the uncertainty of age is so great, that no safe conclusions can be founded on these appearances. The near coincidence of the numbers in the above comparative table, inclines me to adhere to the table of "Mean Mortality" as a correct representation of the mortality of the English people. Without the support of the indirect evidence of this comparative table, it would have been necessary to reduce still more the mortality in infancy, which in the table of "Mean Mortality" is already 20 per cent. less than in any other table.

Grafton Street, Fitzroy Square,
May 30th, 1835.

PHRENOLOGY.—The April number of the *Parisian Phrenological Journal* contains a Discourse pronounced at the annual meeting of the Phrenological Society of Paris, 22nd of August, 1834, by Professor Andral, the president. The object of Professor Andral, in his Address, is to show that phrenology "ought henceforth to form a part of the grave and serious studies of physiology." He states that, though not a single organ in the brain had been determined by Gall, "the foundations of the science would not on that account have existed the less." He regards exceptions to well-established principles as apparent only; and quotes with approbation the remark of M. Bouillaud, that, "while every theory which is contradicted by a well-observed fact is false, it is not less true that every fact which is in contradiction with a rigorously demonstrated theory has been ill observed." "If phrenology," he adds, "be true, give yourselves no uneasiness about its future success; for there is no example on record of any truth which, once launched into the world, has failed there to make its way." The following extract from the account of the Society's proceedings by Dr. Casimir Broussais, shows that the members take a sound view of their duties:—"I affirm and repeat, in the name of my colleagues, that we study phrenology with the completest independence: we are fully convinced of the reality of its fundamental principles, but far from pretending that the science is complete, we do all in our power to contribute to bring about such a result."—*Edinburgh Phrenological Journal*, June, 1835.