

Contributions to vital statistics : especially designed to elucidate the rate of mortality, the laws of sickness, and the influences of trade and locality on health, derived from an extensive collection of original data, supplied by Friendly Societies, and proving their too frequent instability / by F.G.P. Neison.

Contributors

Neison, F. G. P.
Royal College of Surgeons of England

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L. A. W. Barnes Esq. . 2, 9
With Mr. Neison's Compliments:

(2)

CONTRIBUTIONS TO VITAL STATISTICS;

BY

F. G. P. NEISON, Esq., F.S.S., F.L.S.,

ACTUARY TO THE MEDICAL, INVALID, AND GENERAL LIFE OFFICE.



Contributions to Vital Statistics, especially designed to elucidate the Rate of Mortality, the Laws of Sickness, and the Influences of Trade and Locality on Health, derived from an extensive Collection of Original Data, supplied by Friendly Societies, and proving their too frequent Instability. By F. G. P. NEISON, Esq., F.S.S., F.L.S., Actuary to the Medical, Invalid, and General Life Office.

[Read before the Statistical Society of London, 17th March, 1845.]

1. *Duration of Life in England and Wales.*

THE best record of the general mortality in England and Wales is contained in the Annual Reports of the Registrar-General. So far as relates to the number of deaths in the entire community, more complete returns could not be hoped for.

The Fifth Report of the Registrar-General contains a table of the expectation of life, calculated on the mortality of the year 1841. The census of the population having been taken in that year, offered a ready means to determine the value of life for that period; but as the results of the mortality for several years would undoubtedly form a broader and more satisfactory basis on which to found a measure of the duration of life in this country, it is proposed to calculate a table on the Second, Third, Fourth, and Fifth Reports of the Registrar-General; omitting the First Report, that any imperfections incidental to the early management of the Registers may be avoided. It is evidently necessary to ascertain the exact amount of population living at various ages in the country, during the periods of time to which the returns of deaths relate, before results can be obtained, showing the ratio of the population dying at the respective ages.

Previous to the population being calculated for the mean time of each period embraced in the Second, Third, Fourth, and Fifth Reports, it will be necessary to apply a correction to the enumeration of the population at the period of the census.

In 1841, the ages of 35,408 males and 11,472 females, or .456 per cent. of the one, and .141 per cent. of the other, were not given. In the registration of deaths, the ages of a certain proportion are also

omitted; and if the ratio were the same in both cases, those whose ages were not specified might be left out, as the omission of the one would be corrected by the omission of the other; but it happens that, in the returns of deaths over the entire four years referred to, the number of males whose ages were not specified was only 1,650, or .235 per cent. of the whole; and of females 896, or only .132 per cent. of the whole female deaths. Independent corrections will, therefore, have to be applied to each class of results, namely:—

Let $y + \log. x = \log.$ of the actual number alive at the period of life x , provided the age of every person had been ascertained.

$y = \log. b. - \log. a.$

a = population whose ages were ascertained.

b = total population, and

x = the number enumerated at any particular period of life.

This correction having been applied to the census of the population in 1841, and also to the census in 1821, the results obtained form the second, third, fifth, and sixth columns of the following table:—

TABLE I.

Corrected Enumeration of the Population of England and Wales for 1821 and 1841; with the Annual Rate of Increase during the Intermediate Period.

| Ages. | MALES. | | | FEMALES. | | |
|-----------------|---------------------|---------------------|-----------------------------|---------------------|---------------------|-----------------------------|
| | Population 1821. | Population 1841. | Annual Rate of Increase. | Population 1821. | Population 1841. | Annual Rate of Increase. |
| Under 5 | 898,324 | 1,047,502 | 1·007711 | 884,866 | 1,057,926 | 1·00897 |
| 5 — 10 | 787,426 | 952,437 | 1·00955 | 779,516 | 951,687 | 1·01092 |
| 10 — 15 | 685,011 | 879,732 | 1·01258 | 650,342 | 851,649 | 1·01357 |
| 15 — 20 | 578,304 | 780,967 | 1·01513 | 611,741 | 805,090 | 1·01382 |
| 20 — 30 | 857,697 | 1,333,088 | 1·02229 | 1,029,526 | 1,498,751 | 1·01895 |
| 30 — 40 | 673,718 | 999,000 | 1·01989 | 741,881 | 1,051,505 | 1·01759 |
| 40 — 50 | 547,372 | 748,487 | 1·01577 | 572,227 | 777,500 | 1·01544 |
| 50 — 60 | 388,351 | 496,475 | 1·01235 | 402,245 | 529,274 | 1·01381 |
| 60 — 70 | 262,728 | 329,563 | 1·01039 | 284,624 | 369,498 | 1·01313 |
| 70 — 80 | 130,544 | 159,551 | 1·01008 | 142,366 | 184,468 | 1·01303 |
| 80 — 90 | 33,577 | 41,224 | 1·01031 | 41,480 | 53,164 | 1·01248 |
| 90 — 100 | 2,556 | 2,986 | 1·00776 | 3,747 | 4,967 | 1·01420 |
| 100 and upwards | 68 | 82 | 1·00956 | 148 | 167 | 1·00628 |
| Total | 5,845,676 | 7,771,094 | 1·01415 | 6,144,709 | 8,135,647 | 1·01530 |

The Second, Third, and Fourth Reports of the Registrar-General gave the number of deaths in the year preceding the 30th June, 1839, 1840, and 1841 respectively; and the Fifth Report gave the deaths for the year ending 31st December, 1841. The next step required was to determine the population alive at various ages for the mean time of each of the given periods, that is, the population at the various terms of life in England and Wales on the 31st of December, 1838, 1839, 1840, and 30th June, 1841; and the following method was employed:—

Let β = the corrected population at a given age on the day of the census in 1821;

π = the same for 1841;

θ = the period elapsed since 1841.

$\text{Log. } \pi + \left(\frac{\log. \pi - \log. \beta}{20} \right) \theta = \text{log. of the population at the given term of life for the mean time of the period required.}$

The population for each of the periods being obtained in this manner for every term of life, the combined results form columns 2 and 5 of Table II.

Corrections, precisely similar to those applied to the enumeration of the population, were made on the registration of deaths; and the final results for the four years referred to are given in columns 3rd and 6th of Table II.

It may be observed here, that as the deaths happening in the last half of the year forming the fourth period of the Registrar-General, and those taking place in the first half of the year forming his fifth period, are identical, they will of course be included twice in the results now referred to; but as the population has also been taken for the mean of both periods or years, the proper relation is maintained between the population and deaths.

The preceding step was rendered necessary, from the Registrar-General having changed the period for his Annual Report from the 30th June to the 31st December, without having, at the time of making the change, distinguished the deaths belonging to each half year.

TABLE II.

Sum of the Population of England and Wales calculated for five successive periods, viz., for the 31st December, in the years 1838, 1839, 1840, and 30th June, 1841; with the Sum of the Corrected Deaths for the corresponding years as given in the 2nd, 3rd, 4th, and 5th Reports of the Registrar-General; and the Mortality per cent. during that period.

| Ages. | MALES. | | | FEMALES. | | |
|-----------------|-------------|---------|---------------------|-------------|---------|---------------------|
| | Population. | Deaths. | Mortality per Cent. | Population. | Deaths. | Mortality per Cent. |
| Under 5 | 4,156,265 | 292,968 | 7.048 | 4,192,129 | 254,170 | 6.063 |
| 5 — 10 | 3,771,901 | 36,588 | .970 | 3,767,019 | 35,494 | .942 |
| 10 — 15 | 3,473,008 | 18,199 | .524 | 3,358,717 | 19,175 | .570 |
| 15 — 20 | 3,075,023 | 22,464 | .730 | 3,174,272 | 26,003 | .819 |
| 20 — 30 | 5,210,180 | 50,765 | .974 | 5,878,257 | 56,298 | .957 |
| 30 — 40 | 3,914,433 | 43,451 | 1.110 | 4,129,820 | 47,174 | 1.142 |
| 40 — 50 | 2,945,219 | 42,770 | 1.452 | 3,060,397 | 40,781 | 1.332 |
| 50 — 60 | 1,960,445 | 44,196 | 2.254 | 2,086,819 | 40,593 | 1.944 |
| 60 — 70 | 1,302,647 | 55,491 | 4.259 | 1,457,878 | 54,414 | 3.732 |
| 70 — 80 | 631,509 | 57,449 | 9.097 | 727,904 | 60,229 | 8.274 |
| 80 — 90 | 163,089 | 32,461 | 19.904 | 209,902 | 38,064 | 18.134 |
| 90 — 100 | 11,846 | 4,282 | 36.316 | 19,568 | 6,650 | 33.984 |
| 100 and upwards | 325 | 137 | 42.154 | 662 | 311 | 47.277 |
| Total | 30,615,890 | 701,221 | 2.290 | 32,063,344 | 679,356 | 2.119 |

All the preceding corrections having been applied to the population and deaths, the combined results form Table II., the 4th and 7th columns of which show the mortality per cent. at the various terms of life for each sex in England and Wales during the four years referred to, and under that form constitute a complete measure of the value of life during the same period, in the general population of this country.

The 4th and 7th columns of the above table represent the rate of mortality at the mean age of that period of life opposite to which they are placed. More complete tables* were also formed by the method of third differences, and the necessary corrections being applied, a fair expression was obtained of the rate of mortality at each age, beginning with the age of 10, the number living to each subsequent year of life, the numbers dying in each successive year of life, and the specific intensity (the reciprocals of the rate of mortality per cent) of life, at each age.

The following are the principal results of the Tables here referred to. Both male and female life attains its highest specific intensity at the age of 14. Male life possesses a much higher specific intensity than female life up to the age of 25 inclusive; from that to the age of 38 the difference is very little, but generally in favour of male life; and from 38 upwards to nearly the extreme of life, the scale turns in favour of female life, and the specific intensity is higher throughout. At the age of 50 the two sexes attain their balance, the numbers surviving of each, from the age of 10, being equal. The nature of the specific intensity, in the preceding sense, must be clearly understood to refer to that period of life only to which it is affixed, and not to be any index to the general value of life; for it will be seen that although male life possesses a higher specific intensity up to the age of 38, still female life is of a higher absolute value throughout the whole of the same period.

Another Table†(see Abstract, Table III.) exhibits the Expectation of Life as deduced from the data already described; and without attempting anything like an elaborate comparison between it and other tables, hitherto regarded as a near approximation to the real measure of life, such observations only will be made as appear to be more intimately connected with the subject of this paper.

It is clear that a table formed from the data at present under consideration, will show the value of life in the country generally; all classes of society, from the highest to the lowest, being included; and it will therefore serve as a useful standard of comparison with the measure of life in individual classes of society, provided the rate of mortality in those classes can be determined.

In order to convey a general idea of the value of life as represented by this Table, it may be stated that it gives a greater expectation to males throughout the whole range of the Table, than is given in the Table at page xix of the Fifth Report of the Registrar-General:—

* This Table (Table C, p. 5) will be found in "Contributions to Vital Statistics, &c.," being a copy of the whole paper read before the Statistical Society, published by Hugh Cunningham, 193, Strand, 1845, 4to.

† Contributions to Vital Statistics, Table D, p. 7.

| | | | | | | | |
|--|---|-----|---|---|---|-----|---|
| At Age 10 the difference is .68 of a year. | | | | At Age 60 the difference is 1.00 of a year. | | | |
| " 20 | " | .81 | " | " 70 | " | .44 | " |
| " 30 | " | .97 | " | " 80 | " | .15 | " |
| " 40 | " | .92 | " | " 90 | " | .15 | " |
| " 50 | " | .83 | " | | | | |

The value of female life is also higher than female life in the Table of the Registrar-General; the difference of expectation in the two tables being:—

| | | | | | | | |
|--|---|------|---|---|---|-----|---|
| At Age 10 the difference is .57 of a year. | | | | At Age 60 the difference is 1.12 of a year. | | | |
| " 20 | " | .79 | " | " 70 | " | .81 | " |
| " 30 | " | .92 | " | " 80 | " | .44 | " |
| " 40 | " | 1.01 | " | " 90 | " | .32 | " |
| " 50 | " | .98 | " | | | | |

A comparison of the expectation of male life in the same Table with the Carlisle Table, which includes both sexes, shows a higher value of life in the Carlisle Table up to age 54. Again, from that age up to 75 the difference is very little, but generally against the Carlisle Table; and at 75 the Carlisle Table again crosses, and maintains a superiority till the extreme of life. The expectation of female life, however, is higher than the expectation of the Carlisle Table after 15 years of age. At the age of 88, however, they nearly coincide, and the Carlisle Table continues higher after that age.

A comparison of the mean of the expectation of male and female life, with the expectation of the Carlisle Table, yields the following results, namely,

| | | | | | |
|---|--|---|---|-----|------------|
| At Age 10 the difference in favour of the Carlisle Table is | | | | .75 | of a year. |
| " 20 | " | " | " | .32 | " |
| " 30 | the difference in favour of England and Wales is | | | .29 | " |
| " 40 | " | " | " | .49 | " |
| " 50 | " | " | " | .34 | " |
| " 60 | " | " | " | .71 | " |
| " 70 | " | " | " | .35 | " |
| Again at 80 the difference in favour of the Carlisle Table is | | | | .09 | " |
| " 90 | " | " | " | .29 | " |

So that the absolute difference throughout the whole course of both tables is very small, and the near approximation rather remarkable, considering the very different sources from which the data are derived. More minute comparison of those results with several of the best recognized Life Tables, is presented in Table III.

Much attention has of late been given to the supposed influence of locality on the duration of life; still no public means have yet been employed to solve the question correctly. For the progress of vital statistics it unfortunately happens, that the public records of this country are kept with very little regard to method or unity of plan. The Report of the Census may certainly in itself be regarded as a very complete document; and perhaps no other country possesses such excellent mortuary registers; yet for almost every purpose of exact calculation, both documents are nearly useless. No two things should have been more intimately related in design and classification, than the Census of the People and the Registration of Deaths. Still they seem to have been compiled without any regard to each other. For example, if it were required to compare any two counties in England—a manufacturing with an agricultural county—an inland

TABLE III.

| Ages. | England and Wales, A.D. 1833—1841. | | Milne, Carlisle, A.D. 1779—1787. BothSexes. | Deparcieux. Tontine Nominees, Both Sexes. | Demonferrand, France, A.D. 1817—1832. | | Assured Lives. | |
|-------|---------------------------------------|----------|---|--|---|----------|-----------------------|------------------------|
| | Males. | Females. | | | Males. | Females. | Equitable. Davies. | Amicable. Galloway. |
| 10 | 47.76 | 48.38 | 48.82 | 46.83 | 47.00 | 47.42 | 48.83 | ..... |
| 15 | 44.18 | 45.00 | 45.00 | 43.50 | 43.58 | 43.66 | 44.81 | ..... |
| 20 | 40.69 | 41.60 | 41.46 | 40.25 | 40.00 | 40.08 | 41.06 | ..... |
| 25 | 37.35 | 38.36 | 37.86 | 37.17 | 37.25 | 36.83 | 37.44 | 37.81 |
| 30 | 34.10 | 35.17 | 34.34 | 34.08 | 34.00 | 33.41 | 33.98 | 33.68 |
| 35 | 30.81 | 31.98 | 31.00 | 30.92 | 30.50 | 30.00 | 30.66 | 29.72 |
| 40 | 27.48 | 28.73 | 27.61 | 27.50 | 27.00 | 26.58 | 27.40 | 25.94 |
| 45 | 24.14 | 25.41 | 24.46 | 23.92 | 23.41 | 23.16 | 24.10 | 22.37 |
| 50 | 20.85 | 22.05 | 21.11 | 20.42 | 19.91 | 19.58 | 20.83 | 18.99 |
| 55 | 17.64 | 18.72 | 17.58 | 17.25 | 16.50 | 16.25 | 17.85 | 15.83 |
| 60 | 14.59 | 15.53 | 14.34 | 14.25 | 13.25 | 13.16 | 15.06 | 12.88 |
| 65 | 11.75 | 12.53 | 11.79 | 11.25 | 10.58 | 10.50 | 12.35 | 10.26 |
| 70 | 9.22 | 9.84 | 9.18 | 8.67 | 8.08 | 8.08 | 9.84 | 8.11 |
| 75 | 7.01 | 7.52 | 7.01 | 6.50 | 6.16 | 6.16 | 7.52 | 6.35 |
| 80 | 5.22 | 5.64 | 5.51 | 4.67 | 4.75 | 4.75 | 5.38 | 4.88 |

| Ages. | Milne. | | | | | Duvillard. France. BothSexes. | Price. Northampton. A.D. 1735—1780. Both Sexes. |
|-------|--|----------|------------|---------------------------------|----------|-------------------------------------|--|
| | Sweden and Finland, A.D. 1776—1795. | | | Montpellier, A.D. 1772—1792. | | | |
| | Males. | Females. | BothSexes. | Males. | Females. | | |
| 10 | 45.03 | 47.28 | 46.16 | 44.12 | 46.77 | 40.80 | 39.78 |
| 15 | 41.51 | 43.74 | 42.63 | 40.06 | 43.02 | 37.40 | 36.51 |
| 20 | 37.86 | 40.04 | 38.96 | 36.52 | 39.45 | 34.26 | 33.43 |
| 25 | 34.48 | 36.44 | 35.47 | 33.49 | 36.32 | 31.34 | 30.85 |
| 30 | 31.22 | 33.00 | 32.12 | 30.43 | 33.34 | 28.52 | 28.27 |
| 35 | 27.95 | 29.68 | 28.82 | 27.30 | 30.41 | 25.72 | 25.68 |
| 40 | 24.61 | 26.27 | 25.45 | 24.06 | 27.45 | 22.89 | 23.08 |
| 45 | 21.45 | 23.03 | 22.26 | 21.00 | 24.44 | 20.05 | 20.52 |
| 50 | 18.36 | 19.66 | 19.03 | 18.23 | 21.35 | 17.23 | 17.99 |
| 55 | 15.39 | 16.37 | 15.90 | 15.53 | 18.42 | 14.51 | 15.58 |
| 60 | 12.47 | 13.18 | 12.85 | 13.14 | 15.73 | 11.95 | 13.21 |
| 65 | 9.92 | 10.41 | 10.19 | 11.01 | 13.22 | 9.63 | 10.88 |
| 70 | 7.87 | 8.12 | 8.01 | 9.02 | 10.79 | 7.58 | 8.60 |
| 75 | 6.13 | 6.38 | 6.27 | 7.07 | 8.44 | 5.87 | 6.54 |
| 80 | 4.75 | 4.94 | 4.85 | 5.17 | 6.17 | 4.60 | 4.75 |

with a coasting county—in order to determine the relative value of life in the respective populations, it cannot at the present time be done. The Report of the Census Commissioners gives the population for those counties; but on reference to the Reports of the Registrar-General it is found that the deaths are given for quite a different arrangement of districts. Again, if it be required to compare one district of the Registrar-General with another, the same kind of difficulty arises; for, on turning to the Census Report, those districts are in no way recognised. Precisely the same want of unity of plan is to be

regretted in respect to the town districts of England, the districts of the Census Commissioners constantly differing from those adopted by the Registrar-General.

Were these difficulties overcome, it would then be easy to determine the difference of mortality in various districts, in precisely the same manner that the difference of mortality in male and female life has been found in the preceding Table. Another inquiry, at least however, would still remain, before it could be decided to what extent the difference of mortality was owing to the simple influence or peculiarity of locality itself.

At present it is right to assume, that either employment or occupation—condition in life, or rank in society—poverty or riches—has as direct an influence on the duration of life, as peculiarity of locality or habitation; for the effect of neither the one nor the other of the presumed influencing causes has yet been correctly defined. The truth of this assumption may appear more evident thus:—suppose that the town of Liverpool were compared with some purely agricultural district, and that a much higher rate of mortality was found to prevail in the former; it would be no more right to assign this result wholly, or indeed any given portion of it, to the badly-conditioned streets and ill-planned houses of Liverpool, than to any other of the supposed causes.

In order to determine the simple influence of locality, like classes in the respective districts must be compared. In a comparison of districts A and B, if it so happened that in A two elements *c* and *d* were found to influence the value of life, while in B one only of those elements existed, the grounds of comparison would evidently be fallacious. Now this is precisely a parallel case to the state of things which exists in comparisons that have frequently been made between the manufacturing towns and the rural districts of England, and between one manufacturing town and another. Causes influencing the duration of life, independent of locality itself, frequently exist in the one, and not in the other; by overlooking which, observers are often led to assign excessive mortality to imaginary causes. If simple elements were compared, errors of this kind would be avoided. Keeping this in view, and referring to the preceding case, let *c* be supposed to represent comfort, and *d* distress. If, comparing comfort in district A with comfort in district B, a greater mortality were found to prevail in the former than in the latter, it would then be right to assume that the remaining elements—ill-ventilated houses, badly drained streets, and the like—in district A, were not so favourable to life as in district B; but it would have been wrong to draw such a conclusion, had comfort and distress in the one district been compared with comfort only in the other.

It is evident that, in a comparison of the general mortality of any one place with that of another, such errors could not be avoided. It may happen that the prevalence of a particular kind of employment or occupation in the one, which is not common to the other district—but which employment is of an unhealthy nature, or perhaps subject to great fluctuations in prosperity, or probably both combined—may produce an excessive mortality, the cause of which may be attributed to badly-planned dwellings, instead of poverty and its train of direful consequences.

If it were possible to compare any one class in a given district with the same class under exactly similar circumstances in another district, the only distinction being the difference of district or locality, then it is plain that the influence of locality, if any, would manifest itself.

Again, if different classes of persons in the same locality were compared—for example, those following different employments—the only distinction being difference of employment, then the effect of that element, if any, on the duration of life would appear.

In the present paper it is proposed to enter into this question, and to show if possible the influence of locality in the manner just described. The effect of employment on health will be treated of, on the present occasion, so far only as may be necessary to solve the question of locality.

2. *Duration of Life in various Classes.*

The data to which this part of the inquiry belongs have been derived from two sources. One portion—that relating to the Friendly Societies in England—has been obtained through the kindness of Mr. J. Tidd Pratt; and consists of the Quinquennial Returns for 1836–1840, made under the Friendly Societies Act, 10 Geo. IV. c. 56. sec. 34, as amended by 4 and 5 Wm. IV. c. 40, sec. 6. And an inspection of the form of schedule given under that Act will show the nature and extent of the information which can be derived from this source.

It was considered that returns from the Friendly Societies in Scotland would form a valuable contribution to Vital Statistics, and at the same time be interesting to compare with the results obtained from English Societies; especially as Mr. Ansell's valuable work had given rise to many curious conjectures on the comparative amount of sickness in the two countries; the inquiry made by the Highland Society having exhibited a less degree of sickness among the Scotch societies, than the results of Mr. Ansell's investigation showed to be prevalent in societies in England. Accordingly, in 1840, a number of blank schedules were sent to nearly every parish minister in Scotland, with a note requesting him to use his influence with the neighbouring Friendly Societies, to induce them to furnish the information required; but the attempt to procure data in this manner proved an almost complete failure. In 1843 another attempt was made, but on this occasion prizes were offered to those making the best and most complete returns; which had the desired effect of procuring a series of schedules filled up evidently with much care; and although very elaborate, the nicest attention seemed to be given to the minutest detail. These constitute the second source from which the data just referred to are derived.

The data were subsequently abstracted; the results of each Society being separate from those of every other. The results of each particular trade or employment were also kept distinct from those of every other occupation.

By this arrangement a means was afforded to measure the precise amount of sickness and mortality experienced by any particular

Society, the ratio due to each year of life, and also how far its affairs were influenced by the particular trades and occupations of its members.

All the Societies having been abstracted in this way, the results were afterwards combined in the following manner:—The Societies belonging to the Rural Districts were placed in one group. The Societies belonging to Town Districts were placed in another group. And a third group was formed from those Societies established in the great towns or cities*.

This plan was adopted in preference to a binary arrangement, in order to prevent a purely rural district from being mixed up with some of the smaller towns, and the great city districts with the larger towns.

The results of the first group, or Rural Districts, were then combined as follows. The totals of a given trade were placed on one of the abstract sheets; and the totals of the same trade in a second and a third Society, and so forth, were placed next in order on the same sheet, until all the Societies in the Rural Districts of the first county in alphabetical order were exhausted. The sums of those totals were then found, which showed the amount of sickness and mortality among a certain number of persons at each age and of a given trade in that county. The same trade was carried through the rural districts of every other county in the same manner; and the totals for each county being added together, showed the general result for that trade in the whole of the rural districts combined. The same trade was carried through the second group, or Town Districts, and also the third group, or City Districts, in precisely the same manner, so that an opportunity was thus afforded, of viewing the comparative degree of health in the same occupation or employment, in the three districts referred to. Those three districts were next combined, to give the general results for that trade without regard to locality. A second trade was taken up in the like manner, and carried through precisely the same steps, and so also were other trades until all were exhausted. The totals of the various trades in the Rural Districts were then combined, giving the general results for that district without regard to occupation, and so on with each of the other districts; and the combination of these last three gave of course the general results, without regard to either trade or locality.

All the possible combinations of those elements of the data being thus made, the next step was to exhibit the results in a convenient form, from which to make useful deductions. Tables were therefore formed, shewing the total number of persons, at every year of life over which the observations extend, the number of deaths among them yearly, and the amount of sickness yearly, expressed in weeks and decimals of a week. In the same Tables are also given the same facts for quinquennial periods of life, also the rate of mortality per cent., and the average amount of sickness per annum to each person.

As these observations extend over upwards of 400 different trades or occupations, the examination of each under the varied combinations

* A list of the places composing the respective groups of Rural Districts, Town Districts, and City Districts, is given in Appendix, Note II., to the "Contributions."

described would involve the consideration of so immense a number of Tables, as would evidently perplex the present inquiry. Such only will therefore be brought forward as seem to bear distinctly on the more immediate question, What is the influence of locality on health and on the duration of life?*

In the "Rural Districts," the highest specific intensity is attained at the youngest ages, and it decreases up to age 20, from which age up till 31 it increases, and then decreases gradually till near the extreme of life. A comparison of the specific intensity with the general result for the male population in England and Wales shews a higher intensity of life through its whole duration, maintaining at the same time a very remarkable parallelism.

| At Age 20 | | { the Specific Intensity for the male population of England and Wales is as high as at | | Age 39 in the Rural Districts. | |
|-----------|----|--|---|--------------------------------|----|
| " | 30 | " | " | " | 47 |
| " | 40 | " | " | " | 50 |
| " | 50 | " | " | " | 55 |
| " | 60 | " | " | " | 63 |
| " | 70 | " | " | " | 71 |

An approximating value taking place up to about this period, after which they again diverge to near the extreme of life.

The population existing at age 10 in England and Wales is halved between ages 62-3; while in the Rural Districts the same result does not happen till ages 68-9;—shewing under this aspect a superior vitality of six years.

If from the Rural we turn to the Town Districts, the specific intensity will be found to decrease in a regular series, from the beginning to the end of life. It also appears that the specific intensity is higher than for the male population of England and Wales up to age 52, but from that to age 76 it is less. From the latter age to the extreme of life, the values for the two classes cross each other. The following are the ages at which the corresponding specific intensities in both Tables are nearly equal:—

| Age 20 in England and Wales corresponds with Age 31 in Town Districts. | | | | | |
|--|----|---|---|----|---|
| " | 30 | " | " | 41 | " |
| " | 40 | " | " | 45 | " |
| " | 50 | " | " | 50 | " |
| " | 60 | " | " | 58 | " |
| " | 70 | " | " | 68 | " |
| " | 80 | " | " | 82 | " |

In Town Districts half the population disappears between ages 64-5; the same result takes place in England and Wales at ages 62-3.

Turning next to the results for the City Districts, we find that the specific intensity decreases in a uniform series, from the earliest age to the end of life. It also appears that from the age of 10 to 33 there is a higher specific intensity than in England and Wales; and that from 33 to the extreme of life, the specific intensity in the City Districts is less than in the male life for England and Wales. The following are the ages corresponding to equal specific intensities:—

* The Tables here referred to are Tables E and F, pp. 13 and 25 of the "Contributions."

Age 20 in England and Wales corresponds nearly with Age 25 in City Districts.

| | | | | |
|------|---|---|----|---|
| " 30 | " | " | 33 | " |
| " 40 | " | " | 37 | " |
| " 50 | " | " | 46 | " |
| " 60 | " | " | 59 | " |
| " 70 | " | " | 69 | " |
| " 80 | " | " | 79 | " |

Half the population in City District has died off between the ages of 61 and 62, while among males in England and Wales that happened at ages 62 and 63; being in this instance one year in favour of the whole country.

On placing the three districts side by side, we have,

| | | | |
|---|---|------------------------------------|----|
| A higher Specific Intensity in the Rural Districts than in England and Wales up to the extreme of life. | | Town Districts up to the Age of 52 | |
| " | " | City | " |
| " | " | " | 33 |

From this it would appear, that the lower the age of equal specific intensity, the worse the class of lives to which it refers. Another comparison of these three classes of results with those obtained for England and Wales will shew the following series of differences for the corresponding ages of equal specific intensity:—

| Age. | Rural Districts. | | Town Districts. | | City Districts. | |
|-----------------------------------|------------------|----|-----------------|-----|-----------------|-----|
| 20 | | 19 | ..... | 11 | ..... | 5 |
| 30 | | 17 | ..... | 11 | ..... | 3 |
| 40 | | 10 | ..... | 5 | ..... | 3 |
| 50 | | 5 | ..... | 0 | ..... | — 4 |
| 60 | | 3 | ..... | — 2 | ..... | — 1 |
| 70 | | 1 | ..... | — 2 | ..... | — 1 |
| Sums of the series of differences | | 55 | ..... | 23 | ..... | 5 |

This arrangement of the differences of corresponding periods of equal specific intensity also points out a gradual approximation to lower numbers, moving from the Rural towards the City Districts. And a third illustration of the same fact will be afforded by a comparison of the periods at which the equation of life is found for age 10. It is found in—

| England and Wales. | Rural Districts. | Town Districts. | City Districts. |
|--------------------|------------------|-----------------|-----------------|
| At Ages 62—3 | 68—9 | 64—5 | 61—2 |
| diff. | 6 years. | 2 years. | — 1 year. |

As before stated, the illustrations drawn from the specific intensity must be understood to have reference to the identical periods only of life at which the comparisons are made, and not to the absolute value of life in any of the classes. It will, however, at all times be found important to keep in view the specific intensity, as it affords the readiest means to discover those periods at which any peculiar change or difference in the condition of life is taking place. Various diseases have a maximum or minimum effect in destroying life at certain periods; and if a change to a higher specific intensity were found to take place at any given period, the diseases peculiar to that period should be falling from their maximum towards the minimum.

In the three districts now under consideration, it was found that in all except one, the specific intensity uniformly decreased from the beginning to the end of life; but in the Rural Districts the specific intensity was found to increase from ages 20-31. Some change, either in the Rural Districts or uniformly in the two others, must therefore have taken place in the causes affecting the duration of life at that period; and if the nature of this paper led to an examination of the diseases generally prevalent at the same period, the probability is that consumption and diseases of the chest would be found less malignant at that term of life, in relation to the preceding and subsequent periods of life, in the Rural than in either the Town or City Districts.

The next arrangement of the data to which reference will be made, is the expectation of life. This mode of expressing the duration of life is certainly that which is of the most interest to society; for it points out the average number of years which one member of the community with another participates in the pleasures and cares of life. The expectation of life is often confounded with the chance of living an equivalent number of years; but the distinction will be subsequently explained*.

A comparison of the expectation in Rural Districts, with the expectation for males in England and Wales, shows a much higher value of life in the Rural Districts throughout the whole range of the Table. At age 10 the difference is 5·5 years in favour of the Rural Districts, at 30 it is 4·3 years, and at 60 it is 2·1 years. The following Table will show for decennial periods the relative value of life in England and Wales, and in the Rural Districts:—

TABLE IV.

| Age. | EXPECTATION. | | Difference in favour of the Rural Districts. | |
|------|------------------|--------------------|--|-----------|
| | Rural Districts. | England and Wales. | In Years. | Per Cent. |
| 20 | 45·3550 | 40·6910 | 4·6640 | 11·462 |
| 30 | 38·4073 | 34·0990 | 4·3083 | 11·191 |
| 40 | 30·9724 | 27·4760 | 3·4964 | 12·725 |
| 50 | 23·4700 | 20·8463 | 2·6237 | 12·585 |
| 60 | 16·6524 | 14·5854 | 2·0670 | 14·171 |
| 70 | 10·9124 | 9·2176 | 1·6948 | 18·386 |

A comparison of the results for the Town Districts will show a superior expectation of life up to age 35, after which period the expectation is in favour of male life in the general Table for England and Wales. The following abstract shows the results for decennial periods:—

* In Table G, p. 32 of the "Contributions," will be found the Expectation of Life for each of the three districts, and also the General Results for those three combined.

TABLE V.

| Age. | EXPECTATION. | | Difference in Favour of | | | |
|------|-----------------|------------------|-------------------------|-----------|--------------------|-----------|
| | | | Town Districts. | | England and Wales. | |
| | Town Districts. | England & Wales. | In Years. | Per Cent. | In Years. | Per Cent. |
| 20 | 42·2742 | 40·6910 | 1·5832 | 3·888 | | |
| 30 | 34·5753 | 34·0990 | 0·4763 | 1·397 | | |
| 40 | 27·1530 | 27·4760 | .... | .... | 0·3230 | 1·176 |
| 50 | 19·9733 | 20·8463 | .... | .... | 0·8730 | 4·188 |
| 60 | 13·7608 | 14·5854 | .... | .... | 0·8246 | 5·653 |
| 70 | 8·7030 | 9·2176 | .... | .... | 0·5146 | 5·582 |

The expectation of life in the City Districts will be found to be less than in England and Wales from 12 years upwards. At 20 the difference is ·68 years, at 40 it is 1·39 years, and at 60 it is ·82 years in favour of the general value of male life in England and Wales. The following gives a comparative view of the expectations for both classes:—

TABLE VI.

| Age. | EXPECTATION. | | Difference in favour of England & Wales. | |
|------|-----------------|------------------|--|-----------|
| | City Districts. | England & Wales. | In Years. | Per Cent. |
| 20 | 40·0148 | 40·6910 | 0·6762 | 1·664 |
| 30 | 32·8603 | 34·0990 | 1·2387 | 3·632 |
| 40 | 26·0873 | 27·4760 | 1·3887 | 5·054 |
| 50 | 19·9271 | 20·8463 | 0·9192 | 4·409 |
| 60 | 13·7685 | 14·5854 | 0·8169 | 5·608 |
| 70 | 8·7636 | 9·2176 | 0·4540 | 4·092 |

The comparative value of life in the three districts at decennial periods will be seen by an inspection of the following Table; the 6th and 8th columns of which will point out the gradual decrease in the value of life in moving from the Rural to the Town, and from the Town to the City Districts:—

TABLE VII.

| Age. | EXPECTATION OF LIFE. | | | Excess in Favour of Rural, over | | | |
|-------------------|----------------------|---------|---------|---------------------------------|-----------|-----------------|-----------|
| | | | | Town Districts. | | City Districts. | |
| | Rural. | Town. | City. | In Years. | Per Cent. | In Years. | Per Cent. |
| 20 | 45·3550 | 42·2742 | 40·0148 | 3·0808 | 6·790 | 5·3402 | 11·774 |
| 30 | 38·4073 | 34·5753 | 32·8603 | 3·8320 | 9·977 | 5·5470 | 14·442 |
| 40 | 30·9724 | 27·1530 | 26·0873 | 3·8194 | 12·331 | 4·8851 | 15·772 |
| 50 | 23·4700 | 19·9733 | 19·9271 | 3·4967 | 14·900 | 3·5429 | 15·100 |
| 60 | 16·6524 | 13·7608 | 13·7685 | 2·8916 | 17·364 | 2·8837 | 17·318 |
| 70 | 10·7124 | 8·7030 | 8·7636 | 2·2094 | 20·246 | 2·1488 | 19·691 |
| Total Excess..... | | | | 19·3299 | | 24·3479 | |

The next arrangement of this kind which will be brought under notice is the expectation of life as derived from the combination of all the data composing the three districts now referred to; and may be understood to represent the general value of male life as it exists among the members of the community composing Friendly Societies. Throughout the whole range of this table the expectation of life is found to be higher than among the male population of the country generally. A glance at the following table will show for the three districts the difference at the given periods of life:—

TABLE VIII.

| Age. | EXPECTATION IN | | Difference in Favour of the Three Districts. | |
|------|------------------|------------------|--|-----------|
| | Three Districts. | England & Wales. | In Years. | Per Cent. |
| 20 | 43·7736 | 40·6910 | 3·0826 | 7·575 |
| 30 | 36·6051 | 34·0990 | 2·5061 | 7·349 |
| 40 | 29·3306 | 27·4760 | 1·8546 | 6·750 |
| 50 | 22·1920 | 20·8463 | 1·3457 | 6·455 |
| 60 | 15·6942 | 14·5854 | 1·1088 | 7·602 |
| 70 | 10·2057 | 9·2176 | 0·9881 | 10·720 |

A very important distinction is here found to prevail between the value of life in the two tables. The circumstances in which the humble and working population of the country is placed, have generally been thought adverse to a prolonged duration of life: but the healthiest Life Tables hitherto formed have not shown any thing so favourable as the present results, even among what are generally considered the select classes of society:—

It may be well to be understood here, that the persons composing Friendly Societies are almost exclusively the hard-working members of the community, chiefly occupied in the drudgeries and toils of the mechanic arts, and consequently exposed to the inclemencies of seasons, excesses of temperature, impure atmospheres, constrained postures, and other conditions usually thought objectionable. Their incomes are very limited, affording but the scantiest and simplest means of support. Their habitations are of an inferior order, being of the cheapest kind, and consequently in the worst streets. The members of Friendly Societies are therefore generally placed in those circumstances which persons habituated to the luxuries of the upper ranks of society would regard as unfavourable to health and a superior duration of life. In making these remarks, however, it is necessary, as will hereafter be seen, to make a distinction between them and the great bulk of the poorer classes of the country. For an individual to remain a member of a Friendly Society, it is required that he should make his weekly or monthly contribution to its funds; and although a few pence is all that is needed, it presumes on a certain amount of frugality and industrial habit, sufficient to separate him from the reckless and improvident person, who is more openly exposed to the vicissitudes—poverty, distress, destitution, and disease—incidental to fluctuations in the demand for labour.

The superior value of life among the members of Friendly Societies is a very remarkable and important feature in this inquiry, and is a result that generally would not have been anticipated; and the question which naturally follows is, From what source or class does the excess of mortality, which makes up the general average of the community arise?

Those persons having transactions with the Assurance Companies belong, with a very few exceptions, either to the middle or the higher ranks of society; and if the value of life, as deduced from observations in those companies, be admitted as a correct measure for such classes, it will be found that their duration of life is not only less than among the members of Friendly Societies, but also less than in the country generally*.

It may be said, in reply to some of the preceding observations, that the superior value of life in the ranks of Friendly Societies, above the general community, is owing to the effects of selection; but a little reflection will show that the difference must be produced by other causes. Every reasonable means is adopted to test the lives admitted into Assurance Companies, and yet they appear to be of less value than the general average of the country; and Friendly Societies are known *not* to exercise the same degree of scrutiny. In both the interest of the applicant for admission is opposed to that of the Society; and, looking at the results, it is not unlikely that the vigilance of the one may be neutralized by the interests of the other. Another result brought out by the observations on the lives in Assurance Offices will show how inadequate the means of selection usually resorted to are to raise the standard of life above the average of the country. All other inquiries hitherto made on male and female life have tended to attach a greater value to the latter than to the former; but the results in the Assurance Companies have been reversed, showing that some other causes, beyond the method of selection, must have interfered to modify the state of health; for if the means of scrutiny had been adequate to determine the actual character and condition of health, the prevailing feature of each sex would have manifested itself, and the anomalous result of male life being of higher absolute value than female life would not have appeared.

Assurance Companies, it has been stated, are likely to have proposals most freely from among unhealthy persons for sums payable at death; but that proposals for annuities, or sums payable during life, will be made on the lives of the most healthy only; and that the private opinion of the individual being always brought to bear against the Company, the effects of selection under this aspect ought to prevent the results of such observations from being regarded as a true exponent of the value of life in the class of society generally to which those persons belong. There exists no published document, so far as Assurance Offices are concerned, to show whether this opinion is well founded: but there is evidence of the same kind,—of equal, or per-

* At p. 36 of the "Contributions," in Table H, No. 5, col. 2nd, the Expectation of Life is given as deduced from the aggregate observations of Assurance Companies, and includes both sexes; but col. 1st (Males & 1) of the same Table relates to Male Lives only, and is consequently that which should be brought into comparison with the results of this inquiry.

haps from its greater extent, of higher value, than any to be drawn from the Assurance Companies. The tables calculated by Mr. Finlaison, on the lives among the nominees of the Government tontines and annuity schemes, are here alluded to. The facts over which his observations extended possessed almost every advantage that could be desired; and, considering the acknowledged skill and care with which his computations were managed, the Government Table must be entitled to the highest confidence, and the expectation of life thence deduced regarded as the true measure of life in that particular class of society*.

From a comparison of these data, then, it follows that the male lives selected for the Government annuities are not only of less duration than those of the male population of the country generally, and also of less value than lives in Assurance Companies, but that they are actually of less value than those of the members of Friendly Societies in the City Districts. It is evident from these results, that the presumed power of the individual to judge of his own state of health has not shown the remarkable effects anticipated; there is more reason to believe that the natural inclination with which every person is led to look upon his life as good, will very much influence any power of discrimination on his own chances of longevity. It is, however, to be kept in view, that persons of decidedly bad health will rarely purchase annuities; and the exclusion of these has, no doubt, some effect in slightly raising the standard of the table. A similar observation is also to be made with respect to the applicants to Assurance Companies. There is a strong temptation for those in really bad, or at least in indifferent health, to offer themselves for assurance; and if all were admitted, no doubt a lower value would be expressed by the Tables. The known caution, however, usually exercised in these matters, and the medical talent brought to the aid of the offices, is a protection against the very worst lives of that class; about 23 per cent. of the applicants being the average number rejected.

Friendly Societies, although not equally solicitous, are still not without tests for the admission of members, and they possess one advantage over Assurance Companies; the members, and those likely to be candidates, are generally intimately known in their daily habits and ordinary health to each other; and where evidently bad health exists, admission is refused. A consideration of all that has been advanced will show that the greater vitality among members of Friendly Societies cannot be accounted for by the superior mode of selecting lives; for, if that argument were carried out to its full extent, it would go to prove that the other classes in question had, in that respect, the advantage. The blessing thus bestowed on the frugal and industrious workmen of the country composing Friendly Societies in having granted them, as appears by the present inquiry, a prolonged duration of life, must therefore be regarded as a really true and distinctive

* In the "Contributions," p. 37, a Table will be found (Table H, No. 6,) which has been recalculated from the facts given by Mr. Finlaison, at p. 67 of his Report on Life Annuities, in March, 1829—being the combined results of six different classes of observations on male lives. That usually quoted as the Expectation Table of the Government Annuitants, is the one calculated by Mr. Finlaison in 1825, and differs in some important particulars from his subsequent and revised data in 1829.

feature of that class of persons, and is, no doubt, the result of their simple and uniform habits of life, and the more regular and natural physical exercises to which they are habituated.

If the nature of the present paper led to a further investigation of this point, it could be clearly shown, by tracing the various classes of society in which there exists sufficient means of subsistence, beginning with the most humble, and passing on to the middle and upper classes, that a gradual deterioration in the duration of life takes place; and that just as life, with all its wealth, pomp, and magnificence, would seem to become more valuable and tempting, so are its opportunities and chances of enjoyment lessened. As far as the results of figures admit of judging, this condition would seem to flow directly from the luxurious and pampered style of living among the wealthier classes, whose artificial habits interfere with the nature and degree of those physical exercises which, in a simpler class of society, are accompanied with a long life.

Thus far, then, it is plain that the amount of life enjoyed by the middle and upper classes tends rather to depreciate than elevate the standard deduced from the general results of the country. And carrying this out still further, and viewing the value of life in the highest ranks of society,—namely, the peerage and baronetage,—as given in the recent and very interesting paper submitted by Dr. Guy, it will be seen that the expectation of life is not only less than in the general community, but also very much below the measure of life *among the members of Friendly Societies in the City Districts**. It may then be conclusively admitted, that the standard of life in the general community is not elevated in any way by the influence of the middle or upper classes. With regard to the very highest ranks, the opposite conclusion must be come to; but as the numbers of the nobility are relatively small, the inferior value of life there shown is not sufficient to account for the reduction of the scale for the general community so much below the average standard of all classes in Friendly Societies.

Hence it follows that the excess of mortality in the general community must fall on the residue of the people; and although at present there exists no direct means of measuring the precise value of life in that portion of the population, it is evident that an inferential one of equal importance is immediately available.

Admitting that the preceding tables form a correct representation of the value of life in the respective classes, it will be easy to arrive at the value of life in the remaining class; for—

Let Table A represent the rate of mortality in the general community, viz., over all England and Wales;

And let b = rate of mortality in one class, viz., Friendly Societies, and forming a part of A or included in it;—Also,

Let c = rate of mortality in a second class, viz., the middle and upper classes, and also included in A; then it is evident that

$A - (b + c)$ = the rate of mortality in the remaining class composing the community. This latter class includes the improvident and reckless, the poor and the destitute, who are exposed to the inclemen-

* The Expectation of Life in the Peerage will be found at p. 36 of the "Contributions," in Table H No. 3.

cies of the seasons, the fluctuations of trade, and fall victims to epidemical and other diseases. Subsequent illustrations will more clearly establish this fact, when the question of large towns or cities is brought under consideration.

In making the preceding comparisons of the mortality of the Rural, Town, and City Districts respectively, with the average results for the whole population of England and Wales, no further corrections of the figures than those described were needed; but before bringing the table representing the combined results of the three districts into comparison with the mortality of the whole population of the country, it would have been important to be enabled to apply a further correction to the elementary data.

If R, T, and C, represent the population over which the observations extend, for the Rural, Town, and City Districts respectively, and

r , t , and c , represent the number of deaths in the same population for the respective districts at each period of life;

then the mortality per cent., and consequently all subsequent results, for the average of the three districts, or rather the three districts combined, is derived from—

$$\frac{(r + t + c) \cdot 100}{R + T + C}$$

This is the usual mode by which general averages for various classes of lives have been hitherto determined; but it is evident that unless R, T, and C, bear the same ratio to each other which the whole population of the districts they represent do to each other, the average results cannot be true.

This fact may be rendered more intelligible by the following hypothetical illustration. Suppose at any given age the population over which the actual observations extend was 100 for each of the three districts, viz:—

| | | | |
|--------------|-----------------|---------------|-------|
| For District | R = 100 | Annual Deaths | 2 |
| „ | T = 100 | „ | 3 |
| „ | C = 100 | „ | 4 |
| | <hr/> | | <hr/> |
| | R + T + C = 300 | „ | 9 |

then the average result thus derived would show a mortality of 3 per cent.; but if the whole population of those districts had been to each other in any other relation than an equality of numbers—say 100, 50, and 25—then the number of deaths would have become 2, 1.5, and 1 respectively: consequently the correct average mortality would have been 2.571 per cent., instead of 3 per cent.

The following mode of obtaining a correct average has also been suggested, but it is obvious that it would involve errors of a more serious nature than the common method employed.

$$\frac{\frac{r \cdot 100}{R} + \frac{t \cdot 100}{T} + \frac{c \cdot 100}{C}}{3}$$

A single illustration will be adequate to point out the fallacies of this.

At Age 40—45 the actual mortality of the Rural Districts is .8361 per cent.

| | | | | |
|---|---|----------------|--------|---|
| " | " | Town Districts | 1.0637 | " |
| " | " | City Districts | 1.6084 | " |

| | |
|----------------------------|--------|
| Average for the three..... | 1.1694 |
|----------------------------|--------|

But supposing the actual population of the whole of each district at that age was in the ratio of 82763, 34220 and 25428, which are the actual numbers at this term of life, then the correct average mortality of the whole kingdom would be 1.0287 per cent.
but the above result was 1.1694 ,,

| | |
|------------|----------|
| Difference | . 0.1407 |
|------------|----------|

Or an error on the amount of the true result of 13.7766 ,,

Although Table VIII., for all the districts combined, is a correct measure of the average mortality of Friendly Societies in England and Wales, being deduced from the actual numbers in those districts, and in this respect perfect for the purposes of Friendly Societies; yet, unless the numbers representing, at particular years of age, each of the three districts bear the same ratio to the combined districts of that table, at the same ages which the actual population of the country in each of these districts has to the whole population of the country at those ages, corrections would be required for purposes of comparison with the general mortality of the kingdom. But for the same reasons that the corrections suggested would improve the table for comparison with the general mortality of the country, would they also injure the results for the purpose of Friendly Societies. It would, therefore, be better to have the facts under both forms.

As stated in the early part of this paper, if the districts of the Census Commissioners and Registrar-General had been coincident or conterminous, the labour of determining the population at each term of life for the three corresponding districts would have been well repaid.

As already stated, these observations do not in any way affect the rates of mortality as represented in any one district, but affect the combined results for the three districts only. So far as any individual district is concerned, or the comparison of one district with another, or with the general mortality for the whole kingdom, those objections do not apply, for in respect of locality simple elements only enter into the data of each district.

To some it may appear that too much importance has been given to the nature of this error; but as it so constantly enters, under some aspect or other, into nearly all inquiries into Vital Statistics, frequently producing errors of considerable magnitude, it has been deemed necessary to allude to it at length.

The distinction between the rates of mortality in the three districts has been already pointed out; and so far as a single expression of the value of life among those classes, in given districts, is required, nothing more is needed; and the difference between the tables will show the relative value of life in the given districts. Hitherto it has been thought sufficient to rest at this stage in all inquiries into the influence of locality on the duration of life, and to assign the difference thus

appearing in the value of life between the respective districts to the peculiar influence of town or city life. Other causes than locality will, however, be shown to influence the duration of life.

If the data composing the facts presented in the preceding tables be analysed, so as to distinguish one employment from another, it will be found that some occupations are much more healthy than others. The first evidence of this to be brought forward will be confined to the rural districts. From a table* which represents the mortality of labourers in the rural districts, being chiefly agricultural labourers, it appears that a much higher specific intensity prevails up to the age of 80 than among men following all employments in the rural districts. The specific intensity of labourers, however, decreases in a gradual and regular series from the youngest ages in the table, following the rule of the general results of the other districts, and not presenting the apparent anomaly of the general results for the rural districts by showing an increasing specific intensity from twenty to thirty-one years of age. It will be found that the specific intensity for the total inhabitants of rural districts—

At Age 20 is as high as at Age 41 for Labourers.

| | | |
|----|----|---|
| 30 | 41 | „ |
| 40 | 44 | „ |
| 50 | 54 | „ |
| 60 | 64 | „ |
| 70 | 72 | „ |

The population in Rural Districts (all classes) was shown to be bisected at ages 68-9, while among the labourers that will be seen to take place at ages 71-2. The sum of the series of differences of the points of equal specific intensity between the Rural, Town, and City Districts respectively, and the male inhabitants of England and Wales were shown to be 55, 23, and 5; but the sum of the same order of differences for labourers is 78; so that the difference between labourers and the general results for the Rural Districts is more than equivalent to the mean difference between Towns and Cities and the Rural Districts. It will also be seen that the sum of the series of differences of the points of equal specific intensity in the Rural Districts generally, and the labourers, is 46, being above the mean of 55 and 23.

The difference for the equation of life to

Age 10, between Rural and Town Districts, is 4 years.

| | | | | | |
|-----|---|---------------------|---|---|---|
| „ | „ | Town and City | „ | 3 | „ |
| and | „ | Labourers and Rural | „ | 3 | „ |

So that, in this general way of viewing the question, employment produces as wide a distinction as locality†.

It further appears, that the expectation of life among labourers in the Rural Districts exceeds the expectation of the Rural Districts generally throughout the whole term of life. At decennial ages the following is the relative value of life.

* This Table will be found at p. 43 of the "Contributions."

† See Table J, "Contributions," p. 50.

TABLE IX.

| Age. | Rural Districts. | | Difference in Favour of Labourers. | |
|------|------------------------|------------------|------------------------------------|-----------|
| | General Results. G. | Labourers. J. | In Years. | Per Cent. |
| 20 | 45.3550 | 47.9063 | 2.5513 | 5.6251 |
| 30 | 38.4073 | 40.5972 | 2.1899 | 5.7017 |
| 40 | 30.9724 | 32.7693 | 1.7969 | 5.8016 |
| 50 | 23.4700 | 25.0745 | 1.6045 | 6.8500 |
| 60 | 16.6524 | 17.8205 | 1.1681 | 7.8146 |
| 70 | 10.9124 | 11.3498 | 0.4374 | 4.0072 |

The preceding arrangements, however, do not show the full influence of employment on health, or rather that of an individual employment on health; for, in making comparisons of classes with any standard, that standard ought not to include the class held in comparison, but be the residue left by abstracting that class from the general results; otherwise the effect of that class, in changing the integral expression, will not be seen to its full extent, and the concealment of the real difference will be the greater in proportion to the high ratio which the numbers of the class compared bear to the total numbers. For example:—

Let $a = 20$ per cent. and represent the total results or general average; and

„ $b = 25$ } per cent. and represent classes composing the general
 „ $c = 15$ } average A;

Then, if either class b or class c were compared with the total result or general average, the apparent difference would be only 5 per cent.; while the actual difference between it and the residue class is 10 per cent. Hence, if any class of results be compared with the general results in which that is also included, the apparent difference will always be less than the actual difference, whether the effect of that class be to increase or decrease the ratio of the general results.

The class labourers has, therefore, been eliminated from the general results for the Rural Districts, and the residue formed into another Life Table*, and it will be found that the specific intensity for the Rural Districts generally is as high

At Age 20 as at Age 16 for the Residue.

| | | |
|------|------|---|
| „ 30 | „ 16 | „ |
| „ 40 | „ 35 | „ |
| „ 50 | „ 48 | „ |
| „ 60 | „ 58 | „ |
| „ 70 | „ 69 | „ |

The corresponding points of equal specific intensity for the residue at

Age 20 is as high as Age 52 for Labourers.

| | | |
|------|------|---|
| „ 30 | „ 44 | „ |
| „ 40 | „ 48 | „ |
| „ 50 | „ 55 | „ |
| „ 60 | „ 65 | „ |
| „ 70 | „ 72 | „ |

* See Table I., No. 1, p. 43, and Table I., No. 6, p. 48, in "Contributions."

Half the population dies off at age 65-66 in the residue, at age 68-9 in the general average, and at age 71-2 in the labourers.

The great distinction between the value of life among the labouring population in the Rural Districts, and the rest of the Rural Districts, is therefore obvious; and conclusively shows, that even in the same locality, in the rural districts of the country, where all the supposed contaminating influences of ill-ventilated houses, narrow streets, bad sewerage, poisoned air, epidemic town fevers, and factory restraints, are absent, there is nevertheless a very great superiority in the value of life in one class over another. In the Rural Districts recited in the early part of this paper, very little difference can be supposed to exist between the means of support and the various habits of life of the members of Friendly Societies. In fact, they may be presumed to assimilate as near to each other's condition as any means of classification can suggest, the only difference between the individual members being difference of employment or occupation; and therefore, in classifying the various trades, pure elements may be said to be brought into comparison, the only distinction being difference of occupation.

It has already been stated that anything like a complete inquiry into the influence of employment on health is not contemplated in this paper. A few illustrations only will be brought forward to aid the other branch of the inquiry, and by which it will be seen that, independently of locality, difference of employment has a marked effect on the duration of life.

If this position can be fairly established, it will follow as a direct consequence, that wherever an excess of unhealthy trades are congregated, there must also be an increased rate of mortality independent of the local influence; for if the same trades were placed in any other district, there would still be an increased rate of mortality simply in virtue of the trade or occupation.

At ages 30-35, the general mortality of the Town Districts exceeds that of the Rural by 14·981 per cent. of the whole mortality at that period of life; but if the class designated labourers were abstracted from the Rural Districts, the mortality of the residue would be increased 6·181 per cent. of the original ratio. But suppose a still further change to take place, and that the class named labourers is not only abstracted from the Rural Districts, but added to the Town Districts; this arrangement would affect the respective mortalities to such an extent, that instead of the mortality of the Town Districts exceeding that of the Rural Districts by 14·981 per cent., it would fall short of it by 1·831 per cent. of the whole mortality at that period of life. In like manner also would other periods of life be affected. It is evident, therefore, that the residue of the population in the Rural Districts has a factitious value assigned to it, from being mixed up with the class called labourers; and that in any attempt to discover the relative values of life in different localities, unless employment were made an element in the comparison, an undue value would be attached to a great portion of life in the Rural Districts. The nature of the Rural Districts is such, that a great proportion of the upgrown population must consist of agricultural and other labourers. In the facts here collected, they amount to 33 per cent.; and their lives being of higher value than the average lives in the district, it is no more fair

to judge of the value of life and the influence of locality on the residue of the population from calculations involving the consideration of all the lives generally, than it would be just to compare the value of life in the residue in the preceding illustration with town life, and draw the conclusion that life in the rural districts was of less value than in the town districts; for in both cases a factitious value is assigned, by being mixed up with a favourable class.

From the preceding remarks it is evident that in particular occupations, even in the Rural Districts, life is of less value than in others. Those occupations cannot be said to be less healthy from the objectionable features peculiar to large towns and cities, for they must be supposed under very favourable circumstances for prolonged life. From a table presenting the expectation of life in sixteen trades* in the Rural Districts, selected at random, without any previous knowledge as to whether they were healthy or otherwise†; it appears that the value of life is less than the average for the whole Rural Districts; and labourers were before shown to be more healthy than the average results. It is therefore clear, that if a given district were chiefly made up of the class whose lives are above the average value, or of those below it, that the general results for that district would be of high or low value accordingly.

A very small portion of the population in either the Town or City Districts can follow agricultural pursuits; and therefore the standard of life in those districts will be lowered in consequence of that circumstance alone; but on further examination it will be found that the comparative value of life in those districts is not only lowered in consequence of the absence of many of the most healthy occupations common to the Rural Districts, but that it is still further decreased by the presence of some of the most unhealthy employments, not to be found, or at least to a very limited extent, in the Rural Districts. In other words, the effect of the occupations is such, that if the same people were placed in the Rural Districts, no matter over how much surface they were spread, in order to avoid the influence supposed to connect itself with the congregation of large numbers into towns, still the mortality would be much higher among the people thus conditioned, than among the average of the rural population in ordinary circumstances.

If the view brought forward be correct, that the mortality of towns and cities is increased from the existence of a high proportion of trades which are in themselves unhealthy, independent of the influence of the locality, it should follow that the difference found by a comparison of the rate of mortality of a given number of trades in one district, with that of the same trades in another district, should be less than the difference between the rates of mortality for the general results of the same districts. If the differences of the decennial periods from 10 to 70 in the general results for rural and town districts be taken, the sum of the differences will be found to amount to 19·3299 years; but

* Table H, No. 4, p. 37, "Contributions."

† Namely, plumbers, painters and glaziers, weavers, butchers, millwrights, stonemasons, cabinet-makers, printers, bakers, bricklayers, wheelwrights, tailors, cordwainers and shoemakers, sawyers, clerks, carpenters and joiners, and blacksmiths.

the sum of the differences at the corresponding periods for the 16 trades formerly referred to is only 16·3868 years; being less than the other by about 15 per cent. For a like reason it should follow, that if the differences at the same periods between the 16 trades and the general results of each district be taken, they should amount to less in the town than in the rural districts; and accordingly in the rural districts the sum of the differences is found to be 4·7029 years, while in the town districts it is only 1·7598 years.

In order to afford still further evidence of the effect produced on the average value of life by the prevalence of particular trades, a few other cases will be submitted; and to render the illustrations more simple, they will be given for the average of the three districts, or rather the three districts conjoined; and consequently they must be brought into comparison with the general results for the three districts.

The equation of life in miners is at ages 61-2; in bakers, at ages 59-60; plumbers, painters, and glaziers, at 56-7; and clerks at so early a period of life as 51-2*. For the three districts combined, the same result appeared at ages 66-7, showing a difference of 5, 7, 10, and 15 years respectively; and the following table will show the marked difference in the expectation of life in these employments at five decennial periods.

TABLE X†.

| Ages. | Rural, Town, & City Districts. G. | Clerks. J, No. 2. | Plumbers, Painters, and Glaziers. J, No. 3. | Bakers. J, No. 4. | Miners. J, No. 5. |
|-------|---|----------------------|--|----------------------|----------------------|
| 20 | 43·7736 | 31·8347 | 36·9040 | 40·0268 | 40·6700 |
| 30 | 36·6051 | 27·5761 | 30·5082 | 32·3572 | 33·1573 |
| 40 | 29·3306 | 21·8573 | 24·3046 | 24·4756 | 24·9204 |
| 50 | 22·1920 | 16·0465 | 17·0955 | 19·0910 | 17·5346 |
| 60 | 15·6942 | 12·4264 | 12·1675 | 14·0632 | 11·8590 |

The very remarkable difference between the above employments and the general results, cannot fail to occasion some surprise; and at the same time conclusively prove, that any district containing a majority of the above, or other equally unhealthy employments, must show a very reduced average value of life for the district, independent of the influence of the local situation itself on health.

It will no doubt cause some uneasiness in the minds of inquirers to find, that so highly important and industrious a class of men as clerks should stand lowest in the scale of the above employments; and that from 20 to 60 their expectation of life should be only 75 per cent. of the general average. The expectation of life among plumbers, painters, and glaziers in the same period is equal to 81 per cent., miners 85 per cent., and bakers 88 per cent. of the general average.

Plumbers, painters, and glaziers will be found next in the scale; and although much below the general average, they are still of considerably higher value than the class designated clerks.

* See Table I, p. 43, "Contributions."

† An abridgement of Table J, p. 50, "Contributions."

Bakers, as well as the preceding class, have long been supposed to be unhealthy: and although no attempt had hitherto been made to ascertain the precise value of their lives, it is thought that the present results will show a much greater difference than would be generally calculated upon. The class miners will be found to rank above the three others at the early periods of life, but below them at the latter periods of life.

The remark formerly made should be here kept clearly in view, that the difference found by a comparison of any class with the general results will always be less than the actual difference; and therefore the effect which the preceding and other unhealthy employments have in reducing the average rate of mortality, is still greater than what appears by the preceding table.

Some large towns or cities are known to represent a less value of life to their inhabitants generally than other towns; and the explanation usually given of this difference has been the favourable or unfavourable nature of the locality, and a change in the sanitary regulations of the place looked forward to as a certain remedy; but a minute examination of all the external circumstances affecting life will show that the great diversity in the mortality of certain classes arises from the influence of other agents. Thus if we compare the expectation of life calculated from the combined data of all trades in Liverpool, with the general results for the Rural Districts, we obtain a much greater difference due to locality in the apparent sense, than has hitherto been shown by any other tables of the value of life in different localities; but at the same time it will be seen that this difference falls much short of the actual difference between different employments. At age 30 the difference between the expectation of life in the Rural Districts and in Liverpool is 8.2636 years; but the difference between clerks and labourers is 13.0211 years; and so also at other periods of life. It ought to be understood, that in making this comparison, the influence of employment is shown to disadvantage; for as has been already pointed out, every large town has its average lowered by the influence of certain trades; and therefore the actual difference in the above comparison between the Rural Districts and Liverpool is less than there given: and again, in the comparison between clerks and labourers, the expectation for clerks has been for the average of the three districts; but if it had been taken for the City Districts only, a much greater difference would have been found, and consequently the influence of employments would have appeared the greater*.

In the town of Liverpool there is a uniform decrease in the specific intensity of life from the commencement to the end of life; thus, the specific intensities at ages 30, 40, and 50, correspond with the specific intensities at ages 45, 54, and 63 in the Rural Districts; ages 38, 49, and 57 in the towns; ages 29, 42, and 59 in the cities; and at ages 39, 51, and 61 in the three districts combined. Half the population dies off between the ages 58-9,—an earlier period than in the City Districts by three years.

Again, the expectation of life for all trades in Liverpool† will be

* Table K, No 2, of the "Contributions," p. 58.

† See Table H, No. 2, p. 36, of the "Contributions."

found to be lower than the expectation for the City Districts generally*. The following shows the difference at decennial periods of life.

TABLE XI.

| | Ages. | City Districts. | Liverpool. | Difference. |
|--|-------|-----------------|------------|-------------|
| | 20 | 40·0148 | 37·9553 | 2·0595 |
| | 30 | 32·8603 | 30·1437 | 2·7166 |
| | 40 | 26·0873 | 23·1524 | 2·9349 |
| | 50 | 19·9271 | 17·0946 | 2·8325 |
| | 60 | 13·7685 | 11·9626 | 1·8059 |

So far as a general inspection of the above results would suffice, it might be inferred that Liverpool is less healthy than the average of the large cities in England; but it is necessary here again to keep in view the peculiar aggregation of employments which are in themselves unhealthy, independent of the locality; for it so happens, that the class of labourers in large cities is subject to a very high rate of mortality, and that the peculiar business of Liverpool occasions a great preponderance of that class in the dock, and other employments of that kind, a large proportion of which enters into the above results.

It has been already shown for the three districts, that the expectation of life for members of Friendly Societies over the country generally, is higher than that for the whole population of England and Wales. In like manner it will also be found, that the expectation of life among the members of Friendly Societies in Liverpool is also higher than the expectation for the general population of Liverpool.

At page xxvii. of the 5th Report of the Registrar-General will be found a Table of the Expectation of Life for the town of Liverpool; and assuming that it gives a correct representation of the value of life of the whole population, we shall find the comparative value of life between the members of Friendly Societies and the general population in the following Table:—

TABLE XII.

| Age. | Expectation of Life in Liverpool. | | Difference in Favour of Friendly Societies in Liverpool. | |
|------|-----------------------------------|-------------------|--|-----------|
| | Friendly Societies. | Whole Population. | In Years. | Per Cent. |
| 20 | 37·9553 | 33·0000 | 4·9553 | 15·0160 |
| 25 | 33·9067 | 30·0000 | 3·9067 | 13·0223 |
| 30 | 30·1437 | 27·0000 | 3·1437 | 11·6433 |
| 35 | 26·5260 | 23·0000 | 3·5260 | 15·3303 |
| 40 | 23·1524 | 21·0000 | 2·1524 | 10·2500 |
| 45 | 19·9908 | 18·0000 | 1·9908 | 11·0600 |
| 50 | 17·0946 | 16·0000 | 1·0946 | 5·6922 |

A careful consideration of all the preceding observations, it is believed, will be sufficient to show that the excessive mortality of the

* See Table G, p. 32, of the "Contributions."

general population of Liverpool must be due to some other cause than simply that of locality. The persons over whom the observations in the first column extend, being members of Friendly Societies, and almost exclusively workmen and mechanics, of necessity inhabit the inferior class of houses, in the worst conditioned streets; and it is therefore impossible that they can escape the contagious effect of the pestilential diseases supposed to be the scourge of unhealthy neighbourhoods: and admitting this, the results given for the Friendly Societies must evidence all the legitimate effects due to locality; and therefore the excessive mortality of the general population is due to some other cause—such as the poverty and distress which, unhappily, are allowed to remain so much neglected in the large manufacturing and commercial towns of the kingdom. If any part of this argument were to be met by the statement, that the higher expectation of life given for the members of Friendly Societies in Liverpool than for the general community, may be accounted for by the omission of some very unhealthy trades; this would be sufficiently answered by the fact, that 175 employments are included, and, as has been already shown, some of them the most unhealthy occupations; so that a fair average may be said to be taken. A similar objection might also seem to apply against the general results for the whole kingdom; but if it is recollected that upwards of 400 trades are included, the force of the objection will disappear.

It is evident from all that has been said, that the peculiar sanitary condition of large towns has not the remarkable effect which many have supposed in shortening the duration of life; still, it has some effect, and the nature and extent of that influence it is important to understand. But a rude estimate only can be made, until the value of life in every important employment, occupation, or trade has been investigated, for the various localities or districts, on some such plan as that given in the present paper; and then grouping or classifying a given number of these common to different localities; the result arrived at would show the precise amount of influence which a particular district, city, or town, has on the duration of life. A partial or limited comparison of a few trades would not be adequate to answer definitely this question, but an accurate combination of a sufficiently large number of trades would be necessary to guard against the effect of fluctuation.

At the beginning of this paper it was stated, that to carry out the question in this extended degree, was a task of too imposing a nature on the present occasion; and that such illustrations only would be brought forward, as would be necessary to solve the more immediate question.

On the general mortality of large towns especially, little confidence should be placed, even although every other precaution as to distinction of age and other conditions be taken; for fallacies from two sources are apt to enter:—First, if, in comparisons of large towns, precisely the same classes of trades do not exist, errors will arise from that circumstance;—and in the second place, although the same classes of trades do exist in both places, unless the proportionate numbers to the whole population be the same, errors in the result must arise. The nature of the error in the first case is plain, from the fact that different

trades are in the same place influenced by different rates of mortality; and if any given trade is wanting, its tendency to alter the general average will be lost. The error in the second case is of a like nature; for if the absence of the whole class affect the general result, the absence of a fraction of that class must also affect it, although not to the same extent. Illustrations confirmatory of this have already been given when discussing the influence of the class of labourers, and also of the sixteen trades combined, on the general averages for the respective districts; and a recurrence to those illustrations will be sufficient to show the truth of the present observations.

The next part of the inquiry on which I propose to enter is the rate of mortality for female life among the members of Friendly Societies in England and Wales, for the Rural, Town, and City Districts combined*. Male and female life in this class seems to stand, in many respects, in the same relation as male and female life generally in England and Wales; the specific intensities at the earlier periods being higher for male than female life, crossing each other at the middle periods, and turning in favour of female life at the advanced ages. The male population for the three districts is bisected at 66-7, and the female population at the same period of life. In the general population of the country the same thing takes place a year later among females than among males.

The following abstract will show the relative value of male and female life in the country generally, as well as in Friendly Societies†:—

TABLE XIII.

| Age. | Expectation of Life in England and Wales. | | | Expectation of Life among the Members of Friendly Societies. | | |
|------|---|----------|-------------|--|----------|-------------|
| | Males. | Females. | Difference. | Males. | Females. | Difference. |
| 20 | 40·6910 | 41·5982 | ·9072 | 43·7736 | 45·2640 | 1·4904 |
| 30 | 34·0990 | 35·1671 | 1·0681 | 36·6051 | 38·1841 | 1·5790 |
| 40 | 27·4760 | 28·7330 | 1·2570 | 29·3306 | 30·7813 | 1·4507 |
| 50 | 20·8463 | 22·0545 | 1·2082 | 22·1920 | 23·8200 | 1·6280 |
| 60 | 14·5854 | 15·5230 | ·9396 | 15·6942 | 17·2380 | 1·5438 |
| 70 | 9·2176 | 9·8409 | ·9376 | 10·2057 | 10·9750 | ·7693 |

It will thus be seen, that the distinction between male and female life among the members of Friendly Societies, differs very little from that between the sexes in the country generally; and this difference would be considerably reduced if the necessary corrections for employments were made, as the data for male life in Friendly Societies will be composed of a much higher proportion of unhealthy trades, in relation to the whole male population of the country, than the data for female life in comparison to the whole female population. This coincidence of course tends to strengthen the confidence to be reposed in both classes of results, and brings forward an additional argument

* See Table K, No. 1, p. 57, of the "Contributions."

† See Table H, No. 1, p. 36, of the "Contributions."

against the sufficiency of certain inquiries hitherto made, showing in some instances so wide a distinction between the value of life in the sexes.

3. *Duration of Life in Scotland.*

A separate set of returns was procured from Societies in Scotland, and the facts embodied in them have been combined into a distinct class of tables, to which reference will be presently made. The results thus derived will be of the more importance, as serving to confirm those obtained from the English Societies; and their value in this respect is enhanced by the fact, that the Scotch returns extend over a period of twelve years, while those by the English Societies were limited to five years. The Scotch returns were also made under quite different circumstances from those of the English, and they thus act as checks on each other. The nature and extent of the original form in which the information was furnished by the returns from Scotland, have already been referred to.

The principal comparative results may be thus expressed. In the Rural Districts of Scotland the specific intensity increases in a uniform ratio, from the earliest age to the extreme of life. A comparison with the Rural Districts of England shows a higher specific intensity in the Rural Districts of Scotland till age 34; but from that till age 54 it is lower in Scotland, and from 54 to the end of the tables the specific intensity is sometimes higher and sometimes lower. A more general and comprehensive view of the value of life in the two countries will be obtained by comparing the equation of life: for age 10 it takes place between the ages 67-8 in the Rural Districts in Scotland, but between ages 68-9 in England. Again the equation for age 30 takes place in both countries between 70 and 71. Considering the different sources from which the data of the two Tables are derived, and the different periods of years over which the observations extend, the agreement in this respect is somewhat remarkable*.

In the Town Districts of Scotland, half the population dies off at the ages of 65-6; but in the Town Districts in England the same thing takes place a year earlier. It is in the City Districts of Scotland that the most marked difference is found; but when it is recollected that the only places included in the list of Scotch cities are Edinburgh, Glasgow, Paisley, and Aberdeen, and that the observations relate chiefly to the three first-named places, it will in some measure account for the very high rate of mortality. In the City Districts of Scotland there is a much lower specific intensity up to age 60, than even for Liverpool; but from that age to 80 it is higher than in Liverpool. In the City Districts for Scotland, half the population dies off between the ages of 53-4, being eight years earlier than in the City Districts of England, and five years sooner than in Liverpool, and in fact coming very close on the very worst class of results in England—namely, clerks, in which half the population was cut off at ages 51-2. But as the numbers over which the observations extend in the City Districts

* The results for the Scotch Societies will be found in Tables L, M, and N, "Contributions," pp. 64, 73, 77. The places forming the respective districts in Scotland will be found in the Appendix, Note III.

of Scotland are limited, less confidence might reasonably be placed in the results, and the excessive mortality in part assigned to the fluctuation to which small numbers are subject.

On examination, however, of the various groups of results making up the whole class for the City Districts, they were, without exception, found subject to a high rate of mortality, thus evidencing an absolute higher mortality than in the average of English cities.

The results for the three districts combined, show a less specific intensity than in England up to age 66; and from that age upwards, the figures cross each other. In the general results for Scotland, half of the population dies off between ages 64-65; but in the general results for England, that event is prolonged two years beyond that period.

Looking next to the expectation of life*, it will be found that in the Rural Districts of Scotland it is less than in England by about half a year, from ages 20 to 75; but the Town Districts of Scotland give a higher expectation than in England till beyond 70 years of age, and the City Districts of Scotland show a lower expectation of life than Liverpool up till about 50 years of age. In order to admit of better comparison, the general results for the three districts in Scotland and England will be arranged as follows for decennial ages:—

TABLE XIV.

| Age. | Expectation of Life in Friendly Societies in | | Difference in Favour of England in Years. |
|------|--|----------|---|
| | Scotland. | England. | |
| 20 | 42·7218 | 43·7736 | 1·0518 |
| 30 | 35·6512 | 36·6051 | 0·9539 |
| 40 | 28·6565 | 29·3306 | 0·6741 |
| 50 | 21·8122 | 22·1920 | 0·3798 |
| 60 | 15·0184 | 15·6942 | 0·6758 |
| 70 | 10·4296 | 10·2057 | 0·2239 |

It will be thus seen that the Rural Districts of the two countries have shown the nearest approximation; and this is precisely what would have been anticipated from a careful consideration of the elements entering into the formation of the respective Tables. In the Rural Districts of all countries, the condition of the population, as to occupation and employment, is more nearly the same than in the Town or City Districts; and since employment has been shown to have so important an effect on the duration of life, the rates of mortality should differ less in the Rural Districts, where less diversity of employment exists. Before, however, fixing definitely on the Scotch cities so high a rate of mortality, it should be kept in view that one very important element of the investigation has not yet been touched upon. In considering the condition of the English cities, it was shown how an accidental combination of certain trades would produce a very different result from the fair average of the general population; so also, in the present comparison of the Scotch with the English cities,

* Table N of the "Contributions," p. 77.

may an excess of particular trades, not common to both districts, or not existing in both districts in the same ratio, modify the results. The inquiry will therefore not be complete till similar trades in both districts be compared. To enter further, however, into that question would, as already stated, be to go beyond the limits assigned to this paper.

But as some curiosity may naturally be excited by the marked difference in the value of life, as shown in the preceding table, between the Scotch and English cities, it has been thought of sufficient importance to form Mortality Tables for the general population of the city of Glasgow, in order to compare the results with English cities.

These Tables have been formed exactly in the same manner as Tables I. and II. It is therefore not necessary to enter further into that part of the question, than to state that the bases of the Tables are the Mortality Bills for the City of Glasgow for the ten years 1832-1841, and the population as enumerated in 1831 and 1841.

Of the male population of Glasgow alive at age 10, one-half is cut off between the ages 48-9, which is

| | |
|----------|--|
| 20 years | earlier than among Friendly Societies in the Rural Districts of England. |
| 19 | " " " " Scotland. |
| 17 | " " " " Town Districts of Scotland. |
| 16 | " " " " England. |
| 13 | " " " " City Districts of England. |
| 5 | " " " " Scotland. |
| 3 | " " " " Clerks, which was the worst class of results formerly arrived at*. |

TABLE XV.

Population of Glasgow for 1831 and 1841; with the Annual Rate of Increase during the intermediate period.

| Age. | MALES. | | | FEMALES. | | |
|-----------------|------------------|------------------|--------------------------|------------------|------------------|--------------------------|
| | Population 1831. | Population 1841. | Annual Rate of Increase. | Population 1831. | Population 1841. | Annual Rate of Increase. |
| Under 5 | 15,422 | 17,840 | 1·01467 | 14,855 | 17,544 | 1·01677 |
| 5 — 10 | 13,127 | 14,552 | 1·01035 | 12,580 | 14,837 | 1·01664 |
| 10 — 15 | 10,491 | 14,252 | 1·03111 | 10,720 | 14,541 | 1·03092 |
| 15 — 20 | 8,489 | 13,677 | 1·04882 | 12,256 | 16,931 | 1·03281 |
| 20 — 30 | 15,177 | 28,304 | 1·06430 | 23,008 | 32,778 | 1·03602 |
| 30 — 40 | 12,179 | 18,890 | 1·04487 | 14,240 | 20,706 | 1·03814 |
| 40 — 50 | 8,685 | 12,047 | 1·03326 | 9,329 | 12,804 | 1·03220 |
| 50 — 60 | 5,549 | 5,991 | 1·00771 | 6,099 | 7,034 | 1·01436 |
| 60 — 70 | 3,228 | 3,364 | 1·00413 | 3,692 | 4,462 | 1·01911 |
| 70 — 80 | 1,090 | 1,282 | 1·01630 | 1,502 | 1,720 | 1·01365 |
| 80 — 90 | 260 | 256 | —1·00140 | 385 | 447 | 1·01517 |
| 90 — 100 | 26 | 22 | —1·01670 | 32 | 41 | 1·02527 |
| 100 and upwards | 1 | 1 | 1·00000 | 4 | 1 | —1·14855 |
| Total | 93,724 | 130,478 | 1·03364 | 108,702 | 143,846 | 1·02641 |

If the nature of this paper led to a more extended review of all the facts presented many remarkable coincidences would be seen to

* See Table Q, p. 80 of the "Contributions."

have taken place, and one among these must be already obvious. The general results for Friendly Societies in England and Wales were found to be more favourable to life than the results for the whole population of England and Wales, and that in both sexes; so, also, were the results for the members of Friendly Societies in Liverpool more favourable than those for the whole population of Liverpool; and here it will likewise be seen that the mortality of the general population of Glasgow is greater than among the members of Friendly Societies in the City Districts of Scotland.

TABLE XVI.

GLASGOW—Total of the Population as calculated for the 30th of June in each of the Years 1832—1841, inclusive; with the Sum of the Deaths for the corresponding years, as given in the Mortality Bills; and the Mortality per cent. during the same period.

| Age. | MALES. | | | FEMALES. | | |
|-----------------|-------------|---------|-------------------------|-------------|---------|-------------------------|
| | Population. | Deaths. | Mortality. per Cent. | Population. | Deaths. | Mortality. per Cent. |
| Under 5 | 167,389 | 18,846 | 10·6613 | 163,155 | 16,304 | 9·9929 |
| 5 — 10 | 139,087 | 2,331 | 1·6759 | 138,056 | 2,134 | 1·5457 |
| 10 — 15 | 127,201 | 989 | ·7775 | 127,512 | 973 | ·7630 |
| 15 — 20 | 111,753 | 1,209 | 1·0818 | 147,340 | 1,147 | ·7777 |
| 20 — 30 | 218,158 | 3,211 | 1·4718 | 281,626 | 3,292 | 1·1689 |
| 30 — 40 | 156,737 | 3,336 | 2·1284 | 176,405 | 3,228 | 1·8300 |
| 40 — 50 | 104,660 | 3,276 | 3·1301 | 111,731 | 3,001 | 2·6859 |
| 50 — 60 | 57,928 | 2,552 | 4·4054 | 66,086 | 2,628 | 3·9766 |
| 60 — 70 | 33,033 | 2,564 | 7·7619 | 41,084 | 2,651 | 6·4526 |
| 70 — 80 | 11,942 | 1,956 | 16·3791 | 16,212 | 2,244 | 13·8416 |
| 80 — 90 | 2,580 | 780 | 30·2325 | 4,190 | 1,012 | 24·1527 |
| 90 — 100 | 238 | 92 | 38·6554 | 368 | 155 | 42·1196 |
| 100 and upwards | 10 | 9 | 90·0000 | 19 | 15 | 78·9476 |
| Total | 1,130,716 | 41,151 | 3·6393 | 1,273,784 | 38,784 | 3·0447 |

The difference between the equation for age 10 in male and female life for the whole population of Glasgow is 3·125 years, while in the general population of England and Wales it is a little above one year. This suggests the mention of another feature which presents itself in this inquiry. It appears that the higher the absolute value of life in any class of results, the less distinction will there be found between male and female life. Thus:—

| | | | |
|------------------------------|--|----------------------|---|
| Equation of Life for Age 10. | Friendly Societies in England and Wales..... | Females = 56·749 | |
| | | Males = 56·408 | |
| | | —————·341 of a year. | |
| | Total Population of England and Wales..... | Females = 53·554 | |
| | | Males = 52·308 | |
| | | —————1·249 | „ |
| | Whole Population of Glasgow | Females = 41·346 | |
| | | Males = 38·221 | |
| | | —————3·125 | „ |

If comparisons were made between the sexes in the intermediate classes of results, a development of the same feature would be seen. As has already been stated, where the duration of life is reduced below its average standard by the prevalence of unhealthy occupations, the influence will be more strongly felt in the male than in the female sex.

If the expectation of life for the city of Glasgow* be now referred to, the remarkable depreciation in the duration of life there will appear somewhat startling. No Table of Mortality hitherto published has shown anything like so low an estimate. Liverpool has been frequently referred to as an example of the short duration of life; but a comparison of the expectation of male life for Liverpool, with the results for Glasgow will shew,

At Age 30 a higher value by 3.101 years.

| | | | |
|------|---|-------|---|
| „ 40 | „ | 2.548 | „ |
| „ 50 | „ | 1.535 | „ |

The mortality of a population like that of Glasgow is subject to remarkable fluctuations, showing an extreme difference in some years of about 68 per cent., or a mean fluctuation of about 32 per cent. An inspection of the total male deaths for all ages, for each of the ten years 1832-1842, will render this evident.

| | | | | | |
|----------------------|-------|------|----------------------|-------|------|
| Total Deaths in 1832 | ..... | 4811 | Total Deaths in 1837 | ..... | 5423 |
| „ 1833 | ..... | 3229 | „ 1838 | ..... | 3490 |
| „ 1834 | ..... | 3255 | „ 1839 | ..... | 3898 |
| „ 1835 | ..... | 3726 | „ 1840 | ..... | 4470 |
| „ 1836 | ..... | 4334 | „ 1841 | ..... | 4514 |

It will further be seen those remarkable fluctuation are due chiefly to the mortality in mature life, and not to the mortality in infancy, as some writers have believed.

| Year. | From 20 to 50. | In the First Year of Life. | Year. | From 20 to 50. | In the First Year of Life. |
|---------|----------------|----------------------------|---------|----------------|----------------------------|
| In 1832 | 1795 | 332 | In 1837 | 1991 | 371 |
| 1833 | 902 | 306 | 1838 | 1010 | 336 |
| 1834 | 923 | 313 | 1839 | 966 | 318 |
| 1835 | 885 | 365 | 1840 | 1346 | 404 |
| 1836 | 1279 | 115 | 1841 | 1278 | 381 |

It appears, then, that while the extreme difference in the mortality from ages 20 to 50 is 125 per cent., for the first year of life it is only 32 per cent. If the mean fluctuation for ages 20 to 50 be taken, it will be found to be 53 per cent., while that for the first year of life is only 14 per cent. Were the inspection extended to the mortality of female life, similar results would be obtained. Notwithstanding the inferior numbers in infant life, the fluctuation is confined within narrower limits than the mortality of mature life; and this law is in obedience to the doctrine of probability, when applied to any other subject, as well as to the mortality of life. For whenever the intensity which determines any result increases—or in other words, when the probability of any event approaches unity—so also will the fluctuation in a series of events be reduced in amount.

It is evident from the preceding results of the mortality in Glasgow, that a Table of the Expectation of Life calculated for one period of years—for example, the three years, 1833, 1834, 1835—would differ

* Table R, p. 83 of the "Contributions."

widely from a table founded on the results of the succeeding period of three years, and that the next succeeding period of three years would also differ in a marked degree from either of these: it has on that account been thought the better course to embrace the results of the whole ten years. On a previous occasion, a Table of the Expectation of Life for the five years, 1836-1840, had been calculated; and the results were, for ages

$$20 = 27.624 \quad 40 = 21.711 \quad 50 = 16.590$$

bringing the expectation of life above that given for the whole population of Liverpool, in the Fifth Report of the Registrar-General. It would therefore be rash to conclude that the public health of Glasgow is inferior to that of Liverpool; for if the same means existed of calculating the mortality of Liverpool during the ten years to which the results for Glasgow relate, it might then be found that the Expectation of Life, on an average of that number of years, was overstated by the Registrar-General, whose figures were derived from the mortality of one year only.

Female life in Glasgow, as elsewhere, is of higher value than male life. Thus:—

| | At Age 30. | At Age 40. | At Age 50. |
|------------------------------------|------------|------------|------------|
| The Expectation of Females is | 26.8970 | 21.0730 | 15.8617 |
| And of Males | 24.8998 | 19.4532 | 14.5350 |
| Difference | 1.9972 | 1.6198 | 1.3267 |

TABLE XVII.

DUNDEE—*Total of the Populations as calculated for the 30th of June in each of the Years 1835—1844 inclusive; with the sum of the Deaths for the corresponding years as given in the Mortality Bills, and the Mortality per cent. during the same period.*

| Ages. | MALES. | | | FEMALES. | | |
|-----------------|-------------|--------------------------------|------------|-------------|--------------------------------|------------|
| | Population. | Deaths exclusive of Stillborn. | Mortality. | Population. | Deaths exclusive of Stillborn. | Mortality. |
| Under 5 | 41,450 | 3,328 | 8.0289 | 41,513 | 3,042 | 7.3302 |
| 5 — 10 | 34,005 | 413 | 1.2145 | 32,622 | 410 | 1.2568 |
| 10 — 20 | 60,931 | 377 | .6187 | 67,367 | 366 | .5432 |
| 20 — 30 | 46,877 | 481 | 1.0260 | 67,086 | 569 | .8481 |
| 30 — 40 | 39,488 | 562 | 1.4232 | 46,323 | 553 | 1.1950 |
| 40 — 50 | 24,931 | 585 | 2.3464 | 31,782 | 585 | 1.8406 |
| 50 — 60 | 14,826 | 485 | 3.2712 | 18,089 | 533 | 2.9465 |
| 60 — 70 | 8,537 | 528 | 6.1848 | 12,888 | 633 | 4.9116 |
| 70 — 80 | 4,113 | 476 | 11.5730 | 5,128 | 552 | 10.7644 |
| 80 — 90 | 831 | 204 | 24.5500 | 1,197 | 252 | 21.0526 |
| 90 — 100 | 67 | 13 | 19.4030 | 155 | 34 | 21.9289 |
| 100 and upwards | 0 | 2 | 0 | 19 | 2 | 10.5263 |
| Total | 276,056 | 7,454 | 2.7000 | 324,129 | 7,531 | 2.3234 |

The preceding results seem to point out a higher rate of mortality as pervading all the groups of observations brought into comparison

from Scotland; and it is therefore to be regretted that the Registration Act does not extend to that country, and afford a certain means of solving so important a question. The subject, however in its present state, has been thought of sufficient importance to warrant the calculation of Mortality Tables for the Town of Dundee; and accordingly the following Table has been deduced from the Mortality Bills of that town for the ten years 1835-1844, and the census of the population in 1841, on the principles described for the formation of Tables I. and II*.

In Dundee the equation of male life for age 10 takes place at age 55-6, which is seven years beyond the results obtained for the whole population of Glasgow, and even two years higher than the equation of life for the members of Friendly Societies in the average of the Scotch cities†. This result will no doubt be unexpected by some inquirers, as Dundee has usually been held up as the type of unhealthy cities; but the present results show the necessity of extended observations before drawing any conclusions, the remarks made relative to the fluctuation of mortality in Glasgow being equally applicable to Dundee. The following abstract will give the comparative value of male life in the gross population of Glasgow, Liverpool, and Dundee.

TABLE XVIII.

| Age. | Expectation of Life in | | |
|------|------------------------|--|---------------------|
| | Glasgow. Table R. | Liverpool, Reg. Gen. page xxvii. 5th Report. | Dundee. Table R. |
| 20 | 30·9665 | 33·0000 | 35·9632 |
| 25 | 27·8512 | 30·0000 | 32·4423 |
| 30 | 24·8998 | 27·0000 | 29·0866 |
| 35 | 22·1102 | 23·0000 | 25·8297 |
| 40 | 19·4532 | 21·0000 | 22·7017 |
| 45 | 16·9366 | 18·0000 | 19·8168 |
| 50 | 14·5350 | 16·0000 | 17·0891 |

The value of life in Dundee will thus be seen to stand higher than in either of the other cities. If a complete system of registration existed in Scotland, accurate means would be afforded of carrying out a satisfactory inquiry as to the relative value of life in different districts; but so far as the more imperfect system of Local Registration will admit of judging, it does not appear that the duration of life in the large towns of Scotland should be regarded as so much below that of cities in England.

For many purposes, the mode of representing the value of lives at various ages, under the expression "Expectation of Life," will be found inadequate. The method by which that value is obtained for a given age, involves the consideration of the decrements of life at every superior age; and therefore, in any table, the expectation of life,

* The Expectation of Life, as resulting from these Tables, will be found in Table R, p. 83, of the "Contributions."

† See Tables Q and T, pp. 80 and 87 of the "Contributions."

even at younger ages, will be affected by the irregularities of mortality at the older ages. It consequently sometimes happens that a comparison of different tables, especially at the younger and middle periods of life, may show an equal or nearly equal expectation, while there are in reality very different chances under the two tables of living a given number of years; and again, Expectation Tables may show very different values for the same age, when according to the nature of the data there are equal chances of living a given number of years.

From what has been said it will be seen, that although the "Expectation of Life" expresses the true average duration in years of a certain number of individuals at a given age, yet it does not represent the chances of surviving an equivalent number of years; and consequently, for medical and other purposes, in which it is required to determine the relative value, improvement, or other change which may have taken place within a given period of life, another expression must be found. The equation of life, which represents a term of years for which there is an equal probability of living, appears to be the best mode to determine the comparative value of life in different classes or different districts within the same period of years, as the expression is affected by the mortality within those ages only. In order to show the relation which the equation of life bears to the expectation of life, the expression under each form, corresponding to the decennial ages, are given for various classes of results in

TABLE XIX.
Equation of Life—England and Wales.

| Ages. | England and Wales. | | | | Friendly Societies (Females.) | |
|-------|--------------------|--------------|-----------|--------------|-------------------------------|--------------|
| | Males. | | Females. | | Rural, Town and City. | |
| | Equation. | Expectation. | Equation. | Expectation. | Equation. | Expectation. |
| 10 | 52·305 | 47·756 | 53·554 | 48·383 | 56·749 | 49·493 |
| 20 | 44·212 | 40·691 | 43·706 | 41·598 | 49·702 | 45·264 |
| 30 | 36·482 | 34·099 | 38·066 | 35·167 | 41·017 | 38·184 |
| 40 | 28·790 | 27·476 | 30·412 | 28·733 | 32·248 | 30·781 |
| 50 | 21·255 | 20·846 | 22·697 | 22·055 | 23·894 | 23·820 |
| 60 | 14·285 | 14·585 | 15·355 | 15·523 | 16·236 | 17·238 |

| Ages. | Friendly Societies (Males.) | | | | | | | |
|-------|-----------------------------|--------------|-----------------|--------------|-----------------|--------------|-----------------------|--------------|
| | Rural Districts. | | Town Districts. | | City Districts. | | Rural, Town and City. | |
| | Equation. | Expectation. | Equation. | Expectation. | Equation. | Expectation. | Equation. | Expectation. |
| 10 | 58·375 | 53·258 | 54·315 | 50·537 | 51·743 | 47·913 | 56·408 | 51·810 |
| 20 | 49·353 | 45·355 | 45·201 | 42·274 | 43·052 | 40·015 | 47·434 | 43·774 |
| 30 | 40·813 | 38·407 | 36·517 | 34·575 | 34·920 | 32·860 | 38·972 | 36·605 |
| 40 | 32·129 | 30·972 | 28·135 | 27·153 | 27·218 | 26·087 | 30·531 | 29·331 |
| 50 | 23·609 | 23·470 | 20·053 | 19·973 | 20·056 | 19·927 | 22·344 | 22·192 |
| 60 | 15·923 | 16·652 | 12·815 | 13·761 | 13·295 | 13·769 | 14·945 | 15·694 |

TABLE XX.

SCOTLAND—Males.

| Ages. | Rural Districts. | | Town Districts. | | City Districts. | | Rural, Town and City. | |
|-------|------------------|--------------|-----------------|--------------|-----------------|--------------|-----------------------|--------------|
| | Equation. | Expectation. | Equation. | Expectation. | Equation. | Expectation. | Equation. | Expectation. |
| 10 | 57.474 | 53.051 | 55.828 | 50.743 | 43.371 | 42.637 | 54.567 | 50.803 |
| 20 | 48.467 | 44.990 | 46.407 | 42.752 | 34.753 | 34.586 | 45.656 | 42.722 |
| 30 | 39.995 | 37.783 | 37.106 | 35.040 | 27.831 | 28.635 | 37.478 | 35.651 |
| 40 | 31.493 | 30.305 | 28.020 | 27.641 | 21.255 | 22.647 | 29.539 | 28.657 |
| 50 | 23.266 | 22.898 | 19.441 | 20.742 | 16.409 | 17.386 | 21.917 | 21.812 |
| 60 | 15.990 | 16.018 | 11.217 | 13.121 | 12.688 | 13.335 | 15.174 | 15.018 |

TABLE XXI.

Trades in Friendly Societies (Males) England.

| Ages. | Labourers. Rural Districts. | | Clerks. Rural, Town & City. | | Plumbers, Painters, and Glaziers. Rural, Town & City. | | Bakers. Rural, Town & City. | | Miners. Rural, Town & City. | |
|-------|--------------------------------|--------------|--------------------------------|--------------|---|--------------|--------------------------------|--------------|--------------------------------|--------------|
| | Equation. | Expectation. | Equation. | Expectation. | Equation. | Expectation. | Equation. | Expectation. | Equation. | Expectation. |
| 10 | 61.512 | 56.005 | 41.920 | 39.985 | 46.666 | 43.066 | 49.546 | 47.982 | 51.402 | 48.516 |
| 20 | 52.240 | 47.906 | 33.500 | 31.835 | 39.101 | 36.904 | 41.034 | 40.027 | 42.186 | 40.670 |
| 30 | 43.341 | 40.597 | 27.416 | 27.576 | 31.262 | 30.508 | 33.039 | 32.357 | 33.187 | 33.157 |
| 40 | 34.349 | 32.769 | 19.945 | 21.857 | 23.508 | 24.305 | 25.001 | 24.476 | 24.067 | 24.920 |
| 50 | 25.634 | 25.075 | 13.548 | 16.046 | 15.384 | 17.096 | 19.470 | 19.091 | 15.890 | 17.535 |
| 60 | 17.574 | 17.821 | 11.616 | 12.426 | 9.779 | 12.168 | 13.630 | 14.063 | 10.414 | 11.859 |

The terms in the respective columns headed Equation, were determined as follows:—

Let E_x = the number alive in the columns headed "Living" in Tables C, F, I, &c., &c.*, at the given age x .

Then $\frac{E_x}{2}$ = the number alive at an advanced age, $x + n$ which will always be intermediate between the proximate years of age $x + n - \phi$, and $x + n + 1 - \phi$, the fraction ϕ of which is determined as follows:—

$$\lambda(E_{x+n-\phi} - E_{x+n}) - \lambda(E_{x+n-\phi} - E_{x+n+1-\phi})$$

An inspection of the preceding Tables will show that at the earlier ages the equation of life always exceeds the expectation, and that at those ages there is always an even chance of outliving the period of years represented by the Expectation of Life; but the converse is the case for the older ages. It will also be further seen, that in those Tables giving a higher absolute value of life, the equation retains its superiority over the expectation, till a more advanced period of years; or in other words, if the equation and expectation of life in any table be compared, the more advanced the period of life at which the two expressions approximate to equal values, the higher is the absolute value

* For Tables C, F, I, &c., see "Contributions."

of life throughout that table. An example of this will be seen in observing the respective terms for the City and Rural Districts, in the former of which the approximation happens ten years earlier than in the other: again, if the results for the labourers in the Rural Districts be compared with the results for clerks, thirty years' difference will be found; and on comparison of the results for other classes in Tables XIX., XX., and XXI., intermediate periods of approximation will appear.

4. *Influence of Locality on Sickness.*

The next part of this question to be brought under consideration is the influence of locality on the amount of sickness among the members of Friendly Societies*.

Owing to the greater practical convenience of collecting and arranging the data, as well as of subsequently applying the results to the more useful purposes of Friendly Societies, the amount of sickness throughout the whole of this paper is invariably expressed under the denomination of weeks. For example, in Table XXII., opposite to age 35, and under the head "Rural Districts," the decimal expression $\cdot 8991$ signifies that the average amount of sickness to each individual per annum is that fraction of a week. And again, opposite the same age, in the column "City Districts," the average amount of sickness to each person in the course of a year is $1\cdot 2372$ weeks. When, however, it is required to change the expression to the more scientific denomination of the fraction of a year, that may be easily done by multiplying any of the results by $\cdot 019178$.

An examination of the rates of sickness as given for the Rural Districts will shew that it fluctuates up to the age of 32, and that from that age up to 87 there is a uniform and gradual increase. In the Town Districts the rate of sickness will be found subject to a similar increase from the age of 27 upwards; and in the City Districts the rate increases throughout the whole range of the table. A comparison will shew a higher rate of sickness in the Town than in the Rural Districts, throughout the whole period of life. The rate of sickness in the City Districts will also be found higher than in the Rural Districts, from 23 to 63 years of age; it then continues at a lower rate up to the age of 75, when it again rises, and continues higher till the end of life. In the City Districts, from the age of 24 to 44, the sickness is also higher than in the Town Districts; but from 45 to 57 the rate

* In Tables E and L, pp. 16 and 64 of the "Contributions," the amount of sickness is given among a certain number of persons, at every year of life, expressed in weeks and decimals of a week; and in an adjacent column will be found the amount of sickness among the same number of persons in quinquennial periods of life, also the average amount of sickness to each individual per annum. In the same Table the amount of sickness under the various arrangements described for each of the districts recognised in the Tables of Mortality is also given; and an inspection of the last column will give a general idea of the relative amount of sickness in those districts.

Table V., p. 92, has been formed from the last column, by interpolating the terms for the intermediate years of age, by the method of third differences; and the adjusted results were afterwards obtained in the same manner as that described for the Rates of Mortality in England and Wales, among the members of Benefit Societies, in the early part of this paper.

in both districts differs but little. After 57 years of age to the end of life, there is a much higher rate of sickness in the Town than in the City Districts. The following table will give a general view of the relative amount of sickness in the various districts:—

TABLE XXII.

| Ages. | Average Sickness per Annum to each Person—expressed in Weeks. | | | |
|-------|---|-----------------|-----------------|-------------------------------|
| | Rural Districts. | Town Districts. | City Districts. | The Three Districts combined. |
| 20 | ·8387 | ·8564 | ·5659 | ·8398 |
| 25 | ·8630 | ·8649 | ·9650 | ·8744 |
| 30 | ·8753 | ·8794 | 1·1059 | ·9107 |
| 35 | ·8991 | 1·0114 | 1·2372 | ·9836 |
| 40 | 1·0677 | 1·2669 | 1·4663 | 1·1808 |
| 45 | 1·2537 | 1·8323 | 1·8125 | 1·4939 |
| 50 | 1·5896 | 2·5559 | 2·3831 | 1·9603 |
| 55 | 2·3260 | 3·3029 | 3·3036 | 2·7047 |
| 60 | 3·8531 | 4·9132 | 4·4973 | 4·1657 |
| 65 | 7·6305 | 9·1387 | 5·9019 | 7·7501 |
| 70 | 14·1949 | 15·4995 | 9·9610 | 14·0391 |
| 75 | 20·7848 | 24·0134 | 22·3864 | 21·4661 |
| 80 | 24·3545 | 32·9841 | 35·2065 | 26·9405 |

Sickness will be found to follow to some extent the same law with regard to the influence of locality, that was observed to prevail in respect to mortality; being least in the Rural Districts, and increasing in amount in the other districts; but it will be observed that the relation of cause and effect generally supposed to exist between sickness and mortality is not here manifested—in fact, the highest ratio of sickness is sometimes found associated with a favourable rate of mortality. In order to shew, however, the merits of this hypothesis for the general results of the three districts, a table is subjoined shewing the increase per cent. in the rate of mortality in the Town and City Districts above the Rural, also the increased rate of sickness in the same districts at the corresponding ages.

TABLE XXIII.

| Ages. | Increased Mortality per Cent. above the Rural Districts in the | | Increased Sickness per Cent. above the Rural Districts in the | |
|-------|--|-----------------|---|-----------------|
| | Town Districts. | City Districts. | Town Districts. | City Districts. |
| 20 | 27·6008 | 12·7200 | 2·1104 | 32·7650 |
| 30 | 5·4852 | 30·5204 | 0·4684 | 26·3338 |
| 40 | 20·4517 | 75·7842 | 18·6560 | 37·3419 |
| 50 | 35·5833 | 61·6666 | 60·7220 | 49·9182 |
| 60 | 51·5277 | 41·0185 | 27·5130 | 16·7200 |
| 70 | 43·2990 | 26·7248 | 9·1906 | 29·8191 |

Abundant evidence in addition to this is furnished out of the present materials illustrative of this point; for example, labourers, al-

though influenced by the most favourable rate of mortality, are found to be subject to as high an amount of sickness as the general average; and so also are some other occupations, in which the rate of mortality is also favourable, found subject to a rate of sickness much above the average.

Again, the sickness among the sixteen trades formerly referred to is less than the general average, although, as has been shewn, they experience a greater mortality. Bakers also, at the early and middle periods of life, are less subject to sickness than the general average, and among them there is likewise a higher mortality. The class butchers seem to experience a very high rate of mortality, although not subject to above the average amount of sickness. In applying the test of mortality to various localities and employments there is no difficulty, but the case is very different in viewing sickness as an index to the sanitary condition of any trade or of any locality. What constitutes sickness in one case, is often a very different thing from that in another. The standard seems too indefinite and capricious; and although the results as obtained may be considered perfect for all the purposes of Friendly Societies, a careful inquiry will shew their vague nature for medical and other scientific purposes, unless carried further than the mere amount of sickness, without regard to the circumstances under which it has taken place, and the causes producing it. Taking two occupations—tailors and clerks—which happen to be of readiest reference, they are found subject to a very high rate of mortality; still they do not seem, particularly clerks, to be subject to so much as the average amount of sickness; and on consideration of the nature of those employments, it will immediately suggest itself, that the same trivial circumstances which would be sufficient to disable sawyers, and also colliers and miners, would have little effect on those following quiet occupations. Sawyers, colliers, and miners are subject to accidents and various injuries which cannot be considered constitutional disease or sickness; yet it entitles them to relief from Benefit Societies, and they will of course be returned on the sick list. Tailors and clerks are less subject to those accidents, and accordingly their sickness is also less; the other classes, particularly colliers and miners, being much above the average.

But the most striking refutation of the theory, that sickness and mortality bear the relation to each other of cause and effect, will perhaps be derived from a comparison of the general results of mortality in Friendly Societies in England for all districts combined, with that for Scotland*. The result of this comparison will be, that the rate of mortality in Scotland among the members of Friendly Societies is much higher than among the same class in England; and if the theory just recited were to hold good, there should also be found a greater amount of sickness in Scotland; but such is not the case, for instead of there being an increased ratio of sickness, the ratio is actually below that in England. Nothing further need, therefore, be said on this part of the subject; but the argument may be rendered more obvious by an inspection of the following abstract, in which it will be seen that while the excess of mortality is uniformly against Scotland, the excess of sickness is as constantly against England.

* See Tables F and M, pp. 25 and 73 of the "Contributions."

TABLE XXIV.

| Age. | Mortality per Cent. in | | Excess of Mortality in Scotland per Cent. | Average Sickness yearly in | | Excess of Sickness in England per Cent. |
|------|------------------------|-----------|---|----------------------------|-----------|---|
| | England. | Scotland. | | England. | Scotland. | |
| 30 | ·7563 | ·7926 | 4·7997 | ·9107 | ·8376 | 8·0268 |
| 40 | ·9386 | 1·0767 | 14·7134 | 1·1808 | ·9767 | 17·2849 |
| 50 | 1·4267 | 1·5830 | 10·9538 | 1·9603 | 1·8548 | 5·3818 |
| 60 | 2·5054 | 2·9096 | 16·1331 | 4·1657 | 3·9423 | 5·3628 |

The nature of the information on the Schedules relating to the Societies in Scotland would evidently satisfy many speculations as to the cause, duration, and mortality of sickness and disease; but as it is proposed to give in this paper a simple representation of the amount of sickness only in the different districts, all inquiries, however interesting and instructive, as to the ratio of sickness to mortality, under the various circumstances which present themselves of employment and disease, must for the present remain untouched.

The next part of the subject naturally arising in this paper is, the relation which the average amount of sickness, as developed by this

TABLE XXV.

Sickness per Annum to each Person—expressed in Weeks.

| Age. | Highland Society. | Ansell. | Three Districts combined, Table V. | Age. | Highland Society. | Ansell. | Three Districts combined, Table V. |
|------|-------------------|---------|------------------------------------|------|-------------------|---------|------------------------------------|
| 21 | ·575 | ·780 | ·8453 | 46 | 1·032 | 1·411 | 1·5688 |
| 22 | ·576 | ·785 | ·8515 | 47 | 1·108 | 1·475 | 1·6528 |
| 23 | ·578 | ·791 | ·8585 | 48 | 1·186 | 1·544 | 1·7461 |
| 24 | ·581 | ·798 | ·8661 | 49 | 1·272 | 1·619 | 1·8486 |
| 25 | ·585 | ·806 | ·8744 | 50 | 1·361 | 1·701 | 1·9603 |
| 26 | ·590 | ·815 | ·8834 | 51 | 1·451 | 1·791 | 2·0812 |
| 27 | ·596 | ·825 | ·8915 | 52 | 1·541 | 1·890 | 2·2161 |
| 28 | ·603 | ·836 | ·8988 | 53 | 1·633 | 1·999 | 2·3650 |
| 29 | ·611 | ·848 | ·9052 | 54 | 1·726 | 2·120 | 2·5279 |
| 30 | ·621 | ·861 | ·9107 | 55 | 1·821 | 2·256 | 2·7047 |
| 31 | ·631 | ·876 | ·9154 | 56 | 1·918 | 2·410 | 2·8956 |
| 32 | ·641 | ·893 | ·9250 | 57 | 2·018 | 2·586 | 3·1371 |
| 33 | ·652 | ·912 | ·9396 | 58 | 2·122 | 2·788 | 3·4293 |
| 34 | ·663 | ·933 | ·9591 | 59 | 2·230 | 3·021 | 3·7722 |
| 35 | ·675 | ·956 | ·9836 | 60 | 2·346 | 3·292 | 4·1657 |
| 36 | ·688 | ·981 | 1·0130 | 61 | 2·500 | 3·611 | 4·6099 |
| 37 | ·702 | 1·009 | 1·0474 | 62 | 2·736 | 3·991 | 5·1904 |
| 38 | ·718 | 1·040 | 1·0869 | 63 | 3·100 | 4·448 | 5·9073 |
| 39 | ·737 | 1·074 | 1·1313 | 64 | 3·700 | 5·001 | 6·7605 |
| 40 | ·758 | 1·111 | 1·1808 | 65 | 4·400 | 5·672 | 7·7501 |
| 41 | ·784 | 1·151 | 1·2353 | 66 | 5·400 | 6·486 | 8·8760 |
| 42 | ·814 | 1·195 | 1·2939 | 67 | 6·600 | 7·471 | 10·0679 |
| 43 | ·852 | 1·243 | 1·3565 | 68 | 7·900 | 8·659 | 11·3257 |
| 44 | ·902 | 1·295 | 1·4232 | 69 | 9·300 | 10·086 | 12·6494 |
| 45 | ·962 | 1·351 | 1·4939 | 70 | 10·701 | 11·793 | 14·0391 |

inquiry, bears to the amount of sickness, as hitherto shewn in other Sickness Tables.

The only tables to which it is deemed necessary to make reference, are those contained in the Highland Society's Report for 1824, and the tables given in the highly valuable work by Mr. Ansell on Friendly Societies, and published in 1835 under the superintendence of the Society for the Diffusion of Useful Knowledge. The following will shew the relative amount of sickness per annum to each person at given ages according to those tables, and also according to the results of this inquiry.

For the sake of a more convenient and general view of the relative merits of those different results, the following abstract is given.

TABLE XXVI.

| Age. | Annual Amount of Sickness to each Person—expressed in Weeks. | | | | |
|------|--|---------|------------------------------------|--|--------------------------------|
| | Highland Society. | Ansell. | Average of all Districts, Table V. | Excess per Cent. above Highland Society. | Excess per Cent. above Ansell. |
| 20 | ·575 | ·776 | ·840 | 31·5476 | 7·6190 |
| 30 | ·621 | ·861 | ·911 | 31·8331 | 5·4884 |
| 40 | ·758 | 1·111 | 1·181 | 35·8171 | 5·9272 |
| 50 | 1·361 | 1·701 | 1·960 | 30·5612 | 13·2142 |
| 60 | 2·346 | 3·292 | 4·166 | 43·6869 | 20·9798 |
| 70 | 10·701 | 11·793 | 14·039 | 23·7766 | 23·0636 |

The remarkable increase in the amount of sickness, as shewn by the present results, beyond the two other tables, will no doubt appear very startling to those not intimately familiar with the condition of Friendly Societies throughout the country. The rate of sickness as given in the Table of the Highland Society, has been long and generally acknowledged to be much below the actual average, and even so far back as 1825 it was thought unfavourably of by a Committee of the House of Commons. It is unnecessary to enter into the objections against the nature and source from which the data for the Highland Society's Table were obtained, as that subject has been amply discussed elsewhere. For some time after Mr. Ansell's work appeared, it was thought that contributions calculated according to the increased amount of sickness shewn in his tables would render Friendly Societies perfectly safe; but instances occur almost daily of Societies breaking down whose contributions approximate to those tables; and recently the increased amount of sickness has become so apparent to the members of some of the best regulated Societies, that meetings have been held, and reports of a very clear and apposite kind published, pointing to the increased amount of sickness as the cause of their falling condition. A knowledge of circumstances of this kind first led to the present inquiry, the original object of which was simply to answer the question, whether Friendly Societies actually were subject to a higher rate of sickness.

Mr. Ansell's data had reference to the five years 1823—1827; and it is difficult to account for the difference between his tables and the present results, unless it be considered that the imperfect manner in which the affairs of Friendly Societies at that period were managed, did not allow of so accurate information being then obtained as now, when required by Act of Parliament to make quinquennial returns. In Scotland, at the time even of collecting the data for this inquiry, it was found that quadruple the Societies would have filled up schedules in competition for the prizes offered, but were prevented doing so by the incomplete system in which their books were kept. It is not improbable that the difference of the two classes of results may be partially accounted for by the smallness of the numbers over which his observations extended, as in the aggregate they amounted to 24,323 years of life only, or about 5,000 persons for a period of five years. If this fact is considered, and at the same time the irregularities which peculiarity of employment and other circumstances have been shewn to produce, it will not be difficult to account for the dis-

TABLE XXVII.

Comparative Amount of Sickness in various periods of Years according to the Sickness Tables of the Highland Society, the Tables by Mr. Ansell, and the Results of this Inquiry.

| From Age | Amount of Sickness in each Period of Years, expressed in Weeks. | | | | |
|----------|---|---------|----------------------------------|---|-------------------------------|
| | Highland Society. | Ansell. | Average for the three Districts. | Excess per Cent. over Highland Society. | Excess per Cent. over Ansell. |
| 20—30 | 5·870 | 8·060 | 8·7145 | 32·641 | 7·510 |
| 30—40 | 6·728 | 9·535 | 9·9120 | 32·1227 | 3·8035 |
| 40—50 | 9·670 | 13·395 | 14·7999 | 34·6617 | 9·4926 |
| 50—60 | 17·827 | 22·562 | 27·0894 | 34·192 | 16·712 |
| 60—70 | 47·982 | 58·717 | 77·3029 | 37·929 | 24·042 |
| 70—80 | ..... | ..... | 205·3562 | ..... | ..... |
| 20—40 | 12·598 | 17·595 | 18·6265 | 32·3652 | 5·5378 |
| 30—50 | 16·398 | 22·930 | 24·7119 | 32·8775 | 7·2107 |
| 40—60 | 27·491 | 35·957 | 41·8893 | 34·3723 | 14·1618 |
| 50—70 | 65·803 | 81·279 | 104·3923 | 36·965 | 22·140 |
| 60—80 | ..... | ..... | 282·6591 | ..... | ..... |
| 20—50 | 22·268 | 30·990 | 33·4264 | 33·3820 | 7·2888 |
| 30—60 | 34·219 | 45·492 | 51·8013 | 33·9416 | 12·1798 |
| 40—70 | 75·473 | 94·674 | 119·1922 | 36·6796 | 20·3703 |
| 50—80 | ..... | ..... | 309·7485 | ..... | ..... |
| 20—60 | 40·089 | 53·552 | 60·5158 | 33·7545 | 11·5074 |
| 30—70 | 82·201 | 104·209 | 129·1042 | 28·5841 | 19·2831 |
| 40—80 | ..... | ..... | 324·5484 | ..... | ..... |
| 20—70 | 88·071 | 112·269 | 137·8187 | 36·0965 | 18·5386 |
| 30—80 | ..... | ..... | 334·4604 | ..... | ..... |
| 20—80 | ..... | ..... | 343·1749 | ..... | ..... |

crepancy. If the nature of Mr. Ansell's Treatise had required an enumeration of these features, it would have been interesting to have traced the cause.

It is not believed that the mere fact of small numbers would, of itself, be sufficient to account for the difference, without at the same time a peculiarity in the combination of the employments of the persons composing those numbers; for not the least remarkable feature which has appeared in the present inquiry is, the uniformity of the results as to sickness, with even smaller numbers than those included in Mr. Ansell's statement, when all the facts recorded were under similar circumstances as to locality and employment.

In order to give a still further and more comprehensive view of the several tables over periods of years, the following arrangement may be useful.

An inspection of the fourth and fifth columns of the above Table will afford the most conclusive evidence of the increased ratio of sickness above that set forth in previous tables. To those interested in the progress of Friendly Societies the results are highly important, as they will demonstrate the impossibility of permanence in those institutions on their present foundations. Considering the immense number of those Societies which have broken down, it is lamentable to think that so little should have been done to ascertain the real nature and extent of the risks to which they are subject. It is still more remarkable that so many legislative enactments should have occupied the attention of the Government of the country from time to time, and that Committees also of the House of Commons should have had the condition of those Societies for several years under consideration, without any practical measure being carried out for collecting and arranging data in a proper shape to point out the true character of the liabilities to which they are subject. In fact, the stimulus given to the formation of those Societies by some recent Acts of Parliament should be regarded as an evil rather than as a benefit to the working classes. An immense number of Societies were formed in a very short period, and their contributions regulated by the most delusive and inadequate data, so that at the present time very few are to be found calculated to survive many years. Under a scientific and amply developed system, those Societies would be calculated, in a few years, to completely remove the cause of nearly all that poverty, distress and misery which haunt our manufacturing towns, and fill our workhouses with the working classes of the country; but owing to the imperfect and unstable foundation on which they are at present built, instead of being a help and a support to a poor man, they involve him in those difficulties for which he might otherwise have provided. On becoming a member of such a Society, he reasonably looks forward to it as a support for his declining years, and a protection during periods of sickness and disease; but ultimately, at the very time when assistance is required, he discovers that the Society has been formed on a ruinous plan, that the increasing years and infirmities of its members have absorbed all its funds, and that those surviving must be thrown destitute on the parish as a public charity. It is to this point, by the most ill conceived of all proceedings, that the legislation of the Government has hitherto tended. Every facility and encouragement are

given to the formation of Societies, without any help or information for their management or guidance. The ship is cast upon the waves without rudder or compass, and the safety of the vessel left to accident and chance.

As already stated, a Committee of the House of Commons reported in 1825, unfavourably of the Table of Sickness furnished in the preceding year by the Highland Society; still no other data were supplied on which any more confidence could be placed; the consequence was, that Societies were formed, and continued to be managed, on calculations resulting from the same data; and, even up to the present time, thousands of those Societies are conducted either on those terms, or terms still less adequate to carry out the purposes contemplated.

An inspection of Column 4 of the preceding Table will show that, in the decennial periods of life from 20-70, the Friendly Societies in England and Wales experience an excess of sickness of from 32 to 37 per cent. above that indicated in the Table of the Highland Society, or an average increase of sickness over the whole of that period of fifty years of 36.096 per cent.; or, in other words, Friendly Societies actually experience about 138 weeks' sickness in that fifty years, while the Highland Society Table would lead them to expect eighty-eight weeks only.

The ruin of any Society, under such conditions, is inevitable. There are many other errors in the rules of Friendly Societies, connected with the various benefits which they hold out, calculated to ruin their schemes; but if it were necessary here to cite instances in which Societies have suffered from the simple feature of excessive sickness, abundant instances could be pointed out; but the internal evidence contained in this paper, of the actual rate of sickness experienced by Societies in the aggregate, must also prove that individual Societies have been sufferers. In illustration of this point, it is impossible to avoid quoting a passage from a very able Report, dated 8th of February, 1841, submitted to the Edinburgh Compositors' Society, by a Committee appointed to revise the laws. They state, in their Report, that the contributions and benefits of the Society were regulated by the data of the Highland Society; and, in order to discover whether the experience of the Society has harmonized with the original data from which their calculations resulted, an investigation of the actual sickness in the Society was made, of which the following is an abstract:—

TABLE XXVIII.

| Age. | Number of Members. | Actual Sickness in the Society. | | Amount of Sickness expected by the Highland Society Tables. | | Excess of Actual Sickness. | |
|------------|--------------------|---------------------------------|-------|---|-------|----------------------------|-------|
| | | Weeks. | Days. | Weeks. | Days. | Weeks. | Days. |
| 20—30 | 732 | 979 | 1 | 417 | 0 | 562 | 1 |
| 30—40 | 580 | 863 | 5 | 398 | 1 | 465 | 4 |
| 40—50 | 126 | 191 | 5 | 129 | 3 | 62 | 2 |
| 50—60 | 11 | 12 | 2 | 20 | 4 | 8 | 2 |
| Total..... | 1449 | 2047 | 1 | 965 | 2 | 1081 | 5 |

It will thus be seen that the actual sickness experienced by this Society has exceeded that contemplated by the Highland Society Tables by no less an amount than 112 per cent.

The following gives the amount of sickness as experienced by this Society, and also according to the results of various tables.

| | | | | | | Excess of Sickness in Compositors' Society. | | | |
|--|--|--|--|--|--|--|-------|--------|-------|
| | | | | | | Weeks. | Days. | Weeks. | Days. |
| Amount of sickness in Compositors' Society | | | | | | 2047 | 1 | ..... | .... |
| Ditto, Highland Society Tables | | | | | | 965 | 2 | 1081 | 5 |
| Ditto, Ansell's Table.... | | | | | | 1357 | 0 | 690 | 1 |
| Results as given in this paper, City Districts, Table V. | | | | | | 1748 | 0 | 299 | 1 |
| Results as developed in this investigation. | | | | | | Printers | 2000 | 0 | 47 |
| | | | | | | Colliers and Miners | 2146 | 0 | —98 |
| less sickness in Compositors' Society than among | | | | | | Colliers and Miners. | | | |

It will thus appear, that while there was in the Society an excess of 112 per cent. above the Highland Society's Table, and also an excess of 51 per cent. above Mr. Ansell's Table, there is an excess of only 17 per cent. above the results obtained in the present inquiry, for the average of all trades in the City Districts, and of 2 per cent. above the general class printers, which includes both compositors and pressmen; but there is at the same time also actually less sickness than among colliers and miners by nearly 5 per cent.

It has been shown that particular trades and employments are subject to different degrees of sickness and mortality, and the importance of this element in considering the health of towns, and the influence of locality on the duration of life, has already been pointed out; but in viewing the condition of Friendly Societies, the necessity of considering the peculiar effect of certain trades and occupations must appear to be of vital importance. A most remarkable disparity exists between the rates of sickness prevalent in different places and in different employments, and Societies may run the greatest hazard by incautiously adopting each other's Regulations or Tables; for so great is the distinction which obtains between the liabilities incurred by members of different trades, that what would be sufficiently safe for one Society might completely ruin another. It may seem to some that the excessive amount of sickness experienced by the Compositors' Society may be accounted for by the fluctuation in small numbers, but on reference to the Report itself such will not be found to be the case. The facts extend over a term of sixteen years, and the results for the various periods are pretty uniform, and cannot be looked upon as the result of any accident, but must be regarded as a distinctive and proper feature of that trade to which the members of the Society belong.

In calculating tables for the guidance of such a Society, it would evidently not be safe to assume the results for the general average of the country or a given district as a sufficient basis to proceed upon; for, allowing such to be the case, and adopting even the present results as a standard of calculation, there would still be 17 per cent. of the sickness in the above Society unprovided for. As remarked in respect of the rates of mortality in different trades and occupations, so also may it be said of sickness, the present inquiry, therefore, cannot be

regarded as complete till the results for the various employments are published.

Other Societies in Edinburgh, it will be seen from a passage presently to be quoted from the Report in question, have also experienced an increased amount of sickness beyond the rates of the Highland Society's Table, although the sickness in those Societies has not equalled in amount that of the Compositors' Society. It is stated that the sickness in those Societies amounted "on an average to no less than 87 per cent. more than the Highland Society's rate." Considering this statement, from the correctness of detail in other parts of the same report, to be correct, it seems to be a very remarkable coincidence, that in the City Districts, being that with which those Societies should be brought into comparison, there is, according to the results of this investigation, at the same term of life also exactly 87 per cent. more sickness than given in the Highland Society's Table. From 20 to 60 years of age, according to the Highland Society's Table, (see page 98,) there is forty weeks' sickness to each person; but according to the City Districts, Table XXII., there is seventy-five weeks' sickness, or 87 per cent. more than given in the Highland Society's Table.

The practical advantage of thus recognising particular districts and occupations is obvious; for had either of the preceding questions been tested by the results for the general average, no satisfactory solution could have been offered. Hence the reason why some Friendly Societies go on prospering, while others, under apparently the same management and scheme, survive but for a short term of years, to ultimately involve their members, when most in need of support, in ruin. The following extract from the Report of the Committee in question is important:—

"The average annual sickness to an individual is as follows:—

| | | Compositors' Society. | | | Highland Society. | | |
|----------------------------|------|-----------------------|-------|--------|-------------------|-------|--------|
| | | Weeks. | Days. | Hours. | Weeks. | Days. | Hours. |
| From 20 to 30 years of age | .... | 1 | 2 | 1 | 0 | 4 | 3 |
| „ 30 to 40 „ | .... | 1 | 2 | 22 | 0 | 4 | 19 |
| „ 40 to 50 „ | .... | 1 | 3 | 3 | 1 | 0 | 4 |
| „ 50 to 60 „ | .... | 1 | 0 | 17 | 1 | 6 | 3 |

"From a comparison of these two rates, it will be seen that the sickness experienced by this Society has been more than double that given by the Highland Society. Since ascertaining this result, the Committee have made various inquiries in order to ascertain how far this increase corresponded with the experience of other Societies established on similar principles; and they have to report as the result of these inquiries, that in Heriot's Benefit Society, the School of Arts, the Goldsmiths' Equitable, the Journeymen Goldsmiths' and in the Cabinet and Chairmakers' Societies, a very great increase had also been experienced, amounting, on an average of these Societies, to no less than 87 per cent. more than the Highland Society's rate. Great, however, as this increase appears, it is easy to be accounted for when the state of Societies is considered during the period embraced by the Highland Society's inquiry. It is well known that up till the period of the publication of the Highland Society's Report, Societies generally partook very much of a charitable character, no member being

entitled to benefits unless he was in indigent circumstances. Now, when it is considered that the Highland Society's rate of sickness was deduced from the amount of sickness experienced by the 79 Societies above mentioned, during a period when they were formed upon this charitable principle, it is not to be wondered at that now, when they are established upon strictly insurance principles, and when, in consequence, each member claims to the utmost extent of the benefits, the sickness should be found to be so much greater than was at first supposed. This, the Committee conceive, is quite sufficient to account for the great disparity between the rate of sickness given by the Highland Society, and that now found to occur among Societies."

The preceding comparisons did not extend beyond 60 years of age; but, as will appear from subsequent illustrations to be given in this paper, the claims to be made by members after passing their sixtieth year become generally so alarming as to be the usual means of awakening Societies to the danger of their position. For example, although in the Compositors' Society all the members were under 60 years of age, still there was a large amount of what is called permanent sickness. At page 6 of the Report in question, it will be seen that of the members actually sick,

| | | |
|----------------|-----|--------------------------|
| 91.0 per cent. | had | 7½ weeks' sickness each; |
| 3.5 | " | 69 |
| and 5.5 | " | 246 |

It will thus appear, that the amount of sickness among 5.5 per cent. of the members was actually more than double that experienced by 91 per cent. of another class of the same Society. When the subject of permanent sickness is brought forward, its relation to age, its effect on the funds of a Society, and the methods by which the future liabilities of a Society may thereby be determined, will be amply discussed.

Having entered so fully into the characteristic features of the Highland Society Table, in relation to the results of this inquiry, a simple inspection of Table XXVII. will be sufficient to shew to what extent Mr. Ansell's Table is liable to the same objections. At the decennial periods of life from 30—70, it will be seen that there is an excess of sickness in the Friendly Societies in England and Wales over Mr. Ansell's Table, varying from 4 to 24 per cent., or a mean difference over the whole of that period of forty years of 19.283 per cent. This excess of sickness, as well as all the other results in Table XXVII., are derived from making Table XXII. the standard of comparison; but if Mr. Ansell's Table were taken as the standard of comparison, the deficiency in amount of sickness over that period of years would be 23 instead of 19 per cent., and at ages 60—70 the deficiency would be 31 instead of 24 per cent., as given in Table XXVII., or a deficiency of nearly one-third. But in regarding that table as a general guide for Friendly Societies, its inadequacy for many cases will instantly appear by making it bear on the results of Table XXII. for the City Districts, in which, as already stated, the amount of sickness from 21—60 years of age, is seventy-five weeks, being an excess over Mr. Ansell's Table, for that period of life, of no less than 41 per cent. The greatest care and discrimination should therefore be exercised, in established Friendly Societies, not to adopt general results for the

guidance of particular classes. The laws of sickness and mortality are under peculiar modifications in each class, and must be developed before any safe practical conclusions can be arrived at, deserving of public confidence.

The following are the results of a combination of the elementary data of some interest, in a form not hitherto attempted, and from which some useful conclusions may be drawn. In the preceding tables the rate of mortality has invariably been regarded in relation to every member of the Society or Societies, at the given ages; but in column 1 of the following table will be found the results of a different combination. All the members at every year of life, or rather all the members of exactly the same age, being placed into one group, it was then observed how many of these had actually experienced sickness during the course of that year of life. And these being abstracted from the total number of members of the same age, column 1 was deduced, expressing for quinquennial periods of life the per centage of members that are actually sick in the course of one year; for example, out of every hundred members aged 31—35 in a Society, twenty-one will be on the sick list during some part of the year; but of the same number of members aged 61—65, at least thirty-five members would be sick during some period or other of the year.

TABLE XXIX.

| Age. | Per Centage of Members sick during each Year. | Ratio of Sick Members to every 100 not sick in every Year. | Mortality per Cent. among those actually sick. | Sickness per annum among those actually sick. | Total Amount of sickness to each death. |
|--------|--|---|---|--|---|
| 11— 15 | 21·9565 | 28·1337 | ·9901 | 4·1231 | 416·4290 |
| 16— 20 | 22·0743 | 28·3273 | 2·8571 | 3·5887 | 125·6032 |
| 21— 25 | 22·0386 | 28·2686 | 3·0539 | 3·8518 | 126·1271 |
| 26— 30 | 21·6997 | 27·7134 | 3·3271 | 4·1921 | 125·9977 |
| 31— 35 | 21·0147 | 26·6058 | 3·7592 | 4·3585 | 115·9411 |
| 36— 40 | 21·5471 | 27·4650 | 4·0686 | 4·9463 | 121·5732 |
| 41— 45 | 22·9858 | 29·8463 | 4·5306 | 5·9418 | 131·1468 |
| 46— 50 | 24·6042 | 32·6333 | 5·1657 | 6·8556 | 132·7123 |
| 51— 55 | 27·6422 | 38·2022 | 6·2401 | 8·5104 | 136·3839 |
| 56— 60 | 30·2424 | 43·3535 | 7·2732 | 10·9261 | 150·2235 |
| 61— 65 | 35·5676 | 55·2015 | 8·6163 | 15·1975 | 176·3808 |
| 66— 70 | 46·8493 | 88·1443 | 9·6004 | 24·2217 | 252·2988 |
| 71— 75 | 58·3750 | 140·2400 | 12·1306 | 32·6275 | 268·9679 |
| 76— 80 | 73·5916 | 278·6667 | 11·3636 | 36·2367 | 318·8876 |
| 81— 85 | 74·4624 | 291·5790 | 18·4116 | 37·7633 | 205·1064 |
| 86— 90 | 79·4872 | 387·5000 | 17·2043 | 41·0829 | 238·7943 |
| 91— 95 | 50·0000 | 100·0000 | ..... | 39·2450 | ..... |
| 96—100 | ..... | ..... | ..... | ..... | ..... |

An inspection of column 1 will shew, that from the younger ages up to the period 31—35, the ratio or chance for any given member to be sick diminishes; but that from that period of life upwards, the tendency for any given member to be sick increases in a uniform and regular series. No table of this kind has hitherto existed; and it is

believed, that in addition to the more general purposes of Vital Statistics, it will be practically useful to Benefit Societies, in enabling them to determine whether the numbers on their sick list be greater or less than the average. Table XXII will afford a means to determine whether the total amount of sickness in a Society be greater than the average; but the present table simply points out the proportion of members to be expected on the sick list, and is perhaps more important than the other, as a test to the means of selection adopted for the admission of members.

Column 2 is simply a modification of column 1, and needs no explanation further than to state, that it will afford a ready means of testing the relation of the sick to the non-sick members in any one year, when placed in separate groups, as is generally done in Benefit Societies.

In preceding tables the rate of mortality was given for the general population of Friendly Societies; but in the third column of the foregoing Table will be found the mortality per cent. among those persons actually sick. The mortality among the population generally has been shewn to increase with age; so also does the mortality among those persons actually sick increase with age.

In the quinquennial period of life 21-25, the mortality among those sick is 3.0539 per cent.; but in the advanced period of life 66-70, the mortality is increased to 9.6004 per cent., or more than three times that of the other period. An inspection of this column will shew that there is a uniform and gradual rate of increase of mortality.

Tables of this kind are calculated to throw important light on the subject of Vital Statistics. A chronological series would point out any change or modification that may have taken place in the intensity and severity of disease. By the aid of the information given in column 3, premiums may easily be determined for the assurance of lives while actually sick; but as the results in that column do not distinguish sickness under particular diseases, a knowledge of the disease under which the patient might be suffering would be of no assistance to parties undertaking the risk: but if particular diseases, with the sickness and mortality under each, were given in separate classes, then the results would apply to given diseases, in the same manner in which the above results will apply to sickness in general, irrespective of disease. An application of columns 1st and 3rd will afford the means of measuring the exact liabilities of a Friendly Society; and if the same means were available to an Assurance Company of ascertaining the ratio of its members sick, the principles of determining the liabilities in those Companies would undergo an important change.

Suppose that in any particular Society containing 3,647 members, equally distributed over the ten quinquennial terms of life from 20 to 70 years of age, one thousand of those should be found on the sick list in the course of a year, and of one thousand persons found sick, fifty-six deaths would take place in that year; but if in the actual result the balance of those numbers was in any way disturbed, that circumstance would tend to shew whether the selection of lives in the Society was of a favourable or unfavourable character.

The results in column 3 were obtained by direct observation; but

it is evident that if m is made to represent the rate of mortality per cent., and a the results in column 1, then

$$\frac{m \times 100}{a} = \text{column 3.}$$

It is obvious that in applying the results in this table to any practical purpose, independent calculations must be made for each term of years, otherwise errors of the same nature to those pointed out at page 41 would affect the result.

Column 4th of the same table will be found to represent the amount of sickness per annum among those actually sick. From the age of 15 upwards, the amount of sickness will be found to increase in a regular and uninterrupted series. At the term of life 21-25, there is 3·8518 weeks' sickness in a year to each person, but at the term 66-70 there is 24·2217 weeks' to each person actually sick.

Without any further inquiry on this point, the manner in which it will bear on what is called permanent sickness in Friendly Societies is obvious. It will thus be seen, that not only have advanced years a greater liability to sickness, but that, once on the sick list, its duration receives a most remarkable increase. It will also be further seen, that at the two terms of life 21-25 and 66-70, the relative chances of being sick are in the ratio of 220 to 468, while the mortality at the same terms of life is in the ratio of 31 to 96 among those actually sick; and that the amount of sickness to those persons at the respective ages, shews the remarkable disparity of 39 to 242.

The cares, anxiety, and suffering with which the decline of life is thus beset, appear to form a most striking contrast to the improvident carelessness with which in youth any provision for those calamities is regarded. "If any man will not work, neither shall he eat;" and as "the time cometh when no man can work," it is in the summer of life that abundant provision must be made for the vicissitudes of that winter which incapacitates for labour; but how mortifying must be the disappointment which falls on the hopes of those patient contributors to Friendly Societies, who, after thirty or forty years' experience, find in the decline of life, when thrown by their infirmities on those Societies for support, no brighter prospect than the severe and harassing privations of pauperism, or the consolations of the workhouse.

The results in column 4 may be obtained in the same manner as that just described for column 3, viz.;—Let s represent the average sickness per annum, as given in Table XXII, and a the results in column 1 of Table XXIX; then

$$\frac{s \times 100}{a} = \text{column 4}$$

It must be kept in view, that the results in this column, as well as those given in the whole of the same table, will be much influenced by local circumstances and peculiarity of employment, and that it is not to be thought that they can be applied with safety to all Societies promiscuously. Considerable experience and discrimination will always be required, to determine on the due application of many of the most important practical results here produced.

Perhaps the most curious and interesting part of the preceding

Table is column 5, as it presents some remarkable and novel features connected with Vital Statistics. A careful survey of the figures in that column will shew, that although, as age advances, the human constitution has a greater tendency to decay, and greater liability to sickness, still it presents the apparent anomaly of having in advanced life a greater power of enduring sickness than in younger life; and yet, although there is less power to resist the approach of disease, there is a higher capability of sustaining its insidious and destroying agency.

At the period of life 31-35, it will be seen that for every 116 weeks of sickness there is one death; but at the term of life 66-70, there is only one death for 252 weeks of sickness; or in other words, a greater amount of sickness is required to destroy life at advanced ages than at younger ages.

This peculiar feature, which seems to have been unexpected by those giving attention to such subjects, may be explained in several ways. Many of the diseases prevalent in younger life disappear in after years; and, in passing from the diseases peculiar to youth, other diseases ensue, which, although not so acute in their nature, are yet fatal in their results; and thus the change from the acute to the more chronic form of disease will impart increased duration, but not severity, to the sick-list of a Society. Again, many fatal diseases of youth, such as Consumption and other Diseases of the Chest, do not to any great extent incapacitate from labour; and in those diseases the mortality may be high, while the amount of sickness is small.

Nothing like a proper enumeration of all the practical applications of the preceding table is here contemplated; but it may not be out of place to refer to a few of the more obvious uses to which it may be applied. In Friendly Societies, a correct record of the amount of sickness among the members will afford a means of predicting the number of deaths to be looked forward to, as well as the class of members among which such deaths are most to be expected. Investigations into the affairs of a Society will also be much aided by a skilful survey of the relative amount of sickness to the deaths among the members. Provided that, over a sufficiently long period, an unusually large amount of sickness was found to prevail in relation to the number of deaths, it might be safely inferred that some peculiar element affected the results; but if both sickness and mortality should show a marked augmentation beyond the calculated numbers, then such a feature might be regarded as evidence of an inferior condition of health among the members of that Society. For the more important purposes of Medical Science, the results in column 5 are easily available. Perhaps no simpler numerical test could be offered of the efficiency of particular modes of treatment; but to apply the results here given with much success, the figures should have been classified according to the sickness and mortality of particular diseases. A portion of the elementary data will admit of such a classification; and it is intended to publish the results on some future occasion.

Suppose a Medical Practitioner to have within the circle of his patients one thousand persons, whose ages vary from 21 to 70 years, and equally spread over that term of life; according to the results here given, he ought to expect 274 of them to be on his sick list dur-

ing the course of a year—that they would experience 2430 weeks' sickness in the aggregate—and that there would be about sixteen deaths out of that number in the same time; and presuming that he were to visit each patient every alternate day, it would produce 8,505 visits in the course of a year, or about 23 visits daily. Societies and many other public bodies adopt a practice of paying an annual sum for medical attendance and advice; and it will thus be seen that means are available by which to calculate the probable amount of labour and time that may be required for the discharge of such engagements.

It may at this place be again stated, that in applying the preceding results to individual classes, or in a few instances only, it should not be expected that they will in every case be confirmed. Nothing short of a refined classification is calculated to meet the peculiar aspect of all the cases presenting themselves. A review of Table XXII will shew the wide distinction which prevails between the ratio of sickness in the Rural, Town, and City Districts; and in particular trades or occupations the sickness sometimes is double in amount that in other employments. In sickness therefore, as well as in mortality, it is obvious that general results can be but of little practical value. Suppose it were attempted to conduct Societies in Liverpool, or any other large city in England, on the same terms that would be adequate for Societies in the Rural Districts of Kent and Essex—it is manifest that they could not be of long duration.

Here it may be also well to state, that if in any public inquiry it should be attempted to ascribe the increased amount of sickness in the Town Districts to the less healthy nature of the districts, or their peculiar local influence on health, the conclusion would certainly be fallacious. Precisely similar arguments to those made use of in reference to the mortality of those districts, will explain the differences in the ratio of sickness in the same places; and it is therefore to be inferred, that whatever sanitary regulations may be carried out for promoting the health of towns, the wide distinction between the rates of sickness and mortality in particular districts will still not disappear. The cause of that difference is beyond the reach of any sanitary measure; and unless a change were to take place in the character and machinery of the manufactures of a town, by which the workmen would be habituated to less restrained but more natural and complete physical exercises, no improvement in the state of health is to be looked for.

The evils, so far as relates to health, represented to exist by some writers to so frightful an extent, and to connect themselves with inferior sewerage, filthy streets, and ill-planned houses, are certainly overstated by them. The data brought forward have generally been of the most indefinite and insufficient nature; and when, in connection with this, the erroneous methods employed, and the promiscuous manner in which their figures are generally combined, are kept in view, it must seem surprising that the thinking and intelligent portion of the community should have given their opinions any credence, or believed their conclusions entitled to so much weight.

Perhaps no statistical facts are better established than the duration of life among the middle and upper classes of this country; and if the data brought forward in this paper be received as of sufficient

merit to represent the duration of life among the working classes, it will then appear clear that any important change to be hoped for in the value of life in the Town Districts, must be effected through other means than sanitary regulations.

Those persons purchasing Government Annuities, and having dealings with Assurance Companies, are certainly beyond the reach of any improvements to be introduced by local regulations; and if cleanliness of habit, comfort of dwellings, and fresh air, be of themselves powerful elements in raising the standard of life, their influence should be felt among that class of persons. But what are the actual results? The poor workmen inhabiting the miserable streets of our large towns, and inhaling their supposed noxious vapours, are actually longer lived than the affluent and upper classes, whose easy circumstances enables them to inhabit comparatively the palaces of the kingdom.

It is evident, from the great disparity in the value of life among different classes of workmen, whose conditions as to whatever is within the scope of public sanitary measures are the same, that other elements must exist having a powerful influence on the duration of life. It would further appear, by viewing the various classes of society more in connexion with the physical exercises to which they are habituated than in connexion with their moral position and rank in society, and consequently with their sanitary condition, that a better clue will be found to the differences in the duration of life. It is not to be expected that any arrangements whatever as to the drainage and planning of streets are likely to add to the longevity of a tailor; but if it were possible to give his frame the physical exercises of a ploughman, twenty per cent. would be added to the duration of his life. Neither is it to be thought that the plumber, painter, and glazier, is to be relieved from the poison of the metallic emanations to which he is subject; nor that the clerk can inhale the fresh air, and indulge in those exercises necessary to develop his physical constitution, while he follows the drudgeries of the counting-house. It is an aggregation of these, and other employments similarly conditioned, which makes up the excessive mortality of our large towns; and since it has been shewn in the preceding pages that this class of lives is also less healthy even in the country districts, and that the town populations are chiefly made up of persons following such occupations, the legitimate result to be expected is a shorter duration of life in towns, independent of any local influence on health. If improvements and changes are to be effected in the sanitary regulations of our large towns and cities, let them at once be carried out,—not upon the necessity of such municipal innovations to avert a pestilential havoc in human life,—but on the true merits of the question, the comforts, conveniences, and elevation of taste and moral purity, thence arising.

