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The Mortality among Assured Lives viewed in relation to the Sums at Risk

George C. Stenhouse

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*The Mortality among Assured Lives
viewed in relation to the
Sums at Risk.*

BY

GEORGE C. STENHOUSE, F.F.A.,

SCOTTISH WIDOWS' FUND AND LIFE ASSURANCE SOCIETY.

The Mortality among Assured Lives viewed in relation to the Sums at Risk.

(Read before the Actuarial Society of Edinburgh, 4th April 1889.)

WHAT was probably the beginning of knowledge in this country in regard to the subject of Life Annuities and Assurance was the publication, in 1661, by John Graunt, of his *Natural and Political Observations on the Bills of Mortality*. In that publication we have no doubt the primary data on which the business of Life Assurance is founded. By the gradual development and extension of that business, it soon came to be recognised that in all calculations connected with the subject it was needful to proceed on a sound fundamental basis. For not only was it seen to be necessary that the affairs of an institution conducting such business required to be administered for the immediate benefit of those concerned; but it was also observed that there were many prospective liabilities, and that therefore it required to be built on such a solid and substantial foundation as to be able to meet all obligations in the future. This is appreciated by all who are in any way interested in Assurance.

As Life Assurance progressed it was recognised that greater accuracy and carefulness was indispensable, and many mortality tables were published. These I shall not attempt to enumerate, nor to trace the improvements which were observable in them. Through the lapse of time, and by the "comparison of statistics with statistics, and history with history," we have got our knowledge of human mortality very much extended, and have now tables on which we can proceed with the greatest confidence. For ordinary work-a-day use we have the tables founded on the Mortality Experience collected by the Institute of Actuaries, which are probably the most perfect and reliable in existence. As far as we have yet been able to discover, however, human life is not governed by an immutable law. There are various influences continually at work, over which we have little or no control, and so long as this is the case we must continue our investigations

until we discover if there is any underlying law of mortality, or if we cannot formulate any definite law, until our tables attain greater and greater accuracy, and come nearer and nearer perfection.

In one of the recent Presidential Addresses to this Society, that for the Session 1886-87, the Honorary President, Mr. Spencer C. Thomson, touching on the rate of mortality, said: "It is being levelled down,—partly by means of more rapid intercourse between one part of the world and another, whereby failing health is more rapidly recuperated than in former times,—partly by the introduction of an improved sanitary system in unhealthy localities, and a more wholesome mode of life. There are still, however, considerable differences for different groups, whether the classification is by *place of residence*, by *occupation*, by *mode of life*, or by *race*; and it is an ever altering problem with Life Offices to decide how these distinctions had best be drawn, and to what extent they are to be maintained and given effect to."

If there were statistics available on all the points mentioned by Mr. Thomson they would be of immense use to Insurance Offices, for among those who are daily applying for Life Assurance there are all classes and conditions of men, and in selecting business from among these it is necessary that a bad class of lives is not admitted. No doubt many investigations have been made with the view of extending our knowledge regarding the vitality of various classes of lives. Much, however, still remains to be done before our knowledge will be complete regarding the rates of mortality which prevail among these different classes.

The country at large seems to be awakening to the desire for additional statistical information. As you are probably aware, a deputation recently made advances to Government for the purpose of suggesting some alteration in the mode of carrying out the Census returns in the United Kingdom, and among the improvements proposed the necessity was urged of a complete classification of the population, by occupation, trades, and employments. If this is done, and the deaths are classified in the same way, we will obtain a vast amount of useful information, and will be able to judge of the relative healthiness or otherwise of different lines of life, and to trace the influence different callings have on the prospects of longevity. Till such information is available, however, we have to depend altogether on private enterprise. Much can be done in this way, and though, of course, it will be a matter of time before thorough investigation can be made into all the points which have at various times been suggested by different writers, we may be able to do a little; and I think it is incumbent on each of us, when opportunity occurs, to help forward the work by putting on record any statistics bearing on any interesting subject which may happen

to come under our notice. It is only thus that knowledge is increased and science advanced.

As far as I am aware, the matter which I am taking up to-night, viz. "The Mortality among Assured Lives viewed in relation to the Sums at Risk," has not been very fully investigated in this country, and in submitting the paper to the Society I hope I have chanced upon something which may prove both interesting and instructive.

With these preliminary remarks, we shall now pass on to the subject more particularly in hand, which will be treated under the following heads :—

I. INVESTIGATION—

1. Period embraced.
2. Data collected.
3. Lives included.

II. CLASSIFICATION—

1. Decrease by existence.
2. Do. discontinuance.
3. Do. death.

III. FINAL TABLES—

1. Mortality under five years. (1) Sums assured to £500 inclusive.
2. Do. five years and over. (2) Sums assured over £500 to £3000 inclusive.
(3) Sums assured over £3000.

I.—INVESTIGATION.

Not long since the Scottish Widows' Fund and Life Assurance Society had occasion to make an investigation into the mortality experienced among various classes of assured life, and, through the kindness of Mr. Turnbull, I have been permitted to make use of the original data then obtained in the preparation of the following paper.

The results obtained from the experience of an individual office are held by many to be of but "limited usefulness," and are sometimes considered as of comparatively little value. Provided, however, the office is one doing a large general business—that is to say, not confining its operations to one particular class of lives,—and if its operations have been considerable, and have extended over a range of years wide enough to let the full effects of mortality be

felt, I do not see why the results obtained should not be useful. The office with which we are dealing does, I think, give a wide enough basis to go upon, and I hope, therefore, the conclusions arrived at may be deemed trustworthy and of some practical value.

In determining the period which was to be embraced in the investigation to which I have referred, it was decided to begin from a point where the medical examination was fairly satisfactory. I say "fairly satisfactory," for, viewed from the standpoint of the present day, it would probably be thought not quite so perfect as it might be. It may be interesting to the members to learn what, in the early part of the century, was sufficient to satisfy a Board of Directors that a life was eligible for assurance, and I therefore give details of all the documents required in connection with one of the earliest proposals made to the office. The particulars are taken from a proposal dated 1st October 1814.

There is first the proposal, which begins with the narrative that A. B. is desirous of becoming a member of the Society, and a contributor to the stock and funds, in order to secure the provision specified in a schedule which was annexed. The proposer then declares that he is in a good state of health, and not subject to any disease which tends to the shortening of life, and that he does not exceed a certain age. The proposal then goes on to say that if any untrue averment is made in the declaration the benefit "shall cease and determine," and the payments which have been made are to be forfeited to the office. It further states that if the proposer is admitted as a member, he declares his accession to the Articles of Agreement and Constitution of the Office. There then follows a long reference to the said Articles and Constitution, and the proposal concludes, in the manner common to all Scotch deeds, with a testing-clause setting forth the place and date of signing, and the names, designations, and addresses of the two witnesses before whom it was signed.

This was followed by a schedule which, in the case in question, was completed thus :—

"Provision to be secured,	<i>Five hundred pounds sterling.</i>
Contingency on which it is	} <i>The within A. B.'s demise.</i>
to become payable,	
Whether by a single or by	} <i>By annual payments."</i>
annual payments (or if partly	
by both, in what proportions),	

Immediately below this, on the same sheet of paper, is a printed certificate, in the undernoted terms, which had to be completed by a medical man. The portions which he had to fill up are printed in italics.

CERTIFICATE BY A PHYSICIAN OR SURGEON.

"I. H. J., Surgeon in Edinburgh, do hereby certify that A. B., Writer in Edinburgh, mentioned in the within declaration, did appear before me this day, and that I have known *him* for *twelve* years, and that to the best of my knowledge *he* hath never been afflicted with gout, asthma, or any other disease which tends to the shortening of life, and that I do believe *his* present state of health to be good, and *his* habits of living not such as to endanger *his* life. Given at *Edinburgh*, the *first* day of *October* 1814.

(Signed) H. J.

This was all that was required. Though the proposal itself was somewhat formidable, the medical certificate, on the other hand, you see, is of the simplest nature, and it is to be noted that neither agents' nor friends' reports were called for. In course of time, as the necessity of increased carefulness came to be recognised, it became evident that a personal examination was needful. Possibly also the advance which was being made in medical science had its effect. Dr. Laennec of the Hôpital Necker invented the stethoscope, and in 1819 published his *Traité de l'Auscultation Médiate*. It may be mentioned in passing, that shortly after Dr. Laennec's treatise appeared, it was discovered, by means of the art of his own creation, that he was afflicted with consumption, and though he continued to practise in Paris for a few years, his health gradually failed, and he retired to die in his native province of Brittany. His publication "undoubtedly produced a greater effect, in so far as the advance of diagnosis is concerned, than any other single book," and was probably one of the factors which led to the change in the office practice which shortly followed. In the year 1826 a report from the proposer's private medical attendant began to be called for; but it was not till six years later that the office required an examination by its own medical man, and it was still later before it was realised that the study of family history might be useful in giving some idea of a proposer's chances of longevity. The year 1835 saw, for the first time, questions as to family history inserted in the medical report. Naturally the forms then in use have now been still further improved upon, but the examination was considered sufficiently stringent at the latter date to enable the lives to be regarded as first-class, and the beginning of 1835 was therefore taken as the starting-point for the investigation, the period embraced extending over the fifty years from 1st January 1835 to 31st December 1884.

It is perhaps a pity that all the policies issued since the foundation of the office were not included ; for though in the twenty years (1815-1834 inclusive) only about 2700 policies were issued, a very large proportion of these must have disappeared by death in the period under review, and would therefore have given a larger number of deaths for comparison. At that time it would appear that there were, comparatively speaking, more large assurances effected than at present. Not perhaps for very large sums, for offices then did not retain such heavy risks as now, but certainly for sums which would fall under the second class afterwards referred to in this paper. Then, it seems only to have been what would be called the educated and better classes who appreciated assurance, and had the confidence to invest their money in making a provision of this nature for those they left behind. Now, all classes understand the value of an assurance policy, and as more small policies are effected at the present day than formerly, experience seems to show that the tendency is for the average sum assured to decrease.

As the most convenient mode of obtaining mortality results is acknowledged to be with cards, the "card system" was of course adopted. We had on hand the cards which were used in the experience published by the Institute of Actuaries in 1869. These were brought up to date, and again made use of in the investigation. This to a certain extent decided the new form of card to be used, as of course it was desirable to have them somewhat similar for convenience in handling. Every one here is no doubt familiar with the Scotch form of card, but it is given on the opposite page, and alongside the form which was used for the more recent business.

From the latter it will be seen that subdivision of the experience according to nationality, occupation, locality, etc., was contemplated. The new cards, it will be observed, bear the number, amount—alongside of which was inserted the class,—date of issue, date of exit, mode of exit, and duration of the policy. They also bear the name, nationality, occupation, date of birth, age at entry, and age at exit of the assured life ; and further show whether the life is healthy or diseased, and the locality in which the policy was effected. A space was left for the cause of death, but this was not filled up, as the necessary information did not appear in the policy registers. I may mention that in the case of joint-life policies two cards were written. If one of the lives had died the other was treated as a lapse, the card showing that it was so "by death of joint assurer." The cards, after being altered or written, were all carefully compared with the registers.

It is, I imagine, unnecessary to go over in detail how the cards

OLD CARD.

No.	£	
Life		
English, Scotch, Irish, or Foreign		
Healthy or Diseased		
Date of Entry	18	Years in Force.
Date of Exit	18	Age n. b. d. &c.
Duration		
Date of Birth	1	
Age at Entry		
Age at Exit		
Mode of Exit		
Cause of Death.		
Remarks.		

viewed in relation to the Sums at Risk.

NEW CARD.

No.	£	
Life.....		
Occupation.....		
Branch.....Country.....		
Healthy or Diseased		
Date of Entry	18	Years in Force.
Date of Exit	18	Age n. b. d. &c.
Duration		
Date of Birth	18	
Age at Entry		
Age at Exit		
Mode of Exit		
Cause of Death.		
Remarks.		

should be filled up. This was fully explained by Mr. J. P. Longstaff in his paper, "On Investigations into the Rate of Mortality among Assured Lives," which was read at last meeting. I may also refer you to pages 11 and 12 of the "Mortality Experience of Life Assurance Companies, collected by the Institute of Actuaries" for information on the point.

Mr. Meikle, in his paper "On the Official Publications of the Mortality of Assured Lives"—*Transactions of the Actuarial Society*, vol. i. p. 309—recommends the inclusion of the years and months during which a life has been under observation; and Mr. Ryan in his paper, "On the Method of estimating expected Deaths and expected Claims" (*J. I. A.*, vol. xxvi. p. 249), gives a form of card to contain similar information, with precise particulars as to the mode in which it should be completed, in order to show the exact duration of the risks. Such exactness is very desirable, but it will be readily understood that to have adopted the suggestions contained in these papers would have involved an immense amount of additional labour. To have made the necessary alterations, and to have filled in the exact dates of birth, of entry, and of exit in the 20,000 cards we had on hand, would have necessitated reference to registers long disused, and papers long lost sight of, and was considered an unnecessary refinement. The policies were therefore all treated, except in the first year of assurance, as if they had been so many complete years in force, calendar years being taken in place of policy years.

The mode of treatment of the first year of assurance is a vexed question among actuaries. In a letter to the Editor of the Journal (*J. I. A.*, vol. xvi. p. 75), Mr. Sutton calls attention to the matter. Mr. Berridge, in his paper "On the Values of Annuities on Assured Lives" (*J. I. A.*, vol. xix. p. 351), touches on the subject. Then Mr. King deals with it in his well-known contribution "On the Mortality amongst Assured Lives and the requisite Reserves of Life Offices" (*J. I. A.*, vol. xix. p. 381), and, appreciating the difficulty, explains that he gets over it by "treating year 0 as a complete year." And Mr. Sprague again takes it up in his paper "On the Premiums for the Insurance of Recently Selected Lives" (*J. I. A.*, vol. xx. p. 95), and goes into the matter very fully, making, as is his wont, some valuable suggestions on the point. No hard-and-fast rule can be laid down. It will very much depend on circumstances applicable to each individual office how the first year should be dealt with in any inquiry into the mortality. In the present investigation the Institute plan was adopted, the assumption made as to entrants being that they entered equally throughout the year, that is to say, the lives were only assumed to be exposed to risk for six months during the calendar year of entry.

When the cards were all completed they were at first divided into four large groups:—

1. Healthy Males.
2. Diseased Males.
3. Males subject to extra for foreign residence or occupation.
4. All females.

By far the largest number of Assurances are effected on male lives, and attention was consequently confined to these in this investigation. In the tables which follow only the first of the above groups was dealt with. Any male life which had on any account been rated up was not included. These were all treated as diseased lives. Taking then the Healthy Male Lives, they were subdivided as follows:—

CLASS I.—Those assured for sums to £500 inclusive.

CLASS II.—Those assured for sums over £500 to £3000 inclusive.

CLASS III.—Those assured for sums over £3000.

Bonuses are not included; the above figures apply to the original sums assured only.

As occupation has of course a considerable influence, not only on the mortality experienced, but also on the sums assured, I took out, as a matter of curiosity, the occupations for a series of ages in each of the three classes. The results are shown in the lists which follow.

In the subdivision of these classes I have given under Section 1 the occupations from which the majority of the assurances is drawn; under Section 2 the occupations which supply only a moderate number; and under Section 3 those which furnish but a very small proportion of the policyholders. Further, in subdivisions 1 and 2 the occupations are arranged in order according to the number of risks; but in section 3 the numbers are too small to admit of such arrangement, and they are given alphabetically.

CLASS I.—*Sect. 1.*—Clerks (including book-keepers and cashiers), merchants (various), buyers and travellers, drapers, farmers, warehousemen, manufacturers (various), salesmen (shopmen), engineers, schoolmasters, managers (various), tailors, grocers, accountants, builders, doctors, chemists, printers, ironmongers, clergymen, jewellers and watchmakers, solicitors, surgeons, painters, plumbers.

Sect. 2.—Stationers, butchers, brewers, cabinet-makers, officers (Army and Navy), millers, ironfounders, auctioneers, architects, bootmakers, gardeners and nurserymen, surveyors, bakers, hair-dressers, hotel-keepers, artists, photographers, saddlers, commis-

sion agents, confectioners, butlers, professors, dentists, carpenters, upholsterers, tobacco-dealers, servants, journalists, mine-inspectors, gas-fitters, dyers, cab and car proprietors, contractors, barristers, bleachers, carriers, coachbuilders, dairymen, engravers, fitters, masons, stockbrokers, veterinary surgeons, tallow-chandlers.

Sect. 3.—Agents, analysts, artists' colourmen, barge-owners, bellhangers, bookbinders, booksellers, brassfounders, bricklayers, carriers, cattle-dealers, clockmakers, coachmen, compositors, consuls, designers, fell-mongers, furriers, game-dealers, hatters, huntsmen, laundry proprietors, librarians, mantle-makers, messengers, missionaries, organists, pawnbrokers, piano-makers, postmasters, railway superintendents, sculptors, shipowners, shorthand writers, stevedores, spinners, students.

CLASS II.—*Sect. 1.*—Merchants (various), clerks (including book-keepers and cashiers), clergymen, solicitors, doctors, farmers, engineers, surgeons, manufacturers (various), brewers, drapers, warehousemen, wine-growers and merchants, stockbrokers, accountants, commercial travellers, chemists, barristers and advocates, bankers, schoolmasters, shipbrokers, managers.

Sect. 2.—Commission agents, builders, agents (land, estate, etc.), millers, grocers, officers (Army and Navy), architects, surveyors, bleachers, ironfounders, tea-dealers, dyers, auctioneers, produce-brokers, dentists, students, professors, secretaries, shipowners, tailors.

Sect. 3.—Authors, bakers, bellhangers, booksellers, bootmakers, buyers, carriers, cattle-dealers, cigar and tobacco merchants, Civil servants, clothiers, confectioners, contractors, coopers, copper-smiths, coroners, corn-dealers, cotton-brokers, dancing-masters, designers, draughtsmen, drysalterers, factors, fishmongers, fitters, furriers, gamekeepers, graziers, gunmakers, hosiers, ironmongers, jewellers and watchmakers, joiners, missionaries, musical artists, music-sellers, newspaper proprietors, opticians, outfitters, painters, papermakers, pawnbrokers, plumbers, police-officers, printers, publishers, quarriers, registrars, ropemakers, spinners, stationers, sugar-refiners, tallow-chandlers, tanners, upholsterers, veterinary surgeons, wagon-builders, waiters, wool-brokers, yeomen.

CLASS III.—*Sect. 1.*—Merchants (various), aristocracy, manufacturers (various), solicitors, bankers, clergymen, officers (Army and Navy), brokers, spinners, engineers, brewers, barristers and advocates, landed proprietors, wine growers and merchants, stock-brokers.

Sect. 2.—Iron and coal masters, doctors, civil engineers, ship-builders, farmers (gentlemen), shipowners, bleachers, surgeons, shipbrokers, accountants, public officials, papermakers, millowners, managers, secretaries, cashiers.

Sect. 3.—Agents, builders, buyers, chemists, contractors, drapers, drysalters, factors, hosiers, land agents, publishers, schoolmasters, underwriters, upholsterers.

It will be observed that in this third class we have some groups to which there is nothing corresponding in the other lists, that is to say the aristocracy,—who furnish a fair quota of assurers,—landed proprietors and gentlemen farmers.

It is interesting to observe the change in position which different occupations take in the three classes. Thus clerks take a strong lead in Class I., furnishing more than three times the number of policyholders that any other occupation did; they take only the second place in Class II.; while, after a careful examination, we fail to find them at all in Class III.

II.—CLASSIFICATION.

Before the final results for the various sums assured were obtained, the cards had all to be classified and tabulated, and this brings me to the second division of the paper.

The mode of dealing with mortality cards is probably well known to the majority of those present, but some may neither have had occasion to study the subject, nor opportunity to make such investigation, and I hope I shall not be deemed tiresome in shortly sketching the mode of procedure. Of course the procedure is the same for each of the three classes into which the sums have been divided.

Having then the cards for the three classes above mentioned, the object in view is to ascertain the “exposed to risk” and the “died” in each year of assurance for each age at entry. In order to obtain this we proceeded in the following manner. It was of course desired to deal with the number of lives only, not the number of policies.

1. The cards were in the first place arranged alphabetically, so that similar names were brought together, and the cards representing the policies on each life were put in consecutive order. In the case of similar names, comparison of dates of birth, occupation, date of death, cause of death, reference to the registers or the proposal papers, enabled us to determine as to the identity.

When there were more assurances than one on the same life—

(a) If the assurance were continuous the particulars were transferred to a separate card, the date of the earliest policy being taken as that of entry, and the date on which the last disappeared from observation as that of exit. This card was then used and the others put aside.

(b) When an interval occurred between first and subsequent

assurances, as in the case where a policy lapsed and a new assurance was afterwards effected, both cards (when two policies) were left in. If there were more than one additional assurance, the cards, when the subsequent assurances were continuous, were treated as above explained. (Sub-sec. *a.*)

It will thus be seen that no life could appear twice in the same year of life.

2. The cards representing duplicate assurances having thus been eliminated, those remaining were then arranged into groups according to each age at entry.

3. These groups were again divided into three others according as they were existing, discontinued, or had died.

4. These again, as subdivided, were arranged according to age at exit, or, what is the same thing, according to duration.

The cards were gone over so often in the three arrangements last detailed, that any mistake made in one step was readily discovered when the subsequent one was taken.

These steps having been finished, we next proceed to the tabulation of the facts.

5. The cards at each age of exit were counted, and the results (the existing, discontinued, and died) recorded in the respective columns in tables of the form of Table I., to which we will now refer.

As any mistake in this stage of the work would have been a serious matter, and might have considerably affected the results, the work was either very carefully checked or done in duplicate.

6. The existing, discontinued, and died, at each age—*i.e.* each set of figures in columns 1, 2, and 3 of the table—were then summed across, and the total inserted in column 4. Half of the discontinued (col. 2) was entered in column 5, the assumption of course being that discontinuances (surrenders and lapses) take place equally throughout the year.

A check was obtained as each age of entry was completed, or earlier if necessary, by seeing if the sum of column 4 equalled the sum of columns 1, 2, and 3, and the sum of column 5 equalled half the sum of column 2.

7. The total entrants at each age—the summations of column 4—was then placed at the head of column 4, in red ink, and the figures in the column were deducted one by one.

In this the work checked itself, for if correctly done there was no remainder.

8. Over the first set of figures in column 5 half the number of entrants was then written, and deducting from it the figures, if any, in the first line of the column, the exposed to risk in the first year

of assurance was obtained. This was extended in the exposed to risk column, No. 6, opposite year of assurance "0."

9. For the exposed to risk in the subsequent years of assurance, each set of figures in column 5 was deducted from the red ink figures immediately above it in column 4, the results in every case being extended in column 6.

The red-ink figures in column 4 and the figures in column 6 were then summed, and, deducting from the former the total already obtained of column 5, *plus* half the entrants, gave a check on the summation and correctness of column 6. The reason that half the entrants is added is, of course, that in column 4 the whole number is inserted, while from the assumption made regarding the year of entry, only half of these appear in the exposed to risk column.

10. Having now got the exposed to risk and died for each year of assurance at each age at entry, the final step in the preliminary arrangement was to transfer these figures to a table of the form of Table II., arranged according to the current or present age, that is, at the close of the observations. This table hardly calls for any explanation.

Taking, for example, age 35 at entry, the figures showing the exposed to risk and died in the first year of assurance (cols. 6 and 3 of Table I.) will be entered under current age 35 in Table II. in the first year of assurance—year of assurance "0"; for the second year of assurance the figures from Table I. will be entered in Table II., under age 36, in the second year of assurance—year "1"; for the third year of assurance the figures from Table I. will be entered in Table II. under age 37 in the third year of assurance—year "2"; and so on, running diagonally downwards till all the exposed to risk and died, according to Table I., are transferred to Table II. Every age at entry is treated in precisely the same way. After all the ages were finished, the work was carefully compared. A cross summation, inserted in the last double column, of the five ages in each sheet gave the figures for quinquennial groups. Summing now this table for the years of assurance 0 to 4, and from 5 onwards, we had the figures to enable us to obtain our final results for assurances under 5 years, and 5 years and over, in force. Blank lines were left after every fifth age, so that summations of the exposed to risk and died can be filled in either to each point so left, or from point to point as may be desired. From this it will be seen that results can readily be obtained for quinquennial, decennial, or other periods of assurance.

As a final check, a summation was made of the totals of the "exposed to risk" and "died" in the first set of tables, and a summation of all the similar totals in the second set, and the results for each of the three classes were found to agree.

TABLE I.

SUMS ASSURED OVER £500 TO £3000 INCLUSIVE.														
AGE AT ENTRY, 35.									AGE AT ENTRY, 36.					
TOTAL ENTRANTS, 452.									TOTAL ENTRANTS, 436.					
Age at Exit.	Existing.	Discontinued.	Died.	Sum of Cols. 1, 2, 3.	Half of Col. 2.	Exposed to Risk.	Year of Assurance.	Existing.	Discontinued.	Died.	Sum of Cols. 1, 2, 3.	Half of Col. 2.	Exposed to Risk.	Age at Exit.
1	2	3	4	5	6			1	2	3	4	5	6	
35	9	...	1	452 10 442	226 ...	226	0	13	...	1	436 14 422	218 ...	218	36
36	16	4	1	21 421	2	440	1	17	5	2	24 398	2·5 4	419·5	37
37	12	6	4	22 399	3	418	2	9	8	4	21 377	4	394	38
38	12	6	2	20 379	3	396	3	9	10	2	21 356	5	372	39
39	14	3	1	18 361	1·5	377·5	4	13	7	1	21 335	3·5	352·5	40
40	16	7	1	24 337	3·5	357·5	5	6	3	2	11 335	1·5	333·5	41
41	16	4	1	21 316	2	335	6	10	4	3	17 307	2	322	42
42	11	5	1	17 299	2·5	313·5	7	10	5	2	17 290	2·5	304·5	43
43	13	6	3	22 277	3	296	8	16	3	5	24 266	1·5	288·5	44
44	9	5	4	18	2·5	274·5	9	15	3	3	21	1·5	264·5	45

Table No. 1, it will be seen, is of much the same form as that used by Mr. Meikle in ascertaining the rate of mortality experienced in the Scotch Offices, *J. I. A.*, vol. xiii. p. 265; the above form, which is simpler than Mr. Meikle's table, and I think more adapted for the special purpose I had in view, was proposed by Mr. Turnbull in the previous investigation to which reference has already been made (see p. 231). He also suggested at the same time part of the above mode of arranging the data in order to obtain the number exposed to risk and the number of deaths.

All the explanation that the table on the next page requires has already been given. The red-ink figures inserted in the first five of the double columns are the totals of the "exposed to risk" and "died" for risks of under 5 years, and will be found under their respective ages in Table No. VI., hereafter given; and those in the last double column will be found in the Quinquennial Table, No. VIII.

TABLE II.

SUMS ASSURED OVER £500 TO £3000 INCLUSIVE.													
CURRENT AGE.													
Year of Ass ^{ce} .	35		36		37		38		39		35 to 39		Year of Ass ^{ce} .
	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.	
0	226	1	218	1	198·5	...	192·5	...	189	1	1024	3	0
1	471	1	440	1	419·5	2	386	3	371·5	1	2088	8	1
2	499·5	2	445·5	2	418	4	394	4	364	1	2121	13	2
3	447·5	...	469	1	417	3	396	2	372	2	2101·5	8	3
4	450·5	1	427·5	2	447·5	2	398·5	5	377·5	1	2101·5	11	4
	2094·5	5	2000	7	1900·5	11	1767	14	1674	6	9436	43	
5	483	...	422	2	401·5	7	424·5	3	376	3	2107	15	5
6	419·5	...	456	1	398	...	375	3	399·5	2	2048	6	6
7	340·5	4	409·5	1	434·5	1	377·5	4	356	4	1918	14	7
8	322	2	325	3	387·5	4	406·5	2	350·5	1	1791·5	12	8
9	274	1	303	3	305·5	1	357	2	380	3	1619·5	10	9

III.—FINAL TABLES.

The preliminary tables being now completed, we are in a position to proceed to the most important part of the paper,—the final results,—and this brings me to the third section.

The total number of lives under observation was 39,303, made up as follows:—

CLASS I. Lives assured for sums to £500 inclusive,	26,211
„ II. Lives assured for sums over £500 to £3000 inclusive,	11,653
„ III. Lives assured for sums over £3000,	1,439
	<u>39,303</u>

Whereof there were existing at 31st December 1884,	25,224
Whereof had discontinued their assurances,	6,762
Whereof had died,	7,317
	<u>39,303</u>

In order to obtain reliable results, large numbers are of course indispensable, as otherwise great fluctuations are sure to appear. Further, it is impossible to generalise or to place much dependence

on results obtained from narrow premises. The number of lives assured for sums over £3000 is perhaps hardly sufficient to entitle us to attach great weight to the rates of mortality derived from the observations among them, and had they stood alone we could probably not have done so; but viewed in connection with the results obtained in the other two classes, the general tendency cannot be ignored.

I have not considered it necessary to give detailed particulars of the entrants at each age, but the following table shows the numbers obtained by grouping the ages.

III.—TABLE SHOWING THE NUMBER OF ENTRANTS IN EACH OF THE THREE CLASSES, AND THE PERCENTAGE OF THESE TO THE TOTAL.

Ages at Entry.	CLASS I. Sums assured to £500 inclusive.		CLASS II. Sums assured over £500 to £3000 inclusive.		CLASS III. Sums assured over £3000.		Ages at Entry.
	Entrants.	Per-centage.	Entrants.	Per-centage.	Entrants.	Per-centage.	
To 24	3,933	15·01	1,220	10·47	120	8·34	To 24
25—34	12,312	46·97	5,258	45·12	564	39·20	25—34
35—44	6,700	25·56	3,456	29·66	415	28·84	35—44
45—54	2,544	9·70	1,335	11·46	264	18·35	45—54
55—64	639	2·44	336	2·88	71	4·93	55—64
65 & over	83	·32	48	·41	5	·34	65 & over
	26,211	100·00	11,653	100·00	1439	100·00	

From this it is seen that to age 24 the first class show the largest percentage of entrants, the second class a somewhat less one, and the third class show the smallest. Between ages 25 and 34 the percentages in all three classes are high, but also decrease as the sums increase. When we come to ages 35-44 the position of affairs is a little altered, the smallest policyholders showing the lightest percentage, while the other two nearly agree. At ages 45-54, again, the figures go directly in the opposite direction from that found to obtain at the young ages, the percentages gradually increasing with the sum assured. The same is found to hold between ages 55 and 64. Above age 65 the figures are so small as not to be of much practical value. The average age at entry in each of the three classes is 33·3 years, 34·7 years, and 36·6 years respectively.

From this table, then, it would appear that while in all three classes the majority of assurances are effected between the ages of 25 and 34, a larger proportion of assurances for sums ranging from £500 to £3000 is effected above age 34, than for smaller sums, while the proportion is still greater for amounts exceeding £3000. The tendency, in fact, seems to be that men assuring for large amounts approximate more nearly to middle age before effecting policies than those assuring for small sums. This is, however, what might be expected, for it is only when a man is in a fair way to amass a competency, or has attained a good position in life, and has this firmly secured, that he can afford to assure for a large sum, and of course, as a rule, this is only accomplished as middle age is approached.

Now, comparing the Existing, Discontinued, and Died in the three classes, we have the following figures :—

	CLASS I.	CLASS II.	CLASS III.	TOTAL.
Existing, . . .	17,156	7,239	829	25,224
Discontinued, . .	4,880	1,695	187	6,762
Died, . . .	4,175	2,719	423	7,317
	<u>26,211</u>	<u>11,653</u>	<u>1439</u>	<u>39,303</u>

And taking the percentages computed from the above, we have :—

Existing, . . .	65·453	62·121	57·610	64·178
Discontinued, . .	18·618	14·546	12·995	17·205
Died, . . .	15·929	23·333	29·395	18·617

Examining these percentages in detail, we at once observe that :—

1. The proportion Existing gradually diminishes in the three classes,
2. The proportion of Discontinuances gradually diminishes in the three classes, while
3. The proportion of Deaths gradually increases in the three classes.

Looking at the larger proportion of Existing and Discontinued in the first class, we are forced to the conclusion that business is more pushed among people who assure for small amounts than among the others. One cannot help being struck by the considerably larger proportion of Discontinuances among the smallest policyholders. The assurers in this class have unquestionably the greatest struggle for existence, and probably are most liable to failure in life. They, without doubt, feel most keenly the effects of bankruptcy, and of reduction of income through failure in health, and naturally a policy is one of the first sacrifices made. Another cause of the larger per-

centage of discontinuances, however, may be that the assurances are effected at earlier ages, before any settled position in life has been attained, and consequently, when the assured go abroad to push their fortunes many assurances are dropped. On the other hand, the wealthier classes lead altogether easier lives. Their incomes are more secure, and they are able, when ill-health overtakes them, to call in the best medical skill, and have the means to take themselves away to health-resorts to recuperate. These are points which not only affect the discontinuances, but are bound to have a considerable influence on the mortality as well. In the one class, death comes sometimes almost as a relief; in the other, every precaution is taken to ward it off as long as possible.

The "years of life" enjoyed—that is to say, the total of the Exposed to Risk columns—by the 39,303 entrants from the date of their assurances to 31st December 1884 were:—

	CLASS I.	CLASS II.	CLASS III.	TOTAL.
Under 5 years in force, .	101,600·5	47,440	5,960·5	155,001
Over ,, ,, .	182,323·	122,349	18,280·	322,952
	<hr/> 283,923·5	<hr/> 169,789	<hr/> 24,240·5	<hr/> 477,953

Giving as the average } duration of the risks, . }	10·832 yrs.	14·570 yrs.	16·845 yrs.	12·16 yrs.
---	-------------	-------------	-------------	------------

From this it will be seen that the average duration in Class I. is 3·738 years less than in Class II., and 6·013 years less than in Class III., a very important fact, which must not be forgotten when contrasting the rates of mortality. Owing to the shorter average duration, the small policyholders must have undergone medical examination more recently than the others, and the benefit of selection being therefore greater among them, we would expect it to follow as a matter of course that this class should show the most favourable results. We shall afterwards see whether this is borne out by the facts.

Before proceeding to compare the relative mortality among the three classes of risk mentioned, I deemed it well to compare the general mortality experienced by the whole with the mortality of the H^m table, now recognised as a standard. It is open to question if such a comparison was necessary to the inquiry with which this paper more particularly deals; but having made it, as it is at least interesting, and may prove useful in other investigations, I give the Table of Mortality, No. IV., on which it is founded, and the results.

Table IV., on the following page, shows the total number exposed to the risk of mortality, and the subdivision of the assured according as they were under 5 years, and 5 years and over, under observation.

IV.—TABLE SHOWING THE NUMBER EXPOSED TO THE RISK OF MORTALITY,
THE NUMBER OF DEATHS, AGE BY AGE.

Age.	All Durations.		Under 5 Years.		5 Years and over.		Age.	All Durations.		Under 5 Years.		5 Years and over.	
	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.		Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.
6	1	...	1	...	...	...	53	9,882·5	140	1,451·5	8	8,431·	132
7	2	...	2	...	...	...	54	9,449·	146	1,231·5	17	8,217·5	129
8	4·5	...	4·5	...	...	...	55	8,973·5	156	1,039·5	18	7,934·	138
9	8	...	8	...	...	...	56	8,479·5	173	908·	15	7,571·5	158
10	12	...	12	...	...	...	57	8,027·5	212	785·	20	7,242·5	192
11	16·5	...	14·5	...	2	...	58	7,494·5	174	672·5	8	6,822·	166
12	21	...	19	...	2	...	59	7,047·5	173	600·	13	6,447·5	160
13	29	...	22	...	7	...	60	6,618·5	177	521·	5	6,097·5	172
14	53	...	44·5	...	8·5	...	61	6,196·5	190	451·	14	5,745·5	176
15	102	...	88	...	14	...	62	5,730·	190	360·	8	5,370·	182
16	162	...	150	...	12	...	63	5,287·5	178	309·5	8	4,978·	170
17	228·5	...	212·5	...	16	...	64	4,889·5	181	265·5	8	4,624·	173
18	332·5	1	311·5	1	21	...	65	4,488·	158	208·5	4	4,279·5	154
19	498·5	3	451·	3	47·5	...	66	4,126·	176	176·5	6	3,949·5	170
20	736·5	2	657·	2	79·5	...	67	3,742·5	161	147·	7	3,595·5	154
21	1,175·5	6	1,052·5	6	123	...	68	3,375·	170	105·5	5	3,269·5	165
22	1,863	8	1,685·5	7	177·5	1	69	3,026	156	77	4	2,949	152
23	2,764·5	12	2,489	9	275·5	3	70	2,696·5	158	60	1	2,636·5	157
24	3,764	16	3,374·5	12	389·5	4	71	2,418	141	48	2	2,370	139
25	4,942·5	16	4,388·5	13	554	3	72	2,129·5	128	37·5	2	2,092	126
26	6,206·5	36	5,317·5	27	889	9	73	1,880·5	171	29	3	1,851·5	168
27	7,501·5	29	6,081·5	20	1,420	9	74	1,614	138	24	...	1,590	138
28	8,672	44	6,665	26	2,007	18	75	1,367	101	17·5	2	1,349·5	99
29	9,812	47	7,070	27	2,742	20	76	1,180	100	8	...	1,172	100
30	10,966	61	7,412·5	34	3,553·5	27	77	1,018·5	120	7·5	1	1,011	119
31	12,010·5	71	7,548·5	35	4,462	36	78	824	99	3	1	821	98
32	12,807	66	7,526·5	29	5,280·5	37	79	670·5	70	3·5	...	667	70
33	13,459·5	52	7,364·5	25	6,095	27	80	548·5	71	4	...	544·5	71
34	14,021·5	87	7,080·5	43	6,941	44	81	436·5	63	4	1	432·5	62
35	14,463	99	6,709·5	38	7,753·5	61	82	342·5	49	3	...	339·5	49
36	14,784·5	97	6,322·5	33	8,462	64	83	273	38	1	1	272	37
37	14,888	103	5,964·5	32	8,923·5	71	84	206	39	...	...	206	39
38	14,939	117	5,531·5	34	9,407·5	83	85	157	29	...	...	157	29
39	14,928·5	103	5,173·5	26	9,755	77	86	119	28	...	...	119	28
40	14,880	126	4,802	35	10,078	91	87	84	20	...	...	84	20
41	14,707	93	4,411	20	10,296	73	88	61	17	...	...	61	17
42	14,478	126	4,112·5	24	10,365·5	102	89	37	8	...	...	37	8
43	14,130	152	3,770·5	29	10,359·5	123	90	24	5	...	...	24	5
44	13,741	145	3,406	26	10,335	119	91	19	10	...	...	19	10
45	13,297·5	108	3,045·5	16	10,252	92	92	7	2	...	...	7	2
46	12,904	120	2,778·5	22	10,125·5	98	93	4	1	...	...	4	1
47	12,485·5	136	2,534·5	24	9,951	112	94	3	2	...	...	3	2
48	12,090·5	134	2,296	16	9,794·5	118	95	1	...	...	...	1	...
49	11,705	139	2,139·5	21	9,565·5	118	96	1	...	...	...	1	...
50	11,265·5	145	1,974·5	10	9,291	135	97	1	...	...	...	1	...
51	10,796	138	1,801·5	16	8,994·5	122	98	1	...	...	...	1	...
52	10,339·5	160	1,614	13	8,725·5	147	...	...	...	...	...	...	...
								477,953	7817	155,001	936	322,952	6381

V.—TABLE SHOWING THE NUMBER EXPOSED TO THE RISK OF MORTALITY, THE NUMBER OF DEATHS, AND THE PERCENTAGE OF MORTALITY IN QUINQUENNIAL GROUPS.

Current Ages.	All Durations.				Under 5 Years.				5 Years and over.			
	Exposed to Risk.	Died.	Mortality per cent.		Exposed to Risk.	Died.	Mortality per cent.		Exposed to Risk.	Died.	Mortality per cent.	
			Present In-vestigation.	HM (ungraded).			Present In-vestigation.	HM (ungraded).			Present In-vestigation.	HM (ungraded).
1	2	3	4	5	6	7	8	9	10	11	12	13
6—14	147.	...	...	...	127.5	...	...	...	19.5	...	...	...
15—19	1,323.5	4	.30	...	1,213.	4	.33	...	110.5	...	...	...
20—24	10,303.5	44	.43	.69	9,258.5	36	.39	.65	1,045.	...	.77	.94
25—29	87,134.5	172	.46	.69	29,522.5	113	.38	.62	7,612.	59	.78	.97
30—34	63,264.5	337	.53	.82	36,932.5	166	.45	.74	26,332.	171	.65	.94
35—39	74,003.	519	.70	.95	29,701.5	163	.55	.81	44,301.5	356	.80	1.08
40—44	71,936.	642	.89	1.07	20,502.	134	.65	.89	51,434.	508	.99	1.16
45—49	62,482.5	637	1.02	1.36	12,794.	99	.77	1.18	49,688.5	538	1.08	1.43
50—54	51,732.5	729	1.41	1.74	8,073.	64	.79	1.25	48,659.5	665	1.52	1.88
55—59	40,022.5	888	2.22	2.40	4,005.	74	1.85	1.94	36,017.5	814	2.26	2.50
60—64	28,722.	916	3.19	3.48	1,907.	43	2.25	2.90	26,815.	873	3.26	3.57
65—69	18,757.5	821	4.38	5.02	714.5	26	3.64	3.83	18,043.	795	4.41	5.15
70—74	10,738.5	736	6.85	7.33	198.5	8	4.03	5.96	10,540.	728	6.91	7.41
75—79	5,060.	490	9.68	...	39.5	4	10.13	...	5,020.5	486	9.68	...
80—84	1,806.5	260	14.39	...	12.	2	16.67	...	1,794.5	258	14.38	...
85—89	458.	102	22.27	...	...	...	...	...	458.	102	22.27	...
90 & over	61.	20	32.79	...	...	...	...	...	61.	20	32.79	...
All ages	477,953.	7,317	1.53	...	155,001.	936	.60	...	322,952.	6,381	1.98	...

Owing to the fluctuations which are usually observable in taking the percentage of mortality age by age, a comparison on that basis is rendered somewhat difficult, and is not here attempted; but by grouping the ages quinquennially, as is done in Table V. (p. 248), these fluctuations to some extent disappear, and a wider and better basis of comparison is obtained.

It will be seen that in this table I compare the percentages with the corresponding results from the Institute experience:—Column 4 with the figures from the H^m table, for risks of all durations; column 8 with the H^m figures for years of assurance 0-4; and column 12 with H^m for years of assurance 5 and upwards, *i.e.* the ungraduated $H^{m(5)}$ table. If in contrasting these it is kept in view that the mean duration of the risks in the experience on which the H^m table is based is 9.12 years, while, as already stated, the mean duration of the risks with which we are dealing is 12.16 years, we naturally expect that the percentage of mortality in the latter table would compare unfavourably with H^m , but, as you see, the facts do not bear this out, and the conclusion we come to is that the lives under observation are of a class superior to the bulk of those on which the Institute experience was founded. In every instance, it will be observed, the results are in their favour. However, in one or two cases, as we shall afterwards see when we split up the experience, all the classes of risk reviewed do not show equally satisfactory results. It is unnecessary to go over the figures in detail; the table speaks for itself. We shall therefore at once pass on to ascertain which of the three classes of risk shows the most favourable results.

The former of the two following Tables, VI. and VII. (pages 250, 251), shows the number exposed to risk, and the number of deaths at each age for assurances under 5 years in force, and the latter contains similar information for assurances 5 years and over in force. These Tables are framed from the figures in Table II.; the one being the Summations for years of assurance 0 to 4 inclusive, and the other, those for years of assurance 5 and upwards.

It would tax the eye and mind so much to grasp all the figures if the percentages of mortality were worked out age by age, that I have not deemed it advisable to do so. Comparisons on this footing are extremely difficult to follow. The figures have therefore been grouped quinquennially, and Tables VIII. and IX. (pages 252, 253) show the results.

In Table VIII. the number exposed to risk, and the number who died, in each of the three classes mentioned, is given; and Table IX. shows the percentages of mortality deduced from these figures. The former is useful for future reference, but the latter is more so for purposes of comparison.

VI.—TABLE SHOWING THE NUMBER EXPOSED TO THE RISK OF MORTALITY, AND THE NUMBER OF DEATHS, AGE BY AGE, IN EACH OF THE THREE CLASSES.

Lives less than 5 years under observation.

Age.	Sums Assured to £500 inclusive.		Sums Assured over £500 to £3000 inclusive.		Sums Assured over £3000.		Age.	Sums Assured to £500 inclusive.		Sums Assured over £500 to £3000 inclusive.		Sums Assured over £3000.	
	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.		Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.
6	1	...	...	...	...	...	45	1,861	8	1,038·5	7	146	1
7	2	...	...	...	...	...	46	1,716	17	925	5	137·5	...
8	2·5	...	2	...	...	...	47	1,573	17	827·5	6	134	1
9	3	...	4·5	...	...	5	48	1,411	10	750·5	4	134·5	2
							49	1,310·5	14	698	5	131	2
10	5·5	...	5·5	...	1	...							
11	7	...	6·5	...	1	...	50	1,197·5	8	649	2	128	...
12	9	...	9	...	1	...	51	1,082·5	10	595	5	124	1
13	11·5	...	9	...	1·5	...	52	959·5	8	544·5	3	110	2
14	27·5	...	15·5	...	1·5	...	53	870·5	7	484	...	97	1
							54	734	8	414	7	83·5	2
15	59	...	27	...	2	...							
16	105	...	42·5	...	2·5	...	55	615	10	360·5	6	64	2
17	150	...	58	...	4·5	...	56	527·5	8	315	6	65·5	1
18	226	1	79	...	6·5	...	57	459	8	260·5	11	65·5	1
19	330	3	111	...	10	...	58	402·5	3	209·5	1	60·5	4
							59	366	9	185	1	49	3
20	486	2	156	...	15	...							
21	799·5	6	228·5	...	24·5	...	60	331·5	3	152·5	1	37	1
22	1,290·5	7	354	...	41	...	61	285·5	14	136·5	...	29	...
23	1,887	7	540·5	2	61·5	...	62	225	6	116·5	1	18·5	1
24	2,506·5	11	784·5	1	83·5	...	63	190·5	7	104·5	1	14·5	...
							64	159	4	96·5	4	10	...
25	3,169	9	1,101·5	3	118	1							
26	3,776	23	1,387·5	4	154	...	65	129	3	70	...	9·5	1
27	4,231	15	1,662	5	188·5	...	66	111·5	3	56·5	3	8·5	...
28	4,573·5	21	1,871	5	220·5	...	67	95	4	48	3	4	...
29	4,794	17	2,028	10	248	...	68	70·5	3	32	2	3	...
							69	49	2	26·5	2	1·5	...
30	4,966	28	2,195·5	5	251	1							
31	4,988·5	23	2,300	11	260	1	70	35	1	24	...	1	...
32	4,970	22	2,282·5	6	274	1	71	25	1	22	...	1	1
33	4,823·5	18	2,288	6	253	1	72	18	2	19·5	...	...	...
34	4,625·5	30	2,230·5	12	224·5	1	73	15·5	...	13	3	...	...
							74	15	...	8	...	1	...
35	4,399	33	2,094·5	5	216	...							
36	4,133	26	2,000	7	189·5	...	75	11·5	2	5	...	1	...
37	3,882	20	1,900·5	11	182	1	76	7	...	...	...	1	...
38	3,577	20	1,767	14	187·5	...	77	6·5	1	...	...	1	...
39	3,311	19	1,674	6	188·5	1	78	2·5	1	...	...	...	...
							79	2	...	1·5	...	...	...
40	3,008	25	1,600·5	9	193·5	1							
41	2,709·5	14	1,519·5	6	182	...	80	2	...	2	...	...	...
42	2,515	19	1,420·5	5	177	...	81	2	1	2	...	...	...
43	2,282	17	1,322	12	166·5	...	82	1	...	2	...	...	...
44	2,083·5	18	1,165·5	8	157	...	83	...	...	1	1	...	...
	84,725·5	454	38,243·5	153	4,288·5	9		101,600·5	657	47,440	243	5,960·5	36

VII.—TABLE SHOWING THE NUMBER EXPOSED TO THE RISK OF MORTALITY, AND THE NUMBER OF DEATHS, AGE BY AGE, IN EACH OF THE THREE CLASSES.

Lives 5 years and over under observation.

Age.	Sums Assured to £500 inclusive.		Sums Assured over £500 to £3000 inclusive.		Sums Assured over £3000.		Age.	Sums Assured to £500 inclusive.		Sums Assured over £500 to £3000 inclusive.		Sums Assured over £3000.	
	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.		Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.
11	2	...	...	...	...	...	55	4,271	88	3,127	45	536	5
12	2	...	...	...	...	...	56	4,024	94	3,024·5	55	523	9
13	3	...	4	...	...	...	57	3,807·5	120	2,932·5	64	502·5	8
14	3	...	4·5	...	1	...	58	3,560·5	83	2,779·5	72	482	11
							59	3,349·5	89	2,637·5	58	460·5	13
15	8	...	5	...	1	...							
16	8	...	3	...	1	...	60	3,134	86	2,517	75	446·5	11
17	8	...	7	...	1	...	61	2,962·5	84	2,358	74	425	18
18	10	...	9	...	2	...	62	2,751	85	2,232	76	387	21
19	26·5	...	18	...	3	...	63	2,535·5	96	2,084	68	358·5	6
							64	2,339	97	1,940·5	67	344·5	9
20	50	...	26·5	...	3	...							
21	80	...	39	...	4	...	65	2,157·5	77	1,799	61	323	16
22	112·5	1	59	...	6	...	66	1,975	94	1,673·5	68	301	8
23	180·5	2	87	1	8	...	67	1,785	85	1,529·5	61	281	8
24	250·5	4	127	...	12	...	68	1,594	87	1,417·5	69	258	9
							69	1,419·5	55	1,291·5	80	238	17
25	374·5	3	162·5	...	17	...							
26	613	6	247·5	3	28·5	...	70	1,277·5	78	1,153·5	66	205·5	13
27	995	9	383	...	42	...	71	1,147·5	71	1,042·5	58	180	10
28	1,361·5	12	583	6	62·5	...	72	999·5	61	935·5	59	157	6
29	1,836·5	16	816	4	89·5	...	73	881·5	78	832	80	138	10
							74	754	68	714	61	122	9
30	2,335·5	24	1,085	3	133	...							
31	2,901·5	25	1,386·5	11	174	...	75	627	45	613·5	43	109	11
32	3,382·5	29	1,684·5	5	213·5	3	76	549	48	531·5	46	91·5	6
33	3,854	20	1,981·5	7	259·5	...	77	471	55	462	55	78	9
34	4,333	25	2,293	16	315	3	78	375·5	46	379·5	46	66	6
							79	299·5	29	311·5	34	56	7
35	4,811·5	42	2,596·5	17	345·5	2							
36	5,200·5	44	2,875·5	19	386	1	80	249	36	252·5	30	43	5
37	5,431	47	3,073·5	22	419	2	81	191	27	207·5	30	34	5
38	5,712·5	50	3,280	32	415	1	82	147·5	18	165	26	27	5
39	5,897·5	52	3,427·5	25	430	...	83	122	15	130	20	20	2
							84	93	15	95	19	18	5
40	6,053·5	54	3,575	32	449·5	5							
41	6,158	59	3,668	13	470	1	85	76	13	71	14	10	2
42	6,114·5	64	3,768·5	34	482·5	4	86	57	16	54	12	8	...
43	6,070	75	3,795·5	43	494	5	87	40	9	36	8	8	3
44	5,993·5	77	3,833	36	508·5	6	88	30	13	26	4	5	...
							89	15	4	18	4	4	...
45	5,902	62	3,835	26	515	4							
46	5,772	61	3,835	31	518·5	6	90	9	1	11	3	4	1
47	5,634·5	72	3,801·5	34	515	6	91	8	5	8	3	3	2
48	5,515	74	3,760·5	42	519	2	92	2	...	4	1	1	1
49	5,341·5	63	3,695	48	529	7	93	1	...	3	1	...	...
							94	1	...	2	2	...	...
50	5,147	70	3,616·5	58	527·5	7							
51	4,955	73	3,512	40	527·5	9	95	1	...	...	...	...	...
52	4,767	82	3,429	59	529·5	6	96	1	...	...	...	...	...
53	4,577	76	3,321	46	533	10	97	1	...	...	...	...	...
54	4,445·5	74	3,237	45	535	10	98	1	...	...	...	...	...
132,230		1447	80,947	758	11,025·5	100		182,323	3518	122,349	2476	18,280	387

VIII.—TABLE SHOWING THE NUMBER EXPOSED TO THE RISK OF MORTALITY, AND THE NUMBER OF DEATHS
IN EACH OF THE THREE CLASSES, IN QUINQUENNIAL GROUPS.

Current Ages.	UNDER 5 YEARS.						5 YEARS AND OVER.					
	Sums to £500 incl.		Over £500 to £3000.		Sums over £3000.		Sums to £500 incl.		Over £500 to £3000.		Sums over £3000.	
	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.
6—14	69	...	52	...	6·5	...	10	...	8·5	...	1	...
15—19	870	4	317·5	...	25·5	...	60·5	...	42	...	8	...
20—24	6,969·5	33	2,063·5	...	225·5	...	673·5	...	338·5	...	33	...
25—29	20,543·5	85	8,050	27	929	1	5,180·5	46	2,192	13	239·5	...
30—34	24,373·5	121	11,296·5	40	1,262·5	5	16,806·5	123	8,430·5	42	1,095	6
35—39	19,302	118	9,436	43	963·5	2	27,053	235	15,253	115	1,995·5	6
40—44	12,598	93	7,028	40	876	1	30,389·5	329	18,640	158	2,404·5	21
45—49	7,871·5	66	4,239·5	27	683	6	28,165	332	18,927	181	2,596·5	25
50—54	4,844	41	2,686·5	17	542·5	6	23,891·5	375	17,115·5	248	2,652·5	42
55—59	2,370	38	1,330·5	25	304·5	11	19,012·5	474	14,501	294	2,504	46
60—64	1,191·5	34	606·5	7	109	2	13,722	448	11,131·5	360	1,961·5	65
65—69	455	15	233	10	26·5	1	8,931	398	7,711	339	1,401	58
70—74	108·5	4	86·5	3	3·5	1	5,060	356	4,677·5	324	802·5	48
75—79	29·5	4	7	...	3	...	2,322	223	2,298	224	400·5	39
80—84	5	1	7	1	...	...	802·5	111	850	125	142	22
85—89	...	...	...	...	...	...	218	55	205	42	35	5
90 & over	...	...	...	...	...	...	25	6	28	10	8	4
All ages	101,600·5	657	47,440	243	5,960·5	36	182,323	3,518	122,349	2,476	18,280	387

IX.—TABLE SHOWING THE PERCENTAGE OF MORTALITY ACCORDING TO THE INSTITUTE HEALTHY MALE TABLE, AND THAT EXPERIENCED AMONG THE LIVES UNDER OBSERVATION, IN QUINQUENNIAL GROUPS.

Current Ages.	Under 5 Years.				5 Years and over.				Current Ages.
	HM (ungraded).	Sums to £500 inclusive.	Over £500 to £3000.	Sums over £3000.	HM(s) (ungraded).	Sums to £500 inclusive.	Over £500 to £3000.	Sums over £3000.	
6—14	...	·00	·00	·00	...	·00	·00	·00	6—14
15—19	...	·46	·00	·00	...	·00	·00	·00	15—19
20—24	·65	·47	·15	·00	·94	1·04	·30	·00	20—24
25—29	·62	·41	·34	·11	·97	·89	·59	·00	25—29
30—34	·74	·50	·35	·40	·94	·73	·50	·55	30—34
35—39	·81	·61	·46	·21	1·08	·87	·75	·30	35—39
40—44	·89	·74	·57	·11	1·16	1·08	·85	·87	40—44
45—49	1·18	·84	·64	·88	1·43	1·18	·96	·96	45—49
50—54	1·25	·85	·63	1·11	1·88	1·57	1·45	1·58	50—54
55—59	1·94	1·60	1·88	3·61	2·50	2·49	2·03	1·84	55—59
60—64	2·90	2·85	1·15	1·83	3·57	3·26	3·23	3·31	60—64
65—69	3·83	3·30	4·29	3·77	5·15	4·46	4·40	4·14	65—69
70—74	5·96	3·69	3·47	28·57	7·41	7·04	6·93	5·98	70—74
75—79	...	13·56	·00	·00	...	9·60	9·75	9·74	75—79
80—84	...	20·00	14·29	...	...	13·83	14·71	15·49	80—84
85—89	...	...	...	...	...	25·23	20·49	14·29	85—89
90 & over	...	...	...	...	...	24·00	35·71	50·00	90 & over

It will be observed from Table VIII. that "under 5 years" we have only 5960·5 years of life and 36 deaths for policies over £3000. This being so, the percentage of mortality—given in Table IX.—shows considerable fluctuation, which would probably disappear had we larger figures to deal with. One or two exceptional results may be noted. At ages 55-59 the percentage of mortality is 3·61, obtained from 11 deaths and 304·5 years of life, and at ages 70-74 we find the abnormal percentage of 28·57, but this is obtained from a single death and 3·5 years of life. It has been already remarked, that the data is hardly wide enough in one or two cases to give reliable results, and we certainly cannot regard the experience in these two instances as of much importance. As showing the different effects produced according as we are dealing with large or small figures, I may point out that if we added another death to the total number in Class I., and also one in Class III., the effect in the percentage in the latter would be 17·05 greater than in the other—that is, in the former case, it would affect the mortality to the extent of about ·001 per cent. only, while in the latter it would do so to the extent of over ·017 per cent.,—a considerable difference.

X.—TABLE SHOWING THE NUMBER EXPOSED TO THE RISK OF MORTALITY, AND THE NUMBER OF DEATHS IN EACH OF THE THREE CLASSES IN THE UNDERNOTED GROUPS OF AGES.

UNDER 5 YEARS.														5 YEARS AND OVER.									
Current Ages.	Sums to £500 inclusive.		Over £500 to £3000 inclusive.		Sums over £3000.		Sums to £500 inclusive.		Over £500 to £3000 inclusive.		Sums over £3000.		Current Ages.										
	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.	Exposed to Risk.	Died.											
6—24	7,908·5	37	2,433	3	257·5	...	744	7	389	1	42	...	6—24										
25—34	44,917	206	19,346·5	67	2,191·5	6	21,987	169	10,622·5	55	1,334·5	6	25—34										
6—34	52,825·5	243	21,779·5	70	2,449	6	22,731	176	11,011·5	56	1,376·5	6	6—34										
35—44	31,900	211	16,464	83	1,839·5	3	57,442·5	564	33,893	273	4,400	27	35—44										
45—54	12,715·5	107	6,926	44	1,225·5	12	52,056·5	707	36,042·5	429	5,249	67	45—54										
35—54	44,615·5	318	23,390	127	3,065	15	109,499	1,271	69,935·5	702	9,649	94	35—54										
55—64	3,561·5	72	1,937	32	413·5	13	32,734·5	922	25,632·5	654	4,465·5	111	55—64										
65 & over	598	24	333·5	14	33	2	17,358·5	1,149	15,769·5	1,064	2,789	176	65 & over										
55 & over	4,159·5	96	2,270·5	46	446·5	15	50,093	2,071	41,402	1,718	7,254·5	287	55 & over										
All ages	101,600·5	657	47,440	243	5,960·5	36	182,323	3,518	122,349	2,476	18,280	387	All ages										

In Table IX. the rates are again contrasted with those from the H^M table, and, generally speaking, the results are very favourable. In addition to the two cases above mentioned, however, we find the rates in the H^M table exceeded in two instances—Class II., ages 65-69, under 5 years in force, and Class I., ages 20-24 over 5 years in force, and again we find the probable explanation in the paucity of the numbers from which the percentages are deduced.

As different results are sometimes obtained by grouping the same figures in different ways in Table No. X., I have grouped the figures as there shown—all ages to 24, then decennially to age 64, and all over 64,—and on this have superimposed a still larger grouping.

The following table shows the percentage of mortality deduced from the number exposed to risk, and the deaths shown in the immediately preceding table.

XI.—TABLE SHOWING THE PERCENTAGE OF MORTALITY
COMPUTED FROM THE FIGURES IN TABLE X.

Current Ages.	Under 5 Years.			5 Years and over.			Current Ages.
	Sums to £500.	Over £500 to £3000 inclusive.	Sums over £3000.	Sums to £500.	Over £500 to £3000 inclusive.	Sums over £3000.	
6—24	·468	·123	·000	·941	·257	·000	6—24
25—34	·459	·346	·274	·769	·518	·450	25—34
6—34	·460	·321	·245	·774	·509	·436	6—34
35—44	·661	·504	·163	·982	·806	·614	35—44
45—54	·842	·635	·979	1·358	1·190	1·276	45—54
35—54	·713	·543	·489	1·161	1·004	·974	35—54
55—64	2·022	1·652	3·144	2·817	2·552	2·486	55—64
65 & over	4·013	4·198	6·061	6·619	6·747	6·311	65 & over
55 & over	2·308	2·026	3·360	4·134	4·150	3·956	55 & over
All ages	·647	·512	·604	1·930	2·024	2·117	All ages

We have now, I think, sufficient information to enable us to satisfactorily compare the relative mortality experienced in the three classes. By studying the various figures it will soon be seen how the results tend. To analyse one of the tables particularly, we will take up Table No. XI.

We find there are six groups given in plain figures, three in red-ink figures, and all ages are also taken together. Now to examine the first of these, *i.e.* the six groups in plain figures:—

Risks under 5 years in force.—(a) It is observed that in three periods, 6-24, 25-34, 35-44, Class III. shows the lightest mortality; in two, 45-54, 55-64, Class II. does so; while only once, 65 and over, does Class I. show the best results.

(b) To look at the figures in another way:—In three instances, 6-24, 25-34, 35-44, Class I. shows the highest rate of mortality; in three, 45-54, 55-64, 65 and over, Class III. shows the worst results; while in no case does Class II. attain this unenviable position, though at ages 65 and over the percentage is higher than in Class I.

Risks 5 years and over in force.—(a) Here we find that in five periods, 6-24, 25-34, 35-44, 55-64, and 65 and over, Class III. shows the lightest mortality; once, 45-54, Class II. takes this position; while Class I. never does so.

(b) Again in five instances, 6-24, 25-34, 35-44, 45-54, and 55-64, Class I. shows the highest rate of mortality; in one, 65 and over, Class II. does so; while in no case does Class III. show the worst results.

One peculiarity may be here noted. At ages 65 and over, both under 5 years and 5 years and over, the percentages for Class II. exceed those for Class I. Probably in the case of the risks of 5 years and over this is accounted for by the longer average duration of the larger assurances, but this argument will of course not apply with equal force to risks of under 5 years. But, as was previously mentioned, Class I. contains a larger proportion of recently selected lives, and this may perhaps account for the difference.

Next, glancing at the red-ink figures, I think you will agree that there is no use in going over them in detail. It is at once seen that, with two comparatively trifling exceptions—at ages 55 and over—the percentages all decrease as we pass through the three classes to the largest risks.

Finally viewing the percentages for all ages, it is noticed that under 5 years Class I. has the worst results, Class II. has the best results, while Class III. occupies an intermediate position; and over 5 years the percentages gradually increase in the three classes. This last point will be explained a little further on (p. 257).

To bring then these results together, and to draw some conclusions:—

I. *Risks under 5 years in force.*—In the case of the smallest assurances, the mortality as compared with the others is the least

favourable; the assurances between £500 and £3000 show better results; while in the risks over £3000, owing, as already stated, to the small figures with which we have to deal, the results are not so trustworthy as the others, but as a general rule the mortality is fairly satisfactory.

II. *Risks 5 years and over in force.*—We again find here that the lives assured for the smallest sums experience the heaviest rate of mortality; those between £500 and £3000 are considerably better; while the largest policy-holders show decidedly the best results.

You will observe the somewhat anomalous result that while taking the individual figures in the second part of Table No. XI., the percentage of mortality is, with one exception—ages 45-54—in every case in favour of the largest assurances, the average over all is highest in this class. On looking into the matter a little closer, however, we find there is nothing remarkable in this, the fact being that the policies for the largest sums have the longest mean duration; they have consequently felt the pressure of mortality more keenly than the others, and the greater weight having fallen on the old lives, where the mortality is heaviest, the whole average rate is thrown up. This is shown very clearly in Table XII., p. 258, in which the percentages of the number exposed to risk, the number of deaths in various groups, and the mortality in the same groups of ages are given. I may draw your attention to one point, which is, that, at ages 65 and over, the percentages of the deaths in the three classes for risks of “five years and over” are 32·66, 42·97, and 45·48 respectively. The fact that such a large proportion of the deaths in the last class fall in where the mortality is so heavy, accounts for the rate when all ages are taken together being highest among the largest risks. The table does not seem to call for further remark.

My task is now nearly finished, but before closing, a hurried review of what has been done may not be amiss. In the first place, then, we considered the period to be embraced in the investigation, saw how the data was collected, and ascertained what lives were included. We next proceeded to the classification, and found what steps were necessary, in arranging the cards, in order to trace the decrease in the number of lives from year to year, and then explained how the results required to be tabulated to enable the preliminary tables to be prepared. And lastly, having got these minor tables, we showed how the final ones were framed, and concluded the research by contrasting the mortality experienced among the three classes of lives, according as they were under five years, or five years and over, under observation. Little now remains to be done but to discover what inferences may be drawn from the work which has just been concluded.

XII.—TABLE SHOWING THE PERCENTAGES OF THE NUMBER EXPOSED TO RISK, THE NUMBER OF DEATHS, AND THE MORTALITY IN EACH OF THE THREE CLASSES IN THE UNDERNOTED GROUPS OF AGES.

UNDER 5 YEARS.										5 YEARS AND OVER.									
Ages.	Exposed to Risk.			Died.			Mortality.			Exposed to Risk.			Died.			Mortality.			Ages.
	Class I.	Class II.	Class III.	Class I.	Class II.	Class III.	Class I.	Class II.	Class III.	Class I.	Class II.	Class III.	Class I.	Class II.	Class III.				
6—24	7.78	5.13	4.32	5.63	1.23	.00	.468	.123	.000	.41	.32	.23	.20	.04	.00	.941	.257	.000	6—24
25—34	44.21	40.78	36.77	31.35	27.57	16.67	.459	.346	.274	12.06	8.68	7.30	4.80	2.22	1.55	.769	.518	.450	25—34
35—44	31.40	34.71	30.86	32.12	34.16	8.33	.661	.504	.163	31.51	27.70	24.07	16.03	11.03	6.98	.982	.806	.614	35—44
45—54	12.52	14.60	20.56	16.29	18.11	33.33	.842	.635	.979	28.55	29.46	28.71	20.10	17.33	17.31	1.358	1.190	1.276	45—54
55—64	3.50	4.08	6.94	10.96	13.17	36.11	2.022	1.652	3.144	17.95	20.95	24.43	26.21	26.41	28.68	2.817	2.552	2.486	55—64
65 & over	.59	.70	.55	3.65	5.76	5.56	4.013	4.198	6.061	9.52	12.89	15.26	32.66	42.97	45.48	6.619	6.747	6.311	65 & over

Before stating what seem to me to be the general conclusions to which the investigation leads, you will perhaps allow me to draw your attention to previous references to the subject. When the Australian Mutual Provident Office was considering the advisability of commencing business in this country, the Chairman, in defending the proposed step, said: "Those British offices which have investigated the matter have shown that the mortality among holders of large policies is less than that amongst those who hold small ones. In other words, other things being equal, the larger the average sum assured, the more favourable will be the mortality experience." And quite recently, Mr. Richard A. M'Curdy, President of the Mutual Life Insurance Company of New York, in treating of large risks of insurance, said: "As to health and freedom from accident, the experience of companies in England has been that the larger the average amount of the risks, the better the ratio of mortality; and the officers of the companies then deem it a good proof of the improving character of their business, if they can show that the average size of their risks has increased. This extension they would hardly have made had they found this class of business unprofitable. Again, the tables that have been published of the richer classes, like the nobility of England, show a less ratio of mortality than among the poorer classes, or than the average of the whole population."

There may be some statistics with which I am unacquainted which led to the above remarks. As far as I am aware, however, there was not much authority for the conclusions arrived at; but certain it is, that as far as the results of this investigation show, they were perfectly correct. The only published contributions that I know of in this country bearing in any way on the subject are (1) the paper by Messrs. Bailey and Day, "On the Rate of Mortality prevailing amongst the Families of the Peerage during the Nineteenth Century" (*J. I. A.*, vol. ix. p. 305), from which it is found that as a rule the peerage show a higher "expectation of life" than the H^m table; and (2) "The Report by the Joint-Committee appointed to collect the Statistics of the Mortality Experience of the Scottish Life Assurance Offices to 31st December 1863," in which the claim rate is compared with the death rate; but the results give no decided indication as to whether the larger or smaller policyholders are subject to the heavier mortality.

About seventeen years ago the Equity and Law contrasted the mortality among its risks under £300 with those of £5000 and upwards, and the results were found to be decidedly in favour of the large cases. I understand also that the Law Life made some investigation into its risks, which average about £1300, and found

the results very favourable. But I have not seen these statistics, and am not aware that the experiences are available to the general public.

Such investigations as have hitherto been made in this country and elsewhere seem to lead to very conflicting conclusions. Thus according to the American experience—the Connecticut Mutual and the Thirty Offices experience—the mortality seems to be heavier among those who hold policies for large amounts than among those who are insured for small sums. In the German experience—the Gotha Life Office,—again, the converse was found to be the case, the holders of small policies being subject to the heavier rate of mortality; while, as already stated, the results derived from the Scotch experience show no decided tendency either one way or another.

Just a word before concluding. An investigation of the nature of that just concluded usually suggests further research, and this one is no exception to the rule. For example, there is a widespread feeling that the mortality among the very largest policy-holders is not favourable. This may be the case. Whether the idea is correct or not might have been discovered had the investigation been carried a little further, and I almost wish that I had had time to do so. At the same time, if the already small figures for the large policy-holders had been again subdivided, the data would have become so limited as to lose its trustworthiness. It might also be well if we could ascertain correctly the ratio which exists between the losses and expenses incurred in connection with each class of risk and the premiums paid, and having obtained trustworthy data on these points, we would be able to judge exactly of the profitableness or otherwise of each class. Such information is, however, almost impossible to obtain, and this being so, we must simply deal with the facts we have. The tables as they stand may be useful as a guide to show the class of business which apparently should be cultivated, and in any cases where the results are not very favourable, show where care should be exercised.

The conclusions, then, which it seems to me are to be deduced from the investigation made into the mortality of the three classes into which the risks have been divided are:—

1. That the mortality experienced among the lives assured for the smallest sums is least favourable;
2. That the lives assured for the largest amounts are apparently the best class of lives; and
3. That, generally speaking, the mortality decreases as the sum assured increases; or, to put it in another way, the larger the amount of the risk, the better is the ratio of mortality.

In the case of policies above £3000, it will be noted that not only is the average duration greater, but the discontinuances are less, and the mortality lighter than among those for the smaller sums. Moreover, I think we are not far wrong in assuming that, as a rule, the ordinary office expenditure in connection with such assurances is certainly no more than for the smaller amounts. By ordinary expenditure, I mean that incurred for medical fees, clerks' time, office upkeep, and postages. It would therefore seem to be to the advantage of an office to increase the number of large risks on its books, or at least to maintain the average amount of its assurances. At the same time we must recollect that the object for which assurances are effected may to a certain extent qualify the results. For example, policies effected by creditors to cover advances are probably likely to show less satisfactory results than those effected by men in comfortable circumstances merely as investments or family provisions.

The favourable results brought out in the present investigation in the case of the lives assured for the largest amounts may be on account of additional precautions having been exercised in the selection of these risks. When a proposal is made, the acceptance or rejection of the risk lies in the first place, as you are all aware, with the office. Once a risk has been accepted, however, though the contract is of a mutual nature, it must be borne in mind that while the assured can get rid of his part of the bargain at any time, the office, on the other hand, cannot, by any act of its own, free itself of the liability it has incurred. The privilege on this point is one-sided, the advantage being altogether with the assured. This must not be forgotten, and while, as above stated, it appears advisable to secure large assurances, still, in the desire to do so, it must be kept in view that carefulness in selection—on which the safety of an office and the profits it will give largely depend—should not be sacrificed to secure amount.