1888.

NEW ZEALAND.

GOVERNMENT INSURANCE DEPARTMENT

(CASE FOR OPINION DRAWN UP BY F. W. FRANKLAND, GOVERNMENT ACTUARY AND STATIST, ON BEHALF OF THE NEW ZEALAND GOVERNMENT INSURANCE DEPARTMENT, WITH OPINION OF THE ACTUARIES CONSULTED.)

Presented to both Houses of the General Assembly by Command of His Excellency.

NEW ZEALAND GOVERNMENT INSURANCE.

CASE FOR OPINION

DRAWN UP BY

F. W. FRANKLAND, GOVERNMENT ACTUARY AND STATIST.

(i.) *Introductory.*

THE Actuaries' report of the 25th March, 1887, raised certain questions as to the future administration of the funds, and a new question came into prominence at the same time, on which their opinion is desired.

(ii.) *Future Administration of Temperance Section.*

The first of the questions, arising out of the report itself, related to the manner in which the Temperance Section should be administered. The Actuaries reported a deficiency of £2,759 in this section, and, although they stated that this deficiency need not excite uneasiness since no surplus could have been expected to accrue during the short period that the section had been in existence, great dissatisfaction is felt among policy-holders of the section at their temporary exclusion from participation in bonus; and there has been a great check to the issue of new policies in the section, without any corresponding increase in the business of the General Section. The nature of the complaints made may be elucidated by the following extracts from memoranda by one of the leading district representatives of the office:—

"I beg to append a summary of what I think necessary to be done in reference to the Temperance Section of the department, in order to place entrants in as good a position as though taking policies in the General Section. . . . . A newly-created fund—three years old—however favourably circumstanced in the matter of the picked character of the lives included in it, or otherwise, cannot possibly be expected to earn a surplus proportionate to that credited to the fund of the rest of the department, which has been accumulating during sixteen years, and which has had the benefit of all the lapses and surrenders taking place during that period. This existing surplus in the General Section is participated in by entrants immediately upon entry into the section, which surplus those entrants have not contributed a shilling towards creating. Why should the entrants into the Temperance Section of the same office be debarred from the same advantage through the action of the office in separating the funds?

"If it is desired to obtain insurers in the Temperance Section that section will require to be placed upon an exactly equal footing with the General so far as participation in accumulated and accumulating funds of the whole department is concerned; the only separation which should be made ought to be in the matter of the lives, which, each period, should be valued from a mortality point of view. If it be found that the mortality of the Temperance lives proves less than expected, a higher bonus should be paid in proportion; if the mortality proves greater than expectation, a smaller bonus should be paid; but the mode of calculating and valuing the expectancy should be the same in both sections.

"As matters now stand, it appears that admittedly good—if not the best—lives are invited to enter a section—Temperance—which, because of its youth and the peculiar separation of the funds of the department, has not a shilling (in the way of profits) to its credit; while, for the same premium payments, the same lives may, in the same office, become part-owners of a known cash surplus of £94,000. The result is obvious. Temperance business (which was, and may still become, a great attractive feature of the department) will, under such circumstances, become practically unobtainable.

"If no adjustment of the forced disparity between the sections is made, the past history, accumulated capital, and undoubted success of the department become factors which cannot be taken into consideration by the insuring abstainer when comparing our office with others before entering. The office is sure to suffer by the comparison."

The Consulting Actuaries, following the memorandum which had been sent them for their guidance, had based their report on a dissection of the entire accumulated fund of the department into two separate portions, to be credited respectively to the General and Temperance Sections. The materials for the dissection were furnished to them by the department, and they carried it out by apportioning receipts and expenditure between the two funds. In view, however, of the fact that no statute and no Order in Council makes provision for the

keeping of a separate fund in the Temperance Section, the question arises whether the dictates of equity would not be equally well subserved by amalgamating the funds and, at each distribution of bonus, allowing the policy-holders to participate, with respect to that portion of the profit which is due to causes other than favourable mortality, irrespectively of the section —whether Temperance or General—to which they severally belong. Bearing in mind that the Temperance Section exists, not by virtue of any Act of Parliament or Order in Council, but merely by virtue of a clause in the prospectus, which makes no mention of a separation of funds, but only of separate profits, it would seem doubtful whether the department is either legally or equitably bound to keep a separate fund for the Temperance Section, provided that some other method of ascertaining the separate profits of the section can be devised and carried out. Such a method the Government Actuary believes to be possible, and it may be stated in the following words: At each valuation let the total amount of divisible profit be divided into three distinct portions—(1) that due to favourable mortality in the General Section, (2) that due to favourable mortality in the Temperance Section, and (3) that due to causes other than favourable mortality. Distinguishing these amounts as A, B, C respectively, let A be divided among policy-holders of the General Section only, B among policy-holders of the Temperance Section only, and C among policy-holders of both sections, irrespectively of the particular section to which they severally belong. It is, of course, conceivable that one or more of these three amounts may be negative; but, *mutatis mutandis*, the proposed method of distribution would still apply. The Government Actuary has embodied this method in the following draft clause, which, he suggests, might be read after that clause of the New Zealand Government Life Insurance Act which relates to distribution of profit:—

"Such Actuary or Actuaries shall determine, as nearly as may be, how much (if any) of such divisible surplus has arisen from favourable mortality and how much (if any) has arisen from other causes. With respect to the first-named portion of such divisible surplus he or they shall distinguish between the amount of divisible surplus (if any) which has arisen from favourable mortality in the General Section of policy-holders and that which has arisen from favourable mortality in the Temperance Section of policy-holders, and each of the amounts so named shall be divided exclusively among the policy-holders of the section in which the mortality corresponding to such amount has been experienced. The remainder of the divisible surplus shall be divided amongst policy-holders according to such method as the Government shall determine, but irrespectively of the section (whether General or Temperance) to which such policy-holders may belong: Provided always that, if, in the opinion of such Actuary or Actuaries, a loss has arisen through unfavourable mortality in either of the sections named, the amount of surplus to be divided amongst the policy-holders of that section shall be diminished by the amount of such loss."

The opinion of the Consulting Actuaries is requested as to whether the method of distribution embodied in the above draft clause would be just, practicable, and expedient. As the question of its practicability or otherwise involves points of detail, it is desirable to explain that the Government Actuary would propose to estimate the amounts distinguished as A and B by a comparison of the actual and expected death-strains in the two sections, using Sprague's select tables to determine the value of q_x. He has already made such preliminary arrangements in connection with the department's books as would, among other things, enable the determination of death-strains to be made if the proposed method of distribution were to be adopted; but he recognises the vastness of the amount of labour involved in a perfectly accurate determination. The Consulting Actuaries' opinion is therefore further requested as to whether an approximate method could be devised that would do substantial justice.

(iii.) *Method of Distributing Bonus among Individual Policy-holders.*

On both occasions on which a surplus has been divided—namely, at the end of the second and third quinquennia—the cash allocated to the individual policy-holder was in proportion to the loading he had contributed since previous participation or the issue of his policy, as the case might be. The substantial fairness, under certain conditions, of this method is, it is believed, nearly uncontested; but some of the considerations already adduced relative to the future management of the Temperance Section would seem to show that there may be a special objection to it in the case of an office which has two separate sections, started at widely distant epochs, and which values at a much lower rate of interest than that earned by its funds. At least, if separate funds continue to be kept for the two sections, the anomaly may present itself that, of two policy-holders entering together at a recent date, the one who enters the old-established section will receive a bonus, while the one entering the recently-

established section receives none. The conclusion is thus suggested that recent entrants of the old-established section are favoured; and, as, on the supposition that separate funds are kept, the entrants of the newly-established section are disentitled to bonus, it would seem that the favour is not at the expense of the latter, but at the expense of the older entrants in the section to which they themselves belong. As the profit is derived not solely from the loading on the premiums, but also in part from the excess of interest realised over and above that assumed in the immediately preceding valuation, it would seem that some extra profit might fairly be allocated to the older policy-holders in consideration of the excess interest earned during the inter-valuation period by the reserves held on their policies.

Apart from the question of equity, the consideration arises that, although, from the peculiar circumstances of the department's history, the method of distribution hitherto adopted has brought out a higher reversionary bonus at the last division than at the earlier one, yet its ultimate tendency is to produce diminishing reversionary bonuses to the same policy-holder at successive divisions. Such a result would be fraught with grave danger to the future progress of the department, owing to the extreme unpopularity of diminishing reversionary bonuses in the colony. The competition of life insurance offices in New Zealand is now excessively and increasingly severe, and every element of popularity tells with great force on the acquisition of new and retention of old business. The principal rival of the Government office adopts a method which brings out increasing reversionary bonuses, and it makes this a point in its competition.

The Consulting Actuaries' opinion is therefore requested as to whether it would be equitable and expedient to change the method of allocating bonus hitherto adopted for one which would tend to secure approximately constant or, if possible, increasing reversionary bonuses, and, if so, what method it would be best to adopt. One element which should be borne in mind in the choice of a method, and which certainly constitutes an advantage of the method now followed by the department, is the importance of being able to give a conclusive answer to policy-holders who compare their bonuses with those allotted to others and consider themselves aggrieved as a consequence of the comparison. This consideration becomes especially important in view of the fact that the rates of premium have quite lately been largely increased.

(iv.) *Establishment of a Separate Branch for Insurance without Medical Examination.*

It has often been considered a defect in life assurance as at present carried on that persons in ill-health, or with very unfavourable family history, cannot participate in its benefits, and efforts have from time to time been made to remedy this defect. For a Government Insurance Department, which has been founded on high grounds of State policy, and which aims at the encouragement of thrift in the general population and the prevention of pauperism, the question is an especially urgent one. From the point of view of mere commercial success the opening of a separate branch for diseased lives might be to some extent positively disadvantageous, owing to the danger of unscrupulous misrepresentations on the part of agents canvassing for rival offices; yet it has been felt for some years past that, from the higher point of view of the public welfare, the scheme of Government life insurance would not be complete without some provision for the acceptance, under special conditions, of persons who cannot pass the medical examination successfully. The Government Actuary was therefore asked by the New Zealand Government whether some special scheme could not be devised to attain this object, and he devised the following plan :—

ON A NEW METHOD FOR THE INSURANCE OF DISEASED LIVES.

The Hon. the Colonial Treasurer.

In accordance with your instructions, I beg to explain the new method I have devised for the insurance of persons who cannot be accepted in the Ordinary Branch even at extra rates.

2. The reason for the non-acceptance by ordinary insurance offices of lives the vitality of which is below a certain level is that, in the present state of our knowledge, it is impossible to frame a reliable estimate of the risk which such lives bring with them. It has appeared to me, therefore, that the only way of insuring such lives is by dispensing with the necessity of any estimate of the mortality which will take place amongst them.

3. This can only be done by leaving uncertain the sum payable at death, and allowing it to be decided by the mortality actually experienced among the persons who have effected insurances. The greater the mortality experienced the smaller must be the sum payable at death.

4. I would propose, therefore, that a separate section be opened in the Life Insurance Department in which persons shall be allowed to insure without regard to health, habits, or family history. No fixed sum should be guaranteed as payable at death; but a certain proportion of the pure premium income should be periodically divided among the representatives of persons dying

during the interval since the immediately previous division. I shall call this species of assurance *tontine*.

5. The proportion of the pure premium income to be divided should be so determined that the sum payable at death shall be as little as possible affected by the duration of the assurance, especial care being taken that it shall, at any rate, not diminish with an increasing duration of the assurance. In order to effect this I propose that, provisionally, and until the working of the section itself yields data for a more precise estimate, the portion of the pure premium to be divided shall be that which remains after making the same reserve that would be required for healthy lives paying the same premium and having entered at the same age. By this apportionment of the premium the expenses of management would be defrayed from year to year, and a reserve would be accumulated to meet the time when the temporary insurance premium would be in excess of the level pure premium. As soon as this time had arrived the sum periodically divisible would have to be greater than the whole premium income of the corresponding interval, the balance being made up by the accumulation at interest of those portions of the earlier premium income which had not been divided.

6. As an illustration of the scheme in its simplest form, let us suppose a thousand persons, all aged thirty-five, insuring simultaneously, and let us suppose there are no subsequent admissions and no lapses. Let each of these persons pay a pure annual premium of £2 during life, which will, as nearly as possible, assure £100 on a healthy life of the same age, and let the annual expenses of management be 5s. per head (*i.e.*, 12½ per cent. of the pure premium).* The income of the first year is £2,250, of which £250 is required for management expenses. Of the remaining £2,000, together with interest accrued thereon, a certain portion is to be equally divided among the representatives of those dying during the year. To find what portion is to be so divided we must ascertain what proportion of the pure premium payable by a healthy life for insurance of £100 would have to be reserved at the end of a year's assurance. From the ordinary valuation-tables we find this reserve to be £1 3s. 7d., or nearly 60¾ per cent. of the pure premium. Hence the sum to be divided in the first year would be about 40 per cent. of £2,000, *plus* £80 for interest, or about £880. Had the lives been of average health, about nine deaths might have been expected to take place during the year. Let us suppose, then, that four times this number takes place. Then £880 will be divisible among thirty-six persons, giving about £24 to each, while £1,200 is carried to the reserve fund.

7. In the second year the office starts with a reserve fund of £1,200, which earns about forty-eight pounds' worth of interest during the year. As there are now 964 policyholders, the premium income of the year is £2,169, of which £241 is expended in management, leaving a net premium income of £1,928. Adding £77 for interest, £1,200 for reserve from previous year, and £48 for interest on same, we have a total fund of £3,253. Of this the valuation-tables show that £2 8s. must be reserved on each policy, or £2,314 in all. This leaves £939 for distribution among the claimants of the year. Let us suppose them to be again thirty-six (thirty-six out of 964 being a somewhat higher death-rate than thirty-six out of 1,000), then each will receive about £26. The further progress of such a fund is indicated in the subjoined schedules.

8. For several years the sum divisible will be smaller than the net premium income; but from and after a certain date it will always be in excess of that income, and it will eventually exceed the premium income and revenue from interest taken together, and thus begin to trench on the reserve. Two questions therefore present themselves—namely, (1) Will the reserve, diminished according to this law, hold out till the last life is extinct? (2) Will it be exhausted by the failure of the last life? The answers to these questions must, from the nature of the case, obviously be in the affirmative, and researches on the mortality of under-average lives tend to show that the practical result will be that the longest lives will obtain larger sums than those who die early.

9. We have thus examined the simplest case that can occur. In practice of course the conditions will be more complicated. The insurants will not all be of the same age, they will not enter simultaneously, they will not desire to insure for the same amounts, and we shall not be able to make payments to the representatives of those who die soon after entry. Let us examine how these complications severally affect the working of the scheme.

10. Where persons, entering at the same age, desire to be insured for different amounts it is, of course, only necessary to make their premiums proportioned to the sums for which they wish to be insured. It is impossible to quote a definite premium per £100, since no fixed sum can be guaranteed at death; but it is possible to assume an abstract unit of assurance, to which a stated premium shall correspond, and the right to which shall constitute a single tontine *share*. Persons could then be allowed to purchase one or more shares, and would pay premiums in proportion to the number of shares purchased. In the case of a person purchasing a plurality of shares, his death would count in the tontine division as a plurality of deaths, and the sum receivable by his representatives would therefore be in proportion to the number of his shares. It is hardly necessary to add that, in ascertaining the amounts to be respectively divided and reserved in accordance with the principle enunciated in section 5, the premium for each share should be treated as in all respects a separate premium.

It would probably be advisable to permit insurance for fractional parts of a share, such as three-quarters of a share, one-and-a-half share, two-and-a-quarter shares, &c.; but I would fix a minimum limit (say, £1) to the premium receivable from a single individual, *i.e.*, I would not allow any individual to purchase so small an amount of insurance that his premium would fall short of £1; or, if it were thought desirable, for the sake of insuring funeral benefits to the poorer classes, to go below this limit, I would make the premiums payable proportionately larger, so as to cover the proportionately greater cost of management.

* I ignore, for the sake of simplicity, the fact that the initial expenses of management would be much heavier than those which periodically recur.

11. Persons entering at different ages would have to pay different premiums in order to secure shares of the same value. I think it would be best, until more is known of the mortality of diseased lives, to make their premiums proportional to those which would have to be paid by healthy lives of the same age. Thus, if the pure premium at age thirty-five is £2, as supposed in section 6, those for ages twenty, forty, and fifty would be £1 4s. 11d., £2 7s., and £3 10s. 10d. respectively. The proper method of loading the premiums for management expenses will be discussed subsequently. Persons dying in the same year would share alike at death (*i.e.*, in proportion to the number of their shares), whatever their ages might be.

12. Next we have to consider the bearing of the fact that our policy-holders do not insure *simultaneously*. A little consideration will show that this need not in any way affect the method by which the gross amount to be periodically divided is to be determined. Each calendar year will necessarily have a certain premium income from all the members on the books, whatever the length of time they have been insured. This premium income is composed of all the separate premiums paid during the year by the individual policy-holders, and in the case of each separate premium the method described in section 5 will give the portion to be thrown into the fund for division among claimants. Hence there is no difficulty in ascertaining the gross sum to be divided.

It remains to be seen, however, whether this gross sum ought still to be divided *equally* (or rather in exact proportion to the number of shares held) among the claimants, as it unquestionably ought in the first simplest case we considered, where all the policy-holders insured simultaneously. Let us suppose that it *is* divided equally, and consider what will happen. If, as we hope, the mode of apportionment described in section 5 has the effect of somewhat over-estimating the portion of the premium which it is necessary to reserve, then it is clear that, as time goes on, it will be possible (on an average) to pay larger and larger sums to the dying. But if we adopt the practice of dividing the gross divisible fund *equally* (*i.e.*, in proportion to number of shares) among all policy-holders, irrespectively of the duration of their policies, then the whole of this benefit will be made contingent, not on the age of the policies, but on the age of the office. The policy-holder dying in 1895 will receive more than the policy-holder dying in 1890, although both of them may have been insured precisely the same length of time. The policy-holder entering the office at an advanced stage of its existence will benefit at the expense of those who enter the office in its infancy. This is manifestly unfair. In order, therefore, to make the division equitable it will be necessary, if the ratio of the sum divisible to the number of deaths shows a steady tendency to increase as the office grows older, to divide that sum, *not* pro ratâ according to the number of shares held by the claimants, but in such a manner that those claimants who have only been insured a short time would receive no more than their predecessors did in the earlier days of the office, and that the whole benefit would go to those claimants who have been insured longer. The effect of this would be that, as the office progressed, a fixed proportion of assurance would tend to become established, corresponding to each duration of a policy, the sum assured increasing steadily with that duration. Thus it might turn out that, if £30 was the sum payable per share on policies of five years' duration, £40 would be payable on those of ten years', £60 on those of twenty years' duration, and so on. It would, of course, be necessary to wait some fifteen or twenty years before it would be possible to tell whether a steady and permanent tendency to an increase of the sums at death existed—whether, in fact, the needful reserve had been over-estimated by our method of apportionment or not.

13. A further complication is introduced by the absolute necessity of having a probationary period, say, of two years during which no payment should be made except in case of death by *bonâ fide* accident. For the sake of simplicity we have hitherto assumed that a certain proportion of the premiums of each year is annually divided among all the policy-holders dying in that year, however short a time they may have been insured. But it is clear that such a practice would open the door to what are termed "death-bed" insurances, *i.e.*, insurances effected by persons suffering from dangerous acute diseases or in the last stage of fatal chronic disease, thus greatly reducing the benefit to be derived from the scheme by that vast number of lives who are far above this level, though unable to effect insurances in ordinary offices. It is therefore necessary to adopt some plan by which, although all are allowed to enter, lives of the worst class shall receive no benefit at the expense of those above them in the scale of vitality. A probationary period secures this object more satisfactorily than any other device I can think of. A person dying within the probationary period should receive nothing, and forfeit the premiums he had paid in. As, however, the liability to accident is quite irrespective of ill-health, there would be no objection to the payment of a sum in the event of accidental death. But it would not do to divide the whole of the first two years' premiums among the claimants on account of accident, as this would give a much higher sum than would subsequently fall to the lot of persons dying natural deaths. After the office had been in existence a few years it would, I think, be best to make the sum payable on accidental death during the first two years of insurance equal to the average of the sums which had been paid on natural death during the third year of insurance. During the infancy of the office it would be necessary to adopt some other plan, and, in default of anything better, I would suggest that the sum payable on accidental death during the probationary period should be one-fifth of the amount which the premium paid would secure in the Ordinary Branch of the department.

It is worth consideration whether a payment should not also be made in case of death (during probationary period) arising from a disease (zymotic or other) *which could be proved to have commenced after the payment of the first premium*. This would be equivalent to a sort of retrospective medical examination. It would involve no medical examination at entry; but, in case of a claim on account of a natural death within the probationary period, medical evidence would have to be adduced to the effect that the disease causing death had commenced subsequently to the insurance, and that it was not merely the *sequelæ* of a disease which was already in progress at the time the first premium was paid. Unless such evidence could be furnished no payment should be made.

Thus, if a policy-holder died of typhoid fever nine months after insurance, the claim could unhesitatingly be paid; but if he died of inflammation of the lungs it would be necessary to prove that this was not merely an acute termination of a chronic consumption extending back beyond the date of insurance.

14. It is clear that by this method a much larger proportion of the premiums paid during the first two years would be reserved than of those paid subsequently. What should be done with the excess? It is not required in order to meet the increased mortality of later years; the normal reserve (as fixed in section 5) would suffice for this. I therefore recommend that, in the case of each policy-holder, the excess in question, after deducting initial expenses of management, be accumulated at compound interest, and finally paid at his death in addition to the sum to which he was normally entitled. This would give a slight extra advantage to the longest livers.

It is important to observe, as the Secretary has pointed out to me, that many persons who would be declined if proposing for a whole-life policy in the Ordinary Branch would be allowed to take out a temporary insurance of a year or of two years, and could thus protect themselves, if they wished, during the probationary period. This would still further diminish the hardship of having such a condition, though it appears to me that the difficulty is already, to a considerable extent, met by my suggestion of paying in case of death by a disease the absolute commencement of which is proved to be later than the date of insurance.

15. I have hitherto assumed, in order to make the principle of the scheme more plain, that a division would take place at the close of each calendar year. Now, unless the number of lives at risk is very great—much greater than any number we can hope to secure—the death-rate will be sure to fluctuate enormously from year to year, *though not as much as with an equal number of healthy lives*, and the method of division referred to will give very uneven results. Especially will this be the case in the earliest portion of the history of the office. I would therefore propose that, as a matter of practice, divisions should take place triennially instead of annually. This would mean that at the end of each third calendar year the number of deaths during the three immediately preceding years would be ascertained (exclusive, of course, of deaths among policy-holders of less than two years' standing), and the divisible fund, determined in accordance with section 5, would be divided among the claimants in the manner explained in section 12.

It would of course be necessary to make an interim payment immediately on proof of death. As the office grew older it would become safe to allow a tolerably large interim payment, say 60 or 70 per cent. of the average amount paid per share during the preceding triennial periods; but at first, there being no previous experience to go upon, it would be necessary to fix the interim payment by guess, and I would suggest that it be fixed at one-fifth the amount of assurance which the corresponding premium would purchase in the Ordinary Branch. Thus, a person entering at thirty, and paying a premium of £2 4s. 3d. annually, would, in case of death during his fourth or fifth year of insurance, be entitled to an interim payment of £20.

16. I would throw open the Tontine Section to all males and females above the age of twenty resident in New Zealand. It is important to obtain as large a constituency as possible, in order to reduce the fluctuations to a minimum.

17. In case of failure to pay a renewal premium I should allow no cash surrender value. I consider cash surrender values objectionable in principle except at the end of a tontine period under the American plan; but, of course, competition makes it necessary to allow them in the Ordinary Branch. The sum which had been reserved from the former premiums, after payment of share of past claims and expenses, should be regarded as a surrender value capable of (1) keeping alive the full share or shares for a certain limited period, and (2) of purchasing a certain fraction of a share free of further payments. Personally, I should prefer, in all cases after two full years' premiums had been paid, to keep alive the share for just six months, during which time, if ever, experience shows that revival will probably take place, and at the end of that time to apply the remainder of the surrender value to the purchase of a paid-up fraction of a share. What fraction of a share would be the equivalent of a given surrender value it would not for many years be possible to determine accurately, as, without knowing the rate of mortality to which the lives are subject, we cannot establish an accurate equivalence between single and annual premiums; but we should be erring greatly on the safe side if, for the present, we decided to convert the surrender value into an annual premium by ordinary mortality tables, and to apply this annual premium to the purchase of its appropriate fraction of a share.

18. It only remains to indicate the mode in which the cost of management would be met. Fortunately, this would be the simplest conceivable. Since there is no fixed sum assured, there can be no question of loading a pure premium, and there is no necessity for estimating in advance what the cost of management would be. The actual expense of each triennium would be deducted from the premium income accruing therein, and the residue would be treated as the pure premium to be operated on in accordance with section 5.

If it is thought desirable to separate between the expenses of new and of old business the former could, as suggested in section 14, be deducted from the extra reserve made in the probationary years which it is proposed to accumulate at compound interest. In that case only the expense of old business would be deducted from the gross premium income of ordinary years.

This would, on the whole, be fairer than the first-named plan, as under that there would be a tendency for the sums payable to claimants to fall during periods in which a large new business was transacted. But, as there is no medical examination, the cost of new business would be proportionately smaller than in the Ordinary Branch.

F. W. Frankland,
Government Actuary.

22nd May, 1883.

SCHEME FOR INSURANCE OF IMPAIRED LIVES.—SCHEDULE I.

PROGRESS of a Fund established on Mr. FRANKLAND'S System of Impaired-life Assurance. Mortality—Neison's Intemperate Lives; Interest, 4 per cent.

[The fund is supposed to be constituted by 1,000 persons, each aged 20, and paying £1 5s. per annum, exclusive of contribution to expenses of management.)

Year of Establishment.	Age Last Birthday.	Number of Policies at Beginning of Year.	Premium Income Pure).	Interest Accruing.	Number of Deaths.	Amount of Fund at End of Year before Division.	Hm 4-per-cent. Reserve.	Sum divisible.	Sum payable to each Claimant.	Net Increase or Decrease of Year.
			£	£		£	£	£	£ s. d.	£
1	20	1,000	1,250	50	33	1,300	643	657	19 18 2	+643
2	21	967	1,209	74	34	1,926	1,234	692	20 7 1	591
3	22	933	1,166	96	37	2,496	1,791	705	19 1 1	557
4	23	896	1,120	116	37	3,027	2,332	695	18 15 8	541
5	24	859	1,074	136	39	3,542	2,851	691	17 14 4	519
6	25	820	1,025	155	39	4,031	3,340	691	17 14 4	489
7	26	781	976	173	39	4,489	3,789	700	17 19 0	449
8	27	742	928	189	36	4,906	4,206	700	19 8 11	417
9	28	706	883	204	33	5,293	4,591	702	21 5 6	385
10	29	673	841	217	32	5,649	4,937	712	22 5 0	346
11	30	641	801	230	29	5,968	5,262	706	24 6 11	325
12	31	612	765	241	29	6,268	5,550	718	24 15 2	288
13	32	583	729	251	26	6,530	5,831	699	26 17 8	281
14	33	557	696	261	25	6,788	6,091	697	27 17 7	260
15	34	532	665	270	25	7,026	6,316	710	28 8 0	225
16	35	507	634	278	23	7,228	6,529	699	30 7 10	213
17	36	484	605	285	22	7,419	6,720	699	31 15 6	191
18	37	462	578	292	22	7,590	6,875	715	32 10 0	155
19	38	440	550	297	22	7,722	6,992	730	33 3 8	117
20	39	418	523	301	21	7,816	7,092	724	34 9 6	100
21	40	397	496	304	21	7,892	7,158	734	34 19 0	66
22	41	376	470	305	21	7,933	7,192	741	35 5 9	34
23	42	355	444	305	19	7,941	7,231	710	37 7 4	39
24	43	336	420	306	19	7,957	7,233	724	38 2 1	2
25	44	317	396	305	19	7,934	7,196	738	38 16 10	-37
26	45	298	373	303	17	7,872	7,165	707	41 11 9	31
27	46	281	351	301	17	7,817	7,093	724	42 11 9	72
28	47	264	330	297	16	7,720	7,006	714	44 12 6	87
29	48	248	310	293	15	7,609	6,911	698	46 10 8	95
30	49	233	291	288	14	7,490	6,809	681	48 12 10	102
31	50	219	274	283	13	7,366	6,706	660	50 15 5	103
32	51	206	258	279	12	7,243	6,606	637	53 1 8	100
33	52	194	243	274	12	7,123	6,475	648	54 0 0	131
34	53	182	228	268	12	6,971	6,311	660	55 0 0	164
35	54	170	213	261	11	6,785	6,153	632	57 9 1	158
36	55	159	199	254	10	6,606	6,002	604	60 8 0	151
37	56	149	186	248	9	6,436	5,863	573	63 13 4	139
38	57	140	175	242	9	6,280	5,698	582	64 13 4	165
39	58	131	164	234	8	6,096	5,550	546	68 5 0	148
40	59	123	154	228	7	5,932	5,424	508	72 11 5	126
41	60	116	145	223	7	5,792	5,274	518	74 0 0	150
42	61	109	136	216	7	5,626	5,102	524	74 17 2	172
43	62	102	128	209	6	5,439	4,957	482	80 6 8	145
44	63	96	120	203	7	5,280	4,739	541	77 5 9	218
45	64	89	111	194	6	5,044	4,552	492	82 0 0	187
46	65	83	104	186	6	4,842	4,346	496	82 13 4	206
47	66	77	96	178	6	4,620	4,121	499	83 3 4	225
48	67	71	89	168	7	4,378	3,817	561	80 2 10	304
49	68	64	80	156	7	4,053	3,492	561	80 2 10	325
50	69	57	71	143	6	3,706	3,207	499	83 3 4	285
51	70	51	64	131	7	3,402	2,837	565	80 14 3	370
52	71	44	55	116	6	3,008	2,509	499	83 3 4	328
53	72	38	48	102	6	2,659	2,161	498	83 0 0	348
54	73	32	40	88	5	2,289	1,862	427	85 8 0	299
55	74	27	34	76	4	1,972	1,617	355	88 15 0	245
56	75	23	29	66	4	1,712	1,361	351	87 15 0	256
57	76	19	24	55	4	1,440	1,094	346	86 10 0	267
58	77	15	19	45	3	1,158	890	268	89 6 8	204
59	78	12	15	36	2	941	754	187	93 10 0	136
60	79	10	13	31	2	798	612	186	93 0 0	142
61	80	8	10	25	2	647	466	181	90 10 0	146
62	81	6	8	19	1	493	394	99	99 0 0	72
63	82	5	6	16	1	416	319	97	97 0 0	75
64	83	4	5	13	1	337	242	95	95 0 0	77
65	84	3	4	10	1	256	163	93	93 0 0	79
66	85	2	3	7	1	173	82	91	91 0 0	81
67	86	1	1	3	1	86	..	86	86 0 0	82
			24,451	12,409	1,000	..	..	36,860	..	..

SCHEME FOR INSURANCE OF IMPAIRED LIVES.—SCHEDULE II.

PROGRESS of a Fund established on Mr. FRANKLAND'S System of Impaired-life Assurance. Mortality—Neison's Intemperate Lives; Interest, 4 per cent.

[The fund is supposed to be constituted by 1,000 persons, each aged 35, and paying £2 per annum, exclusive of contribution to expenses of management.]

Year of Establishment.	Age Last Birthday.	Number of Policies at Beginning of Year.	Premium Income (Pure).	Interest accruing.	Number of Deaths.	Amount of Fund at End of Year *before* Division.	H^m 4-per-cent. Reserve.	Sum divisible.	Sum payable to each Claimant.	Net Increase or Decrease of Year.
			£	£		£	£	£	£ s. d.	£
1	35	1,000	2,000	80	46	2,080	1,126	954	20 14 9	+1,126
2	36	954	1,908	121	44	3,155	2,171	984	22 7 3	1,045
3	37	910	1,820	100	43	4,151	3,137	1,014	23 11 7	966
4	38	867	1,734	195	43	5,066	4,020	1,046	24 6 6	883
5	39	824	1,648	227	42	5,895	4,830	1,065	25 7 2	810
6	40	782	1,564	256	42	6,650	5,563	1,087	25 17 7	733
7	41	740	1,480	282	39	7,325	6,247	1,078	27 12 10	684
8	42	701	1,402	306	39	7,955	6,854	1,101	28 4 7	607
9	43	662	1,324	327	38	8,505	7,384	1,121	29 10 0	530
10	44	624	1,248	345	36	8,977	7,852	1,125	31 5 0	468
11	45	588	1,176	361	35	9,389	8,238	1,151	32 17 9	386
12	46	553	1,106	374	33	9,719	8,559	1,159	35 2 5	321
13	47	520	1,040	384	31	9,983	8,823	1,160	37 8 5	264
14	48	489	978	392	29	10,193	9,040	1,153	39 15 2	217
15	49	460	920	398	28	10,358	9,196	1,162	41 10 0	156
16	50	432	864	402	26	10,462	9,321	1,141	43 17 8	125
17	51	406	812	405	24	10,538	9,423	1,115	46 9 2	102
18	52	382	764	407	24	10,594	9,455	1,139	47 9 2	32
19	53	358	716	407	23	10,578	9,440	1,138	49 9 7	− 15
20	54	335	670	404	21	10,514	9,411	1,103	52 10 6	29
21	55	314	628	402	20	10,441	9,344	1,097	54 17 0	67
22	56	294	588	397	19	10,329	9,243	1,086	57 3 2	101
23	57	275	550	392	17	10,185	9,147	1,038	61 1 2	96
24	58	258	516	387	16	10,050	9,030	1,020	63 15 0	117
25	59	242	484	381	14	9,895	8,933	962	68 14 3	97
26	60	228	456	376	14	9,765	8,784	981	70 1 5	149
27	61	214	428	368	13	9,580	8,624	956	73 10 9	160
28	62	201	402	361	13	9,387	8,414	973	74 16 11	210
29	63	188	370	352	12	9,142	8,200	942	78 10 0	214
30	64	176	352	342	12	8,894	7,941	953	79 8 4	259
31	65	164	328	331	12	8,600	7,637	963	80 5 0	304
32	66	152	304	318	12	8,259	7,289	970	80 16 8	348
33	67	140	280	303	13	7,872	6,845	1,027	79 0 0	444
34	68	127	254	284	14	7,383	6,299	1,084	77 8 7	546
35	69	113	226	261	13	6,786	5,759	1,027	79 0 0	540
36	70	100	200	238	13	6,197	5,169	1,028	79 1 6	590
37	71	87	174	214	12	5,557	4,590	967	80 11 8	579
38	72	75	150	190	11	4,930	4,027	903	82 1 10	563
39	73	64	128	166	11	4,321	3,421	900	81 16 4	606
40	74	53	106	141	9	3,668	2,908	760	84 8 11	513
41	75	44	88	120	7	3,116	2,501	615	87 17 2	407
42	76	37	74	103	7	2,678	2,071	607	86 14 3	430
43	77	30	60	85	6	2,216	1,691	525	87 10 0	380
44	78	24	48	70	4	1,809	1,437	372	93 0 0	254
45	79	20	40	59	4	1,536	1,172	364	91 0 0	265
46	80	16	32	48	3	1,252	969	283	94 6 8	203
47	81	13	26	40	3	1,035	757	278	92 13 4	212
48	82	10	20	31	2	808	614	194	97 0 0	143
49	83	8	16	25	2	655	467	188	94 0 0	147
50	84	6	12	19	1	498	394	104	104 0 0	73
51	85	5	10	16	1	420	319	101	101 0 0	75
52	86	4	8	13	1	340	242	98	98 0 0	77
53	87	3	6	10	1	258	163	95	95 0 0	79
54	88	2	4	7	1	174	83	91	91 0 0	80
55	89	1	2	3	1	88	..	88	88 0 0	83
			32,550	13,086	1,000	..	..	45,636	..	..

It will be seen that the essential feature of the proposed plan is the absence of any guaranteed assurance, the sum payable at death being made to depend in a certain way on the mortality actually experienced in the Diseased-life Section. It is obvious that this feature militates *pro tanto* against the popularity of the scheme, but the Government Actuary did not feel himself justified, in the present state of statistical knowledge, in incorporating any guarantee into his scheme, unless it were for a scale of sums assured so small as to fail in making the plan more popular. Under these circumstances, the Consulting Actuaries' opinion is requested as to whether a scheme of insurance for diseased lives can safely be inaugurated with fixed sums assured, and also whether the scheme devised by the Government Actuary, with or without modification, is safe, practicable, and otherwise satisfactory. Suggestions for improving it in any of these respects are invited.

(v.) *Questions submitted to the Consulting Actuaries.*

In pursuance of the foregoing remarks, the following questions are now submitted to the Consulting Actuaries :—

1. Would it be just, practicable, and expedient to amalgamate the funds of the General and Temperance Sections and, at future valuations, estimate the profit in each section in accordance with the principle of the draft clause quoted in (ii.) ?

If so, what would be the most desirable method of estimating the profit from favourable or loss from unfavourable mortality in each section, and what would be the best method of dividing this profit in each section among the individual policy-holders insured in it?

2. Apart from the question of estimating special profit from mortality in the two sections, would it be equitable and expedient to change the method of allocating bonus (among individual policy-holders) hitherto adopted, for one which would tend to secure approximately constant or, if possible, increasing reversionary bonuses to the same policy-holder, at successive divisions? If so, what method would it be best to adopt?

3. Is the scheme of diseased-life insurance explained in (iv.), with or without modification, safe, practicable, and otherwise satisfactory? Can any suggestions be made for its improvement, and in particular could minimum sums assured (and, if so, for what amounts), arranged on a sliding scale according to duration of policy, be safely guaranteed ?

The Consulting Actuaries are invited to explain, as fully as may be convenient, their reasons for the opinions they express in reply to these questions.

F. W. Frankland,
Government Actuary and Statist.

4th November, 1887.

JOINT OPINION UPON THE FOREGOING CASE

OF

ARTHUR HUTCHESON BAILEY, Esq.,
A former President of the Institute of Actuaries, and Actuary to the London Assurance Corporation;

RALPH PRICE HARDY, Esq.,
A former Vice-President of the Institute of Actuaries, and Consulting Actuary to the United Kingdom Temperance and General Provident Institution; and

GEORGE KING, Esq.,
A former Member of the Council of the Institute of Actuaries, and Actuary to the Atlas Assurance Company.

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1. We have carefully considered the questions which have been submitted to us, and have had the advantage of the presence of Mr. Frankland at our consultations, which has been of great service to us by the explanations which he has afforded of the circumstances under which these questions have arisen.

QUESTION I.

2. In answering Question 1, it may be well to set out at the commencement the clause in the prospectus by virtue of which the Temperance Section was opened. It is as follows:—

"To fulfil and encourage the growing desire in favour of a special class of insurance expressed by a large and increasing number of persons in the community who profess and practise the principles of total abstinence from intoxicating liquors, a distinct section has been established in which only total abstainers are insured. On medical testimony and published statistical information is based the contention that such abstinence is greatly conducive to longevity, and to limitation and prevention of diseases. It is recognised that those persons for whom the new section is inaugurated will naturally consider themselves entitled to enjoy whatever increased insurance benefit, in the shape of additional profit, may arise from the lower rate of mortality which is claimed as one result of their abstinence. The profits, therefore, of this section will be divided only amongst those insured within it, who adhere to the practice of total-abstinence principles.

"With a view to prevent infringement of these principles amongst the assured in this section, a declaration of continuous adherence to the practice thereof will annually be required from the insured. A form of declaration will be periodically forwarded to each policy-holder in the section, to be made and signed by him, and returned to the nearest agency, or to the head office.

"For the due protection of the interests of policy-holders who strictly conform to the agreement to abstain from alcoholic liquors, it is provided that a policy-holder who at any time violates the essential condition of the section shall thereupon be entered on a non-profit list of the section, and be debarred from participation in any profits which may thereafter be declared."

3. It will be noticed that in the above extract the statement is emphatic that a *distinct section* has been established in which only total abstainers are assured; and that, although the only difference of profits particularly referred to is that arising from an assumed difference in the rate of mortality, yet the statement is equally emphatic that the profits of the section "*will be divided only amongst those insured within it who adhere to the practice of total-abstinence principles;*" and, again, that those who depart from such principles will be entered on a non-profit list *of the section.*

It may be pointed out that, if the regulations were literally carried out, there would be another source of difference in profits between the General and Temperance Sections, besides the assumed difference in the rates of mortality, because the automatically-created non-profit list in the Temperance Section would, in the course of time, probably produce a surplus. There would, doubtless, be other sources of difference in profits, such as possible difference in the proportionate numbers of policies lapsed or surrendered; but it is needless to particularise them further.

4. In view of the clear language of the prospectus, and the apparent intention to keep the entire profits of the two sections separate, we did not consider that we had any option, in the valuation made as on 31st December, 1885, to do otherwise than treat the two sections as practically distinct concerns, and to apportion the fund in accordance with the particulars supplied to us. Moreover, looking at all the facts, we are of opinion that the course then pursued was just to all parties; and, further, that, if continued, the members of the Temperance Section who permanently adhere to the practice of total-abstinence principles will, in the long-run, have no cause to be dissatisfied.

5. It would appear, however, from the case submitted to us, that in some quarters of the colony the true bearing of the language of the prospectus has not been adequately realised, and that it has been expected that the bonuses to General and Temperance policy-holders will differ only if the rates of mortality in the two sections differ.

If this be the prevailing view in the colony, we think that (legislative sanction being obtained, if necessary),—

(*a.*) It would be practicable and not unjust to amalgamate the funds of the General and Temperance Sections, and at future valuations to dissect the surplus in accordance with the principle of the clause drafted by the Government Actuary and Statist;

(*b.*) The question of expediency can be better decided in the colony than in London.

We would, however, remark that, on the one hand, if the funds be kept apart there may from time to time be fluctuations in the relative amounts of profits of the two sections, these fluctuations being produced by various causes, besides differences in the mortality-experience; that it would be difficult to explain popularly the reasons for the fluctuations, and that, consequently, there would be a constant tendency to prejudicial discussions which might interfere with the flow of business and the prosperity of the Association. Moreover, disputes might arise also as to the apportionment of the expenses, which might have similar effects. On the other hand, if the funds be amalgamated, complications must take place in the office calculations, which mean additional trouble and expense: but these can be surmounted, at the cost of additional clerical assistance. In amalgamating the funds, all causes of difference in bonus in like cases would be eliminated, except difference in the mortality-experience of the two sections; and, consequently, the grounds of harassing agitation would be removed.

6. Striking the balance of advantages, in our opinion there is no occasion, in so far as existing members are concerned, to amalgamate the funds; but amalgamation appears to be desired by some portions of the community, and hence is likely to result in extension of business.

7. The method, briefly sketched by the Government Actuary and Statist in the case submitted, of estimating the profit from favourable or the loss from unfavourable mortality in each section, is the correct one; and it would be the proper method to follow, if absolute accuracy in the calculations were a matter of importance. But it would involve an almost prohibitive amount of labour, and we think an approximate method, as suggested by the Government Actuary and Statist, will have practically the same effect.

8. In the Appendix is given a special mortality table, with corresponding monetary tables at 4 per cent. interest. The mortality table has been formed from the standard hitherto used in the valuations of the department—namely, "The Institute of Actuaries' Experience of Healthy Male Lives"—by dealing only with the duration of the policies, and not with the ages of the lives. It is thus, practically, an average-mortality table, corresponding to the average age at entry according to the Institute experience, namely, 35½ years. This average-mortality table will measure, with sufficient accuracy, the departure of the experience of the lives assured in the department from the standard, the average age at entry in the department being not very different—namely, 36⅔ years in the General Section, and 33⅗ years in the Temperance Section.

9. We suggest that the policies in each section should be grouped according to their duration, without reference to age; and that the "expected claims" be ascertained annually, by multiplying the amount exposed to risk for each year of assurance by the corresponding rate of mortality in the average mortality table.

Assuming, for purposes of illustration, that there has been favourable mortality, the difference between the actual claims and expected claims thus calculated will represent, with sufficient closeness, for each year of assurance the extra amount remaining at risk on the books, over and above the amount which would have remained at risk had the mortality-experience of the department coincided with the standard. In order to ascertain the real gain from the favourable mortality, the reserve which must be held against this extra amount

remaining at risk must be calculated, and we think this may be done, with sufficient accuracy for all practical purposes, by valuing the extra amount by the monetary tables in the Appendix hereto, again observing only the duration of the policies.

10. On the above system the labour would be materially reduced, though necessarily heavy. For the ordinary whole-life assurances one grouping only would be required in each section. For the endowment assurances, and the whole-life assurances by a limited number of premiums, a group would have to be made for each class according to the number of premiums reserved under the policies; but by adopting a quinary arrangement the labour here could be considerably shortened. Thus, groups could be formed of policies issued under the five-premium scale, ten-premium scale, &c.; and policies on other scales could be placed in the nearest quinary group. Thus, a policy on the twelve-premium scale would be included with those on the ten-, and a policy on the thirteen-premium scale with those on the fifteen-, and so on.

11. In the method sketched out above, of estimating the profit or the loss from mortality, it is assumed that all the policies on the books have been issued at tabular rates, whereas some of them are subject to extra charge. Each year, therefore, the total amount of extra charge must be ascertained, and treated as additional profit from mortality.

The method that, in our opinion, should be followed in dividing the profit from mortality in each section among the individual policy-holders assured in it will be explained in our reply to Question II.

Question II.

12. Within certain limits, it is, in our opinion, expedient to adapt the method of allocating bonus among individual policy-holders of an assurance association to the views of the assured; and we think that the method hitherto adopted by the New Zealand Government Insurance Department may, under existing circumstances, be modified, and that, in giving effect to the modification, the end may be kept in view of approximately constant or even increasing reversionary bonuses to the same policy at successive divisions.

On each of the two occasions of allocation of bonus the divisible surplus was distributed in proportion to the "loading" on the premiums in respect of the several policies. The accumulated funds have, however, now reached a large amount; and it is reasonable to expect that a considerable portion of the surplus which will be available for division at future valuations will have accrued from the higher rate of interest realised over that assumed in the calculations.

14. We would suggest that the amount of surplus thus arising from interest be ascertained at each valuation, and that it be distributed among the policies existing at the date of the valuation, in proportion to their respective reserve values at the date of the last-preceding valuation.

The remainder of the divisible surplus (after setting aside the profit from mortality, discussed in the next paragraph) should, we think, be divided in proportion to "loading"—that is, in the same manner as has been hitherto followed in distributing the whole of the divisible surplus.

15. In order to complete our reply to Question I., it remains to say what, in our opinion, would be the best method of dividing the profit from mortality in each section among individual policy-holders assured in it. The theoretically-correct method would involve an enormous amount of labour, out of all proportion to the advantages it would bring. We think that that labour may be diminished, and yet that substantial justice may be done, by merging in each section the profit from mortality with that portion of the surplus coming to the section, which we have recommended should be distributed in proportion to "loading."

16. On the general question of the distribution of profit, we would remark that, by allotting the surplus arising from interest in proportion to policy-values, a tendency will be introduced towards bonuses increasing with the duration of the policy; but it is not possible to say that the reversionary bonuses will always so increase. That will depend on the rate of surplus interest. For example: we have made an estimate, and, assuming that the rate of interest realised on the funds is maintained at about $1\frac{1}{4}$ per cent. above the rate employed in calculating the reserves, the reversionary bonuses to an ordinary whole-life policy will remain nearly constant from valuation to valuation; while, if the difference between the rates of interest be maintained at more than $1\frac{1}{4}$ per cent., the reversionary bonuses will probably increase. This, however, is merely an estimate; and an exact calculation is impracticable.

17. In conclusion, we wish to express our strong opinion that no rigid rules for the

distribution of surplus should be laid down. The method should be capable of modification (under actuarial advice) at each valuation, so as to meet altering circumstances. The permanent interests of the assured, collective and individual, will best be consulted by leaving entire discretion to the governing body.

Question III.

18. We have examined the scheme suggested for assurances upon diseased lives.

It is proposed to divide the contributions into shares, for each of which there is to be made a fixed annual payment, graduated according to age; but the sum assured is to be uncertain, and to be dependent upon the mortality actually experienced. No medical examination is to be required; but there is to be a probationary period of two years, during which no amount is to be payable except in the case of death by accident.

19. We think the scheme safe, and the method proposed for its working ingenious. There are existing societies which contract to secure a fixed sum assured for a varying annual-payment; and, regarded merely as a problem of life-assurance finance, the converse of the proposition,—to arrive at an annually-varying sum assured in consideration of a fixed annual payment,—is quite capable of solution.

20. But, before pronouncing an opinion as to its applicability to the particular class of lives referred to in the scheme, it may be desirable to inquire into the past experience of assurances on such lives.

Sixty-three years ago two societies were founded to entertain proposals for assurances on lives which had been declined. Others were subsequently established for a similar purpose. From statistics of one of these societies to which we have had access, extending over a period of about forty years, it appears that the rate of mortality among the diseased lives was 78 per cent. in excess of that among the healthy, and that no material improvement is observable when the early years of assurance are omitted.

21. The cost of assurance on diseased lives is therefore materially greater than on healthy lives. But it is found by experience that, if considerable additions to the ordinary rates of premium are asked, they will seldom be paid, so that, practically, the limit of surcharge is soon reached; and the result is that, while nearly all life-assurance societies now grant policies with moderate additions to the ordinary premium, the lives of those who are subject to serious organic disease, or are of known intemperate habits, or have a very unfavourable family history, remain unassured—not for want of attempts to determine rates of premium for the risks, but because the premiums demanded are not paid.

All the lives included in the experience we have mentioned were subjected to medical examination, and several cases were found to be ineligible altogether. But it is one of the features of the proposed scheme that medical examination is to be dispensed with, and that no one is to be refused. We think therefore that the class of lives coming within the scheme would be composed, for the most part, of the worst, and that the mortality among them would be very heavy during the first two years.

22. We can therefore come to no other conclusion than this: that a scheme of life assurance in which the amount payable at death would be nil for a probationary period of two years, and afterwards altogether uncertain, except that it would be much less than the same annual payment would secure for an ordinary life, would not be accepted by the public; and, further, that for policies effected for business purposes, such as security for loans, the scheme would be useless.

And we do not think that a minimum sum assured can safely be guaranteed in ignorance of the rate of mortality that may prevail. Even if attempted, the amount must be so small as at once to subject the scheme to discredit.

For these reasons we think it undesirable that such a scheme should be put forward.

A. H. Bailey.
Ralph P. Hardy.
George King.

London, 27th December, 1887.

APPENDIX.

Mortality Table, arranged for Years of Assurance.

TABLE I. (Numbers).

Duration. x.	q_x.	p_x.	D_x 4%.	N_x 4%.	a_x 4%.	Duration. x.
0	·00459	·99541	100000·	1543605·	15·436	0
1	·00762	·99238	95713·	1447892·	15·128	1
2	·00989	·99011	91329·	1356563·	14·854	2
3	·01150	·98850	86948·	1269615·	14·602	3
4	·01259	·98741	82644·	1186971·	14·363	4
5	·01349	·98651	78464·	1108507·	14·128	5
6	·01425	·98575	74429·	1034078·	13·894	6
7	·01489	·98511	70547·	963531·	13·658	7
8	·01560	·98440	66822·	896709·	13·419	8
9	·01658	·98342	63250·	833459·	13·177	9
10	·01758	·98242	59809·	773650·	12·935	10
11	·01862	·98138	56498·	717152·	12·693	11
12	·01971	·98029	53314·	663838·	12·451	12
13	·02085	·97915	50253·	613585·	12·210	13
14	·02204	·97796	47312·	566273·	11·969	14
15	·02328	·97672	44490·	521783·	11·728	15
16	·02457	·97543	41783·	480000·	11·488	16
17	·02590	·97410	39189·	440811·	11·248	17
18	·02728	·97272	36705·	404106·	11·010	18
19	·02869	·97131	34331·	369775·	10·771	19
20	·03015	·96985	32063·	337712·	10·532	20
21	·03165	·96835	29901·	307811·	10·294	21
22	·03322	·96678	27841·	279970·	10·056	22
23	·03488	·96512	25880·	254090·	9·818	23
24	·03669	·96331	24017·	230073·	9·579	24
25	·03871	·96129	22246.	207827·	9·342	25
26	·04106	·95894	20562·	187265·	9·108	26
27	·04389	·95611	18960·	168305·	8·877	27
28	·05013	·94987	17431·	150874·	8·655	28
29	·05386	·94614	15920·	134954·	8·477	29
30	·05569	·94431	14483·	120471·	8·318	30
31	·05642	·94358	13150·	107321·	8·161	31
32	·05676	·94324	11931·	95390·	7·995	32
33	·05726	·94274	10821·	84569·5	7·815	33
34	·05827	·94173	9809·1	74760·4	7·621	34
35	·05999	·94001	8882·2	65878·2	7·417	35
36	·06252	·93748	8028·2	57850·0	7·206	36
37	·06586	·93414	7236·9	50613·1	6·994	37
38	·06991	·93009	6500·1	44113·0	6·787	38
39	·07448	·92552	5813·3	38299·7	6·588	39
40	·07927	·92073	5173·4	33126·3	6·403	40
41	·08393	·91607	4580·0	28546·3	6·233	41
42	·08800	·91200	4034·3	24512·0	6·076	42
43	·09111	·90889	3537·8	20974·2	5·929	43
44	·09149	·90851	3091·7	17882·5	5·784	44
45	·09213	·90787	2700·8	15181·7	5·621	45
46	·09260	·90740	2357·7	12824·0	5·439	46
47	·09290	·90710	2057·1	10766·9	5·234	47
48	·09311	·90689	1794·2	8972·7	5·001	48
49	·09358	·90642	1564·6	7408·1	4·735	49
50	·09653	·90347	1363·6	6044·5	4·433	50
51	·10676	·89324	1184·6	4859·9	4·103	51
52	·12850	·87150	1017·4	3842·58	3·777	52
53	·15178	·84822	852·59	2989·99	3·507	53
54	·16323	·83677	695·38	2294·61	3·300	54
55	·17257	·82743	559·50	1735·11	3·101	55
56	·18883	·81117	445·13	1289·98	2·898	56
57	·20489	·79511	347·19	942·79	2·716	57
58	·22047	·77953	265·44	677·35	2·552	58
59	·22699	·77301	198·96	478.39	2·404	59
60	·24683	·75317	147·88	330·51	2·235	60
61	·25056	·74944	107·10	223·413	2·086	61
62	·25387	·74613	77·176	146·237	1·895	62
63	·26591	·73409	55·368	90·869	1·641	63
64	·29000	·71000	39·082	51·787	1·325	64
65	·36000	·64000	26·681	25·106	·942	65
66	·56089	·43911	16·419	8·687	·529	66
67	·76000	·24000	6·933	1·754	·253	67
68	·90000	·10000	1·600	·154	·096	68
69	1·00000	·00000	·154	..	..	69

MORTALITY TABLE, ARRANGED FOR YEARS OF ASSURANCE—*continued.*

TABLE II. (LOGARITHMS).

Duration. x.	Log l_x.	Log q_x.	Log p_x.	Log D_x 4%.	Log N_x 4%.	Log a_x 4%.	Duration. x.
0	5·00000	$\bar{3}$·66181	$\bar{1}$·99800	5·00000	6·18853	1·18853	0
1	4·99800	·88196	·99668	4·98097	·16074	·17977	1
2	·99468	$\bar{2}$·99520	·99568	·96061	·13245	·17184	2
3	·99036	2·00070	·99498	·93926	·10367	·16441	3
4	·98534	·00000	·99450	·91721	·07445	·15724	4
5	·97984	·13000	·99410	·89467	·04474	·15007	5
6	·97394	·15381	·99377	·87174	·01456	·14282	6
7	·96771	·17289	·99348	·84848	5·98387	·13539	7
8	·96119	·19301	·99317	·82492	·95265	·12773	8
9	·95436	·21948	·99274	·80106	·92088	·11982	9
10	·94710	·24507	·99230	·77677	·88854	·11177	10
11	·93940	·27008	·99184	·75203	·85561	·10358	11
12	·93124	·29472	·99135	·72684	·82206	·09522	12
13	·92259	·31907	·99085	·70116	·78788	·08672	13
14	·91344	·34315	·99032	·67497	·75302	·07805	14
15	·90376	·36692	·98977	·64826	·71749	·06923	15
16	·89353	·39033	·98920	·62100	·68124	·06024	16
17	·88273	·41339	·98860	·59316	·64425	·05109	17
18	·87133	·43578	·98799	·56473	·60650	·04177	18
19	·85932	·45774	·98736	·53569	·56794	·03225	19
20	·84668	·47922	·98670	·50601	·52854	·02253	20
21	·83338	·50036	·98603	·47568	·48828	·01260	21
22	·81941	·52136	·98533	·44468	·44711	·00243	22
23	·80474	·54258	·98458	·41297	·40499	0·99202	23
24	·78932	·56453	·98377	·38052	·36186	·98134	24
25	·77309	·58786	·98285	·34726	·31771	·97045	25
26	·75594	·61343	·98179	·31307	·27247	·95940	26
27	·73773	·64234	·98051	·27783	·22611	·94828	27
28	·71824	·70013	·97766	·24131	·17860	·93729	28
29	·69590	·73128	·97596	·20193	·13017	·92824	29
30	·67186	·74577	·97511	·16086	·08088	·92002	30
31	·64697	·75141	·97478	·11894	·03068	·91174	31
32	·62175	·75407	·97462	·07668	4·97950	·90282	32
33	·59637	·75788	·97439	·03427	·92722	·89295	33
34	·57076	·76546	·97393	3·99163	·87367	·88204	34
35	·54469	·77810	·97313	·94852	·81874	·87022	35
36	·51782	·79605	·97196	·90462	·76230	·85768	36
37	·48978	·81863	·97041	·85955	·70426	·84471	37
38	·46019	·84455	·96853	·81292	·64457	·83165	38
39	·42872	·87206	·96639	·76442	·58320	·81878	39
40	·39511	·89910	·96413	·71378	·52017	·80639	40
41	·35924	·92391	·96193	·66087	·45555	·79468	41
42	·32117	·94450	·95999	·60577	·38938	·78361	42
43	·28116	·95958	·95851	·54873	·32168	·77295	43
44	·23967	·96137	·95833	·49020	·25244	·76224	44
45	·19800	·96441	·95802	·43150	·18133	·74983	45
46	·15602	·96659	·95780	·37249	·10802	·73553	46
47	·11382	·96803	·95766	·31325	·03209	·71884	47
48	·07148	·96900	·95755	·25388	3·95292	·69904	48
49	·02903	·97117	·95733	·19440	·86971	·67531	49
50	3·98636	·98467	·95591	·13469	·78136	·64667	50
51	·94227	$\bar{1}$·02839	·95097	·07357	·68663	·61306	51
52	·89324	·10889	·94027	·00751	·58463	·57712	52
53	·83351	·18121	·92851	2·93074	·47567	·54493	53
54	·76202	·21280	·92261	·84222	·36071	·51849	54
55	·68463	·23697	·91773	·74780	·23932	·49152	55
56	·60236	·27607	·90911	·64849	·11059	·46210	56
57	·51147	·31152	·90043	·54057	2·97442	·43385	57
58	·41190	·34335	·89183	·42397	·83081	·40684	58
59	·30373	·35601	·88819	·29876	·67978	·38102	59
60	·19192	·39240	·87689	·16992	·51918	·34926	60
61	·06881	·39891	·87474	·02978	·34910	·31932	61
62	2·94355	·40461	·87281	1·88748	·16507	·27759	62
63	·81636	·42473	·86575	·74326	1·95842	·21516	63
64	·68211	·46240	·85126	·59198	·71422	$\bar{1}$·12224	64
65	·53337	·55630	·80618	·42620	·39978	1·97358	65
66	·33955	·74888	·64257	·21535	0·93887	·72352	66
67	1·98212	·88081	·38021	0·84089	$\bar{1}$·24403	$\bar{1}$·40314	67
68	·36233	·95424	·00000	$\bar{1}$·20406	1·18752	2·98346	68
69	0·36233	0·00000	— ∞	1·18752	..	..	69

[*Approximate Cost of Paper.*—Preparation, nil; printing (1,375 copies), £13 2s.]

By Authority: GEORGE DIDSBURY, Government Printer, Wellington.—1888.