

## THE TREATMENT OF SUB-STANDARD LIVES IN PRACTICE

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Has it ever really been proved that the lives that we call under-average *are* under average? It would be very interesting indeed to have an investigation not of individual impairments, but of a block of lives that are rated-up, except, perhaps, the very heavily rated-up cases, just to see whether their mortality is really higher than of those we take at ordinary rates.

C. S. PENN, *T.F.A.* XIX, 82 [1949]

THE purpose of this paper is to provide a basis for a discussion on the treatment of proposals for life assurance on sub-standard lives. To assist in this discussion a body of mortality data in respect of the sub-standard lives of a particular office is presented. The data relate to ordinary life assurances issued in this country subject to a diminishing lien. In the light of these data certain suggestions are made regarding the relative financial importance of the extra mortality of impaired lives in modern conditions. Apart from this statistical material, there is little that is new or original in the paper, although it is hoped that the author's relatively simple outlook on the subject may be of general interest and of assistance to students. The paper is concerned with the actuarial and practical aspects of the subject rather than with the medical aspects.

There has been a tendency in this country in the past to divide this subject into two almost independent trends of thought. First, there is the idea that, in place of the old process of rating-up the age, a more scientific approach requires the consideration of the incidence of the extra risk—is it early, constant or late? On the other hand, there is the numerical rating system in which points for and against the life are given according to a schedule of favourable and unfavourable features of personal and family history and clinical findings. The first, or British, tradition lays emphasis on the incidence of the risk; otherwise, the rating of a life is fixed on a broad over-all judgment (by the medical officer or by the actuary or by joint consultation) of the features of the risk. The latter, or American, tradition assumes that (except in special cases) the form of the extra risk is a uniform percentage of the normal mortality and otherwise the rating is fixed by reference to the points-schedule already referred to.

This dichotomy can be clearly seen in the following two quotations from the same page of a paper entitled *Notes on constant and increasing extra mortality* by S. C. Keppic and A. C. Stepney (*T.F.A.* XIX, 47 [1949]):

It is likely that many underwriters when faced with a proposal from an under-average life do little more than attempt to decide whether the life is subject to decreasing, constant, or increasing mortality.

and

It is well known that the American offices have chosen to express extra mortality as a percentage, constant throughout life, of the basic mortality experienced by their healthy lives assured.

The persistence in this country of the 'early, constant or late' view of sub-standard mortality is apparent from the discussion of that paper and from the discussion of the later paper entitled *The investigation of extra mortality* by T. M. Springbett (*T.F.A.* xix, 260 [1950]). The persistence of this idea in this country despite its comparative neglect elsewhere is a remarkable phenomenon, associated perhaps with the absence of any British experience of the mortality of sub-standard lives as well as with our incurable insularity of outlook.

It is submitted that a more appropriate approach to the problem of sub-standard mortality in present practical conditions is a combination of the two traditional approaches. First of all, it is suggested that to fix the primary attention on the incidence of the extra risk is to be concerned with the second moment or spread of the extra mortality before settling the general level of the extra mortality. This general level is usually so speculative that refinements about shape can hardly fail to introduce a spurious accuracy that serves no purpose other than to confuse the exercise of sound judgment. There are, of course, exceptions to this too-general statement. On the other hand, the British tradition of an over-all judgment of the final rating has an obvious advantage over a piecemeal mechanical approach: any points-schedule must be an arbitrary rough-and-ready instrument which fails to take account of those subtle indications in the proposal papers which, rightly or wrongly, the experienced underwriter regards as important and, in some cases, even more important than the specific medical facts.

The approach advocated for the general run of cases is, therefore, the assumption of a uniform percentage extra mortality, the amount of which is to be fixed by an over-all judgment of the facts of the case in the light of the policy of the office with regard to its first-class standard and to the necessity or otherwise of imposing a rating right up to the assumed level of extra mortality.

It would seem that this approach has for a good many years been adopted by the Scandinavian offices which specialize in sub-standard lives. Their approach is summed up in the following quotation from the paper entitled *Some statistical notes on the insurance of under-average lives in Sweden* by Paul Bergholm (*Transactions of the Eleventh International Congress of Actuaries*, III, 201 [1937]):

The Committee estimates the anticipated extra mortality of each accepted risk.

With regard to the extra mortality, the accepted risks are allotted to one of the following risk tables: 0%, 1-70%, 71-100%, 101-150%, 151-200%, 201-250% and above 250%.

Reference should also be made to the valuable paper by Olav Aabakken in the same volume (p. 177) entitled *The insurance of under-average lives in Norway. Statistical investigations*. The similarity of approach between these papers and the present paper will be apparent in various other respects, e.g. in the study of percentages of the proposals allocated to the various rating groups and the examination of the mortality of the separate rating groups.

Before discussing the question of the first-class standard and the possibility of tempering the wind to the shorn lamb, brief reference may first be made to the fact that for endowment assurances, which commonly form by far the greater proportion of new proposals, the assumption of an extra mortality of  $k\%$  can be at once translated into a diminishing lien or an extra premium by simple principles which are presumably part of every underwriter's stock-in-trade (see, for example, A. B. Chiles, *J.S.S.* iv, 244 [1935]). These principles

are referred to in the new 'Life Offices' text-book by M. E. Ogborn and N. E. Coe. For an endowment assurance subject to continuous premiums we can assume with sufficient accuracy that the sum at risk diminishes in a straight line from unity at entry to zero at maturity. The percentage lien should, therefore, start at  $100k/(100+k)$  and diminish to zero in arithmetical progression over the period of the policy. Also, with sufficient accuracy, the reserves required are the same as for a first-class life. For premiums payable less frequently, the initial lien may be reduced in respect of that part of the first premium not required for initial expenses and should diminish in steps as each premium falls due. In practice, annual steps are often used even for quarterly or monthly premiums. In actual underwriting on the diminishing lien system, the underwriter fixes the lien directly on his judgment of the facts and does not normally go through the intermediate process of deciding upon the percentage extra mortality.

The extra premium equivalent to  $k\%$  extra mortality is readily obtained from the approximate formula  $\cdot 01k(P_{[x] \text{ } [x] \text{ } \overline{n}} - P_{[x] \text{ } \overline{n}})$  (see, for example, H. Jecklin, *Proc. Cent. Assembly Inst. Actuaries*, 11, 174). This formula is also sufficiently accurate for whole-life assurances, except that if  $k$  exceeds 100 it is clearly better to interpolate between  $P_{x:\infty}(r \text{ lives})$  and  $P_{x:\infty}(r+1 \text{ lives})$  where  $100(r+1) > (100+k) > 100r$ .

Extra premiums calculated in this way are, of course, net extra premiums and need to be loaded appropriately to obtain the office extra premiums. In an office whose normal system is the lien system, a proportion of applications will be received for an alternative extra premium to be quoted. These proposals are, no doubt, a 'selected' sub-group out of the whole group of rated-up cases and care is needed if the office is to avoid exploitation. A convenient way of fixing such alternative extra premiums is to compute the office temporary-assurance premium for a reducing sum assured equal to the diminishing lien on a life subject to  $k\%$  extra mortality, assuming that the temporary-assurance premiums have not been fixed at an unduly high level. To do this it is usually sufficient to substitute a uniform sum assured for half the period and to charge  $(1+k/100)$  times the office temporary-assurance premium for half the period. An example will make the process clear. Suppose that a lien of 30% reducing  $1\frac{1}{2}\%$  per annum has been quoted for a 20-year endowment assurance subject to annual premiums on the basis of assumed extra mortality of approximately 50%. The extra premium payable for 10 years or until earlier death would be 1.5 times the office's 10-year temporary-assurance premium for 30% of the sum assured. The corresponding extra premium payable for 20 years or until earlier death would be somewhat more than half the extra premium payable for 10 years and could be taken as 60% thereof for practical purposes.

It is convenient here, for the sake of completeness, to mention two special points. These are (1) that it is usual (and obviously sufficiently accurate for practical purposes) to charge the same bonus loading and to allot the same bonuses for sub-standard lives as for first-class lives and (2) that the diminishing lien—as opposed to a constant lien for a limited number of years—has become the normal practice, because for the purpose of the income tax relief on life assurance premiums the Inland Revenue is prepared in suitable circumstances to ignore a diminishing lien in applying the limitation of 7% of the sum assured on death.

The body of lives accepted at standard rates is obviously not a homo-

geneous group. Any underwriter is aware of the fairly wide range of risks between the super-life—the perfect specimen with an impeccable family history and personal habits and engaged in one of the ideal occupations—and the border-line life who has been just squeezed into the first-class group. The first-class rates of mortality represent the average mortality of the whole group of lives. We can think of these lives as being subdivided into groups with mortalities round the average. Without getting embroiled, on this occasion, in controversial questions in the philosophy of probability theory, it is not difficult to conceive that we could easily select at entry a group, a small percentage of the whole, of super-lives who would experience mortality rates for a number of years after entry of, say, less than 85% of the average mortality of the whole group of first-class lives. Similarly, on the basis of the facts disclosed in the medical and other proposal papers, we could select a small group who would experience, say, more than 130% of the average mortality of the whole group of first-class lives.

These considerations indicate that the first-class standard is a matter of deliberate policy rather than an objective criterion. Indeed, the standard may fluctuate from time to time in the same office. The experienced underwriter will acknowledge the difficulty of maintaining an unvarying standard. And we know that the general standard varies from office to office.

Similarly, the division of the lives regarded as sub-standard into various groups of assumed extra mortality (whether this is a deliberate process or the by-product of individual assessment of risk) must be regarded partly as the result of policy and not solely the reflection of objective facts. Nevertheless, each such group can be thought of as having a typical average mortality level (e.g.  $[100 + k]\%$  of the first-class mortality) and as being capable of being distributed into sub-groups around such average level. Obviously, the distribution for the lowest sub-standard group must be expected to overlap the distribution for the first-class group and also to overlap the distribution for the next higher sub-standard group. This must be expected to be so, however carefully an office may try to pursue an objective underwriting policy.\* These ideas are implicit in the American and Scandinavian approaches and are expressed explicitly by R. D. Murphy in the following words from his paper entitled *Methods employed in statistical research for risks on under-average lives*, in the same Congress volume (p. 163):

Lives which are accepted at normal rates of premium are by no means homogeneous in their mortality classification. In the United States it is common practice to insure without extra charge groups of risks which display a mortality not more than approximately 125% of the average mortality of those insured at normal rates. Hence the whole normal or standard class includes a large proportion of preferred risks to balance the less desirable risks and the very best group experiences a mortality substantially below that of the least favourable group.

It is further evident from the study of groups that they proceed more or less continuously from the best to highly impaired groups, and the line of demarcation between normal and under-average business is a very fine one, difficult to apply when drawn.

With these thoughts in mind we may now consider some tentative figures suggested from practical experience both of underwriting and of analysis of

\* In theory at least, the lives may be allocated among the groups and distributed within the groups in many different ways and still preserve in each arrangement the features discussed above. The significance of this from the point of view of the theory of probability is not suitable for discussion in the present context.

the statistics of underwriting. Suppose that an office declines only a very small percentage of its proposals (i.e. well under 1%), accepts 90% at standard rates and puts the rest into four sub-standard mortality groups of increasing severity distributed roughly in the proportions 60, 20, 12 and 8. These four groups can be regarded as being subject (both as assessed and as broadly realized in practice) to mortality ratios of 150%, 200%, 300% and 500% of the first-class mortality, representing light, medium, heavy and very heavy ratings respectively. These figures are not altogether inappropriate as a rough representation (and particularly rough for the higher groups in which the number of lives would necessarily be small) of a particular office's experience for a good many years before the war. Variations by age at entry, by class of assurance, by size of policy, etc. would, of course, be expected, but the figures given are intended to reflect the over-all position of a regularly distributed flow of new business.

It is clear that if all the lives in the first sub-standard group were accepted at standard rates, the average mortality of the first-class group would go up by about 3% (i.e.  $.1 \times .6 \times .50$ ). Similarly it can be calculated that if all the lives in all the sub-standard groups were accepted at standard rates the average mortality of the first-class group would go up by about 10%. In the long run the claims would be approximately 10% higher. If, on the other hand, the office imposes diminishing liens appropriate to the group to which each life is assigned, the total sums at risk would be reduced in the proportion of approximately 100 to 110. The word 'approximately' is used here because the differential mortality rates would eliminate the lives more rapidly in the higher mortality groups than in the lower mortality and first-class groups. There is also the different incidence of N.T.U. rates (a 'not taken up' case is one where a proposal is accepted, either at standard rates or on sub-standard terms, and the proposer refuses to proceed with the contract) and of lapse rates, both of which, in practice, have been found to be higher for the higher mortality groups.

Compared with a reduction of 10 in 110 of the total sums at risk, the total of the liens deducted from the claims would obviously be less than 9% of the total death claims paid. In the office to which reference has already been made the liens deducted were found, before the war, to be less than 5% of the total death claims paid. Further, the total liens were less than 5% of the total amount of surplus distributed to with-profits policyholders.

The foregoing considerations naturally raise the question of whether, in fact, all the work of underwriting, medical examinations, special reports, assessment of risks, etc., and the disappointment to the proposers and agents in cases rated as sub-standard are really necessary or worth while. To answer this question we may first consider the underwriting problem from the points of view (1) of the office, (2) of the particular proposer and (3) of the other policyholders.

The idea of accepting at standard rates a mixed group of lives is already familiar to the life offices because they readily accept groups of employees and other groups of non-self-selected persons for group life assurance and insure the sub-standard lives along with the first-class lives at the group rates of premium. In industrial assurance the degree of exclusion from the normal standard is very much less than in ordinary life assurance. Thus, from the point of view of the office, the underwriting problem is largely a question of fixing premiums that will prove to be suitable for the whole group of lives

accepted at standard rates. The more widely this group is extended, the more risk there is of the office being exploited by sub-standard lives and hence, in theory, of finding itself, either on its premium scale or on its bonus record, in a non-competitive position for the best lives. If too great a leniency were exercised in an office's first-class standard, there can be no doubt that these unhappy results would ensue. Industrial assurance, however, shows that the underwriting net can be given a very wide mesh without significant danger provided that the office sells its policies on a large enough scale and does not lay itself open to serious discrimination by the inferior lives from the point of view of the amount proposed to be assured. In industrial assurance practice, the field staff eliminate the grosser risks, including proposals on lives who are actually ill, and prevent their reaching the office.

It seems, therefore, that an office can be as lenient as it likes provided that it does not thereby attract an undue proportion of sub-standard lives or encourage its agents to seek out sub-standard lives. It would be necessary for a lenient office to be progressively more stringent with proposals for amounts well above its average sum assured and for proposals at the older ages.

Provided that a policy of leniency does not lead to exploitation of the office by sub-standard lives, the interests of the other policyholders would not normally be impaired to any significant degree. On the other hand, a policyholder who has insured his life while in first-class condition might regard it as unfair to himself if another person can wait until his life is impaired and then obtain a policy on normal terms with the same office. This certainly is a difficult point in principle, but in practice the usual position is that the agent or other representative has canvassed the individual for assurance and not until after the canvass has been concluded does the question of possible non-acceptance arise. Features of a kind which a life office regards as adverse for underwriting purposes are often regarded as unimportant by proposers and even by agents. In many cases the feature may be unknown to the life himself and only become apparent on medical examination. From the point of view of all three of the parties, the office, the individual proposer and the other policyholders, it seems that if the proposer does not know that he is sub-standard then, whatever is wrong with him, it might be safe to include him in the first-class group. In other words, what is wanted for scientific underwriting is perhaps a lie-detector rather than a medical examiner with all his modern apparatus. More seriously, we may doubt the wisdom of the modern tendency to use ever more elaborate tests, either to discover adverse things about a life that nobody knew before or alternatively to justify the underwriter in ignoring clinical findings which clearly indicate that the proposer has or should have doubts about himself.

The question of the terms to be offered to lives not acceptable at first-class rates on the office standard may now be considered. In practice, there is little statistical guidance available on the amount of rating (percentage extra mortality) to be imposed in the light of the facts about the life proposed for assurance. Even if there were definite statistical material of past experience this might well be of dubious value in underwriting to-day. There is reason to believe that the reductions in mortality that have been shown in recent years arise in large measure from improved medical and surgical treatment of impaired lives and the improved prognosis of treated cases rather than from a general fall in mortality of the best lives. The groups hitherto showing

heavy mortality appear to be showing the greatest improvements. There is no reason to suppose that this will not go on.

Past experience, therefore, of the mortality of sub-standard lives would, even if known to the underwriter, provide him with at best an outside limit to the size of the lien, or extra premium, that should be imposed. The longer the term of the policy the more speculative the rating would be. We may suppose that, except in the case of a proposer who has had actuarial training and underwriting experience, the proposer is unlikely to know whether the terms offered to him are generous or otherwise. We know from experience that sub-standard acceptances tend to be subject to a greater N.T.U. rate (see p. 209) than are first-class acceptances and that the most highly rated cases are subject to the highest N.T.U. rates. In a proportion of cases, no doubt, the proposer thinks that the decision of the office is unjustified. Whatever the reason—and it may be that the N.T.U. cases are in fact better lives than those who pay the first premium and complete the contract—there would seem to be little harm in adopting a policy of leniency in fixing the actual terms of a lien or extra premium for those cases which fail to reach the first-class standard. It is suggested that the initial amount of diminishing liens might suitably be fixed on the basis of the assumed percentage extra mortality, but that the lien might be allowed to run off over two-thirds or three-quarters of the term of the policy rather than persist throughout the term. An extra premium might similarly be fixed and arbitrarily limited to a period shorter than the full term of the policy. For whole-life assurances a suitable practice might be to run off the lien or the extra premium at the expiry of a period of years depending on the age at entry but not exceeding the expectation of life.

There are some proposals for which the assumption of a uniform percentage extra mortality is unsuitable having regard to the nature of the impairment. These cases are relatively infrequent, and there is no business reason why we should strive after a meticulous accuracy in fixing terms of acceptance for them. In cases considered to be subject to early risk, a practical solution is to fix the diminishing lien in the usual form and then to respread its incidence so that it operates more heavily in the early years. For example, a lien of 45% decreasing by 3% per annum on a 20-year endowment assurance might be converted into a lien of 72% decreasing by 8% per annum or into a fixed debt of 60% for the first 6 years, the total number of percentage units of deduction from the sum assured being the same. The rationale of this process is that for an early risk it is sufficiently accurate to assume that  $C_{x+t}$  is constant over the range of  $t$  considered.

In the case of late risks on endowment assurances it is obvious that the incidence of the extra risk is such that it must fall either after the policy has matured or in the later durations of the policy when the sum at risk is small. Acceptance at standard rates or subject to a nominal extra or nominal lien would be the appropriate alternative courses. For a whole-life policy subject to a significant degree of late risk the diminishing lien is inappropriate in principle but a suitable extra premium is not difficult to fix. On the other hand, it is a medico-actuarial conceit to suppose that a significant extra mortality commencing long after the policy has been effected can be fixed with any approach whatever to precision. Although the basic assumption of the underwriting methods outlined in this paper is a uniform percentage extra mortality, we must recognize that sooner or later the percentage extra mortality

must diminish as we reach the older ages. Assuming that the main object of the office is to defeat discrimination against itself it would not be inappropriate in the case of a late risk on a whole-life policy to adhere to the percentage extra mortality system but to be less lenient about the rapidity with which the diminishing lien is allowed to run off.

The approach to underwriting discussed in this paper is intended to apply to the general run of an office's business. It is suggested that unusually large sums assured, particularly for whole-life or for temporary assurance, call for a somewhat different approach, particularly if it is necessary to seek re-assurance for part of the policy. Proposals for large sums assured necessarily come from the more well-to-do section of the population. A proposal for a large amount from a person with only a moderate income would inevitably be suspect; a reliable report on the object that the policy is to serve and also on the means to support a large policy is an essential ingredient in the underwriting requirements. But even the well-to-do cannot pay for very large assurances out of the margins in their net incomes to-day. It is difficult to see what proper purpose a large life policy can serve when the proposer is wealthy on capital account and when he intends to meet the annual premiums out of capital. The use of life assurance to provide for death duties is often a legitimate proceeding, but it is an expensive business when it serves to increase the rate of estate duty as well as its amount. A temporary assurance to meet the death duties on and to preserve the gross value of a gift in the event of death during the statutory period is a fairly common procedure, but care is necessary if the office is to avoid exploitation. Underwriting large cases is as much a matter of testing *bona fides* as it is a matter of testing the physical status of the proposed life. For a large assurance there seems to be little justification for leniency or for taking an undue risk at the expense of the body of more normal policyholders.

It remains now to summarize the statistical material mentioned in the introduction to this paper. The data comprise ordinary life policies issued with a diminishing lien during the years from 1925 to the present time. The experience is based on policies, has been taken out every year, and since 1937 has been subdivided into four rating-groups comprising liens commencing at (1) 45% or less, (2) 46%-65%, (3) 66%-85% and (4) over 85%. The data are analysed according to age at entry, year of exposure and year of entry; the actual deaths are compared with the expected deaths by the A 1924-29 table using the select rates for the first 3 years of duration. To obtain the exposed to risk and deaths, the policies have been grouped in quinary groups of entry ages for each year of entry. Then for each such group of entrants the exposed to risk for each calendar year (including the year of entry) has been taken as half of the number of policies in force at the beginning of the year plus half of the number of policies in force at the end of the year plus half of the number of deaths in the group during the calendar year. The rates of mortality used to compute the expected deaths were as follows:

For the year of entry	$\frac{1}{2} (q_{[x]} + q_{[x-1]})$
For the first year after entry	$\frac{1}{2} (q_{[x]} + q_{[x-1]+1})$
For the second year after entry	$\frac{1}{2} (q_{[x]+1} + q_{[x-1]+2})$
For the third year after entry	$\frac{1}{2} (q_{[x]+2} + q_{x+2})$
Thereafter	$q_{x+n-1}$



The entry ages are next birthday and the  $x$  in the above formulae is the middle age in the quinary group of entry ages. The process somewhat overstates the rate of mortality appropriate to the calendar year of entry (the exposed is, of course, approximately half of the new entrants still in force at the end of the year of entry). For subsequent years the rate of mortality applies to the middle age of the range of the quinary group of ages attained at the beginning of the year. This somewhat overstates the expected deaths at the middle and older ages where the exposed to risk is greater at the younger ages of each quinary group than at the older ages of the group. Meticulous accuracy in these matters is less important than a consistent system, particularly when the standard table is arbitrary and not very relevant to the actual experience. These points should, however, be remembered when considering the figures of the experience. It is of interest to note that the office's first-class mortality was substantially below the A 1924-29 rates before the war and has been even lower since the war.

The experience of the sub-standard lives just before the war may be summarized by the figures for the experience of the two years 1938-39 given in Table 1.

Table 1

Rating group	Exposed to risk in 1938-39 (all years of entry)	Actual deaths	$100 \times \frac{\text{Actual}}{\text{Expected}}$
1	34,808	285	102
2	11,189	123	123
3	3,841	58	158
4	3,309	65	232

*Note.* The above figures exclude the experience in the calendar year of entry.

The post-war experience comprises the experience for the years 1946-50. The rating group (4) was virtually eliminated for entrants since 1942; such cases are now either included in group (3) or declined, mostly the former. Table 2 shows the post-war experience for each calendar year and rating-group separately, Table 3 shows the post-war experience according to groups of years of entry, and Table 4 shows the post-war experience according to groups of years of duration and groups of ages at entry for each rating-group separately.

Table 2

Year of exposure	Rating-group							
	1		2		3		4	
	Actual deaths	$\frac{A}{E} \times 100$	Actual deaths	$\frac{A}{E} \times 100$	Actual deaths	$\frac{A}{E} \times 100$	Actual deaths	$\frac{A}{E} \times 100$
1946	201	88	115	127	56	124	40	211
1947	256	109	101	106	61	125	24	129
1948	204	84	112	114	65	123	30	167
1949	198	80	81	80	71	128	38	221
1950	219	87	117	112	78	134	33	203
All years	1078	90	526	107	331	127	165	185

Table 3

Years of entry	Rating-group							
	1		2		3		4	
	Actual deaths	$\frac{A}{E} \times 100$	Actual deaths	$\frac{A}{E} \times 100$	Actual deaths	$\frac{A}{E} \times 100$	Actual deaths	$\frac{A}{E} \times 100$
1925-39	737	97	306	116	134	126	92	165
1940-45	288	81	184	101	149	124	72	218
1946-50	53	58	36	84	48	144	1	—

Table 4

(In this table 'duration' means calendar year of experience less calendar year of entry.)

Age next birthday at entry	Durations 0-4		Durations 5-14		Durations 15-25		All durations	
	Actual deaths	$\frac{A}{E} \times 100$	Actual deaths	$\frac{A}{E} \times 100$	Actual deaths	$\frac{A}{E} \times 100$	Actual deaths	$\frac{A}{E} \times 100$
Rating-group 1								
15-29	14	80	45	93	35	96	94	92
30-44	38	71	163	98	148	110	349	99
45-54	38	80	189	87	111	106	338	92
55-64	20	55	146	80	71	109	237	83
65 and over	4	23	49	76	7	65	60	65
All ages	114	66	592	87	372	106	1078	90
Rating-group 2								
15-29	2	—	15	112	14	132	31	100
30-44	17	77	78	143	73	133	168	128
45-54	25	102	97	108	45	107	167	106
55-64	23	105	79	96	26	96	128	98
65 and over	5	44	24	98	3	93	32	82
All ages	72	83	293	111	161	117	526	107
Rating-group 3								
15-29	9	177	16	263	10	352	35	250
30-44	29	176	52	191	24	182	105	184
45-54	21	122	73	145	11	110	105	136
55-64	16	95	50	90	7	126	73	94
65 and over	4	107	8	29	1	—	13	39
All ages	79	133	199	119	53	158	331	127
Rating-group 4								
15-29	—	—	14	361	5	147	19	257
30-44	1	—	36	247	9	99	46	191
45-54	—	—	52	195	11	137	63	178
55-64	2	—	31	163	3	180	36	166
65 and over	—	—	1	—	—	—	1	—
All ages	3	134	134	207	28	126	165	185

While it is no part of the purpose of the paper to discuss the question of whether the ratings imposed were, on the whole, suitable, having regard to the mortality actually experienced, this question inevitably obtrudes itself

in any consideration of the figures given in Tables 1-4. A brief comment on this aspect of the figures may therefore be desirable. It may be noted that, assuming the first-class mortality immediately before the war to have been 80% of the expected by the A1924-29 table and the post-war experience to be 70%, the pre-war mortality percentages corresponding to extra mortalities of 45%, 90% and 250% (which, bearing in mind the practice of shortening the period of the lien, may be taken as corresponding roughly to the average mortality equivalent of the ratings in the rating groups 1, 2 and 3 respectively) work out at 116%, 152% and 280% of the A1924-29 rates, and the corresponding post-war mortality percentages work out at 102%, 133% and 245% of the A1924-29 rates. Thus, the experience both before and after the war shows that the ratings imposed were more than adequate. It is worth noting that if the initial liens had all been 10 points lower (e.g. 40% instead of 50%, decreasing over the same limited period) the corresponding post-war mortality percentages for the rating groups 1, 2 and 3 respectively would have been approximately 92%, 115% and 180% of the A1924-29 rates.

Considering the experience apart from the level of ratings imposed the following points may be noted:

1. While the post-war experience is markedly lighter than the pre-war experience there is no clear sign of any trend in the post-war period.
2. The rating groups show a progression of levels of mortality in the proper order, of 1-4, although the groups do not show as wide a range amongst themselves as might have been expected. There is clearly scope for passing some of the group 1 lives into the first-class group, some of the group 2 lives into group 1 and some of the group 3 lives into group 2. As already mentioned, group 4 has been eliminated for new business since 1942. It may be that, as a result, group 3 will show progressively heavier mortality as time goes on.
3. The later years of entry (Table 3) and the earlier durations (Table 4) show unmistakable signs of lighter mortality than the earlier years of entry and the later durations. It is impossible to say to what extent this may be due (a) to a form of selection, (b) to the possibility of the extra mortality on the whole being of an increasing percentage variety, (c) to the effect of selective lapsing, (d) to a change in underwriting standards, or (e) to a different distribution of risks being offered to the office in the post-war period from that offered in the pre-war period. It should, of course, be borne in mind that in Table 4 the lives in durations 0-4 must have entered after 1941 while those in durations 15-25 must have entered before 1936. The lives in these two groups are therefore quite different from each other. The lives in duration group 5-14 overlap the other two groups.
4. Table 4 shows the experience according to age at entry. While the numbers of deaths are small and the method of obtaining the expected deaths somewhat overstates them for the oldest age-groups, it is apparent that lives entering at ages 65 and over have experienced remarkably light mortality in all rating-groups and durations. Apart from this, rating-group 1 seems to show fairly uniform results for all entry ages. To a lesser degree this applies also to rating-group 2; there is some evidence of the mortality in this group being relatively heavier for the younger entry ages than for the older entry ages, but

the feature is hardly significant having regard to the number of deaths in each group. But when we come to groups 3 and 4 the feature of percentages falling as the age at entry advances is quite marked and is present in the duration sub-groups.

5. The data have been arranged to follow the lives through subsequent durations and years. They are thus not conveniently arranged for grouping in attained ages. In any case this would not be very appropriate for groups of sub-standard lives, but the figures in Table 4 subdivided according to ages at entry and durations give some indication of the experience by attained ages.

The supporter of the 'early, constant or late' approach can properly refer to the possibility, or even likelihood, of each rating group containing sub-groups of the three different kinds of extra mortality. The features of the experience in groups of ages at entry give different indications regarding the levels of the appropriate ratings. Nevertheless, the experience as a whole does little or nothing to disturb the practical suggestions made earlier in this paper, namely, that a uniform percentage extra mortality assumption is a suitable practical basis for underwriting, that the level of extra mortality has been falling, that a lenient policy both for the allocation of lives to the first-class group and for the amount and duration of diminishing liens may safely be pursued. The ideas underlying the suggestions made should be regarded in the nature of a hypothesis and the experience in the nature of a test of the hypothesis rather than that the ideas have been inferred from the experience. The ideas are not, in any sense, proved by the experience; they still stand because the experience does not demolish them!

It is particularly noteworthy that the mortality of the first sub-standard group has already fallen below the level of the A 1924-29 table. In considering whether to treat as first-class lives all future cases which would have been included in the first rating-group, it would be necessary to judge whether such a course would lead to any substantial degree of exploitation of the office's more lenient underwriting policy. A more cautious approach would seem to be desirable. A decision to select the 'better' cases in the group for acceptance at standard rates could hardly fail to leave a residue which would experience a substantially heavier mortality than the whole group as well as to raise slightly the mortality of the first-class group. The significance of any steps taken to introduce more leniency into an office's underwriting standards naturally depends on how lenient the office already is and also on the circumstances of the office with regard to the sources of its business, the nature of its agency connexions and its methods and traditions of underwriting. Experience has shown that with unvarying methods and standards the proportions of cases in the different groups exhibit a remarkable degree of statistical stability. This suggests that when changed standards are introduced, valuable guidance can be obtained and control exercised by the resulting movements in these proportions.

Some comment seems to be desirable on the absence from this paper of any reference to the 'causes of rating', i.e. the impairments and other features which provide the basis for treating a life as sub-standard. The plain truth is that the futility from the office's point of view of attempting to subdivide the data according to cause of rating was long ago recognized. The vast numbers of different causes of rating, the various degrees of severity, the varying periods for which an impairment may have existed or since it apparently cleared up,

the varying treatments and the unlimited combinations of impairment that arise, would make an investigation of the combined experience of the offices difficult enough and of doubtful utility, even if the mortality of the first-class standard and of the sub-standard groups were not changing all the time. But this continual flux, together with the need to subdivide at least by age and duration, seems to make an investigation by cause of rating, even on the largest scale, a futile proceeding so far as life assurance underwriting is concerned. There is, however, a vast store of information in the papers of life offices which might well provide valuable information from a medical or sociological point of view. The Institute can and should take an active interest in disinterested research of this kind. It would be a mistake, however, and would seriously reduce the value of any investigation if its form and the analysis of the resulting statistics were misdirected to the out-moded purpose of facilitating life assurance underwriting.

These remarks are directed against the idea of an 'objective' analysis of the data of sub-standard lives according to nature and severity of the 'cause of rating'. There is, however, another approach to the question of 'cause of rating' and that is to pose a hypothesis regarding the extra mortality of different groups of lives according to cause of rating and to test it by the experience. For example, an office charging extra premiums could test their adequacy, or otherwise, by comparing, for sections of the lives, the total extra premiums paid with the total sums at risk paid on death less a suitable deduction for the expected deaths on the first-class basis.

The Congress paper by Aabakken (*loc. cit.*) gives a very valuable method of testing the hypothesis of the suitability of the mortality ratings imposed for a group of lives as a whole. This method has been applied in Scandinavia to study the extra mortality of particular impairments (e.g. heart cases or peptic ulcer cases) without subdivision according to severity of cause. The method is to calculate the expected deaths on the basis of the mortality ratings imposed: e.g. a life subject to  $k\%$  extra mortality contributes  $(1 + k/100)q$  ( $q$  = the first-class rate of mortality) to the expected deaths of the group. Alternatively, the expected deaths on the first-class basis can be compared with a total of modified actual deaths, e.g. each death may be reduced in the proportion of  $k$  to  $(100 + k)$ . On the diminishing lien system, a further alternative would be to scale down each actual death in the proportion of (sum assured less reserve less lien deducted) to (sum assured less reserve). In these ways it is possible to see if, for example, peptic ulcers as a whole have been too harshly or too leniently treated. The process has not yet been applied in the office whose experience is given in this paper. The ascertainment of the 'cause of rating' would require reference to the proposal papers in each case which would be a very laborious task unless confined to new business. It is worth noting that this process is another example of posing a hypothesis in a form suitable for statistical testing.

In conclusion, I desire gratefully to express my indebtedness to several colleagues in the Pearl Assurance Company, Ltd., with whom over the years I have been associated in underwriting work, and particularly to Mr J. M. Moore with whom I have had many discussions on the subject and who has made a number of valuable suggestions for and provided constructive criticisms of the paper; also to Mr W. J. Goshawke for saving me from a particularly bad howler in the presentation of the statistics.

## ABSTRACT OF THE DISCUSSION

**Mr A. J. Steeds**, in opening the discussion, said that it was of interest first of all to consider what the author had accomplished. He had analysed, for one large office, the practical results of what might be called subjective selection. That process of selection was not condemned by the results produced, nor, in the speaker's opinion, was it justified by them. That negative conclusion seemed to be as much as the author expected.

The title of the paper was, perhaps, misleading, because it did not teach the reader how to treat sub-standard lives in practice. The paper mentioned the two traditions of underwriting, the British and the American, and it was clear that the author had a foot in each camp; he approved the standard assumption of the American Numerical Rating System that, for the majority of impairments, the form of extra risk could be assumed to be a uniform percentage of the normal mortality; yet he appeared to regard as impracticable an investigation of the mortality of lives assured grouped according to specific impairments, so that underwriting had to be left to the over-all judgment of the facts by the chief medical officer or the actuary, or both. As a result, the uniform extra percentage of mortality assumed by the author became merely a convenient method of grouping rated-up proposals. Whether a risk was described as '100% extra mortality', as '8 years addition to the age', as 'a level extra premium of 10s. %' or as 'a decreasing debt of 50 %', actuaries were continuing to underwrite on an arbitrary basis unless their suggestions had some statistical backing.

He did not understand the need for the author's roundabout method of calculating extra premiums where a lien was not acceptable. It would be more direct to use the percentage of extra mortality assumed in arriving at the lien in order to determine directly the charge appropriate to the age and the term of the policy. In the method suggested, the proposer would be charged loadings both in the basic premium and in the temporary-assurance premium; the loadings might be substantial unless the temporary-assurance premiums were extremely low.

The paper invited a discussion of selection and its importance to an office. There would be general agreement that, for most offices, the total extra premiums received, or the value of the equivalent liens, were small in relation to the premium income. Much time was spent by many senior life-office actuaries in the process of selection, and the effort was justified only if it enabled the actuary to exercise the desired control over lives assured by his office.

The objects of selection were discussed in the paper. They were (1) to ensure that the assumptions about mortality made by the actuary in calculating his premiums would be sound, (2) to enable the mortality element of the premiums to be reduced to a minimum for normal lives, which comprised, perhaps, nine-tenths of the whole, (3) to be equitable to impaired lives, and (4) to avoid anti-selection by the impaired minority. A fifth might be added—that, as a duty to society, offices wished to grant the benefits of life assurance as widely as possible.

In so defining the objects of selection it became clear how greatly it had been affected by the improvement in mortality to which actuaries had become accustomed. It was amusing to speculate on what success actuaries would have had if they had been dealing with mortality which had steadily worsened over half a dozen generations. Certainly, an actuary who based his premiums on the A 1924-29 table and who did not require a mortality profit to pay either expenses

or bonuses could afford to relax his underwriting standards considerably compared with the standards by which the A 1924-29 data had been selected. It was, of course, impossible to maintain standards of selection unchanged, nor was the tendency necessarily to relax. Much of the medically examined data of the A 1924-29 experience had ignored blood-pressures, or at least the diastolic blood pressures, so that in one respect the tendency had been to select more carefully. It would be interesting to know whether, in the opinion of actuaries who had been underwriting for a long time, there had been a conscious relaxation of the standards since the A 1924-29 table was published. In his own brief experience there seemed to have been a definite relaxation. That might be a good thing, but he would prefer a deliberate change, based on objective standards, to an unconscious alteration in the subjective approach.

If the object of underwriting was to give the majority the cheapest cover, actuaries were faced with the awkward fact that both interest and expenses were likely to produce greater differences in their premiums than differences in mortality. No one would disagree with the importance of avoiding anti-selection, although, since the vast majority of life proposals, both large and small, were the result of active canvassing, the effect of anti-selection might perhaps be exaggerated. Anti-selection might be found in the very large policies to which the author referred, but for them the fullest medical evidence was usually available. There remained the duty of treating equitably the small percentage of lives acceptable on some terms other than at normal rates; though that percentage might decrease as underwriting standards broadened, there would always be some lives which had to be rated but did not need to be declined.

The author appeared to feel that the claims of equity would be satisfied if a more lenient attitude were adopted in general; but without some knowledge of the importance to attach to various impairments underwriters could not know whether they were being lenient in the right cases. The results summarized in Tables 1-4 confirmed the feeling that impaired lives were usually treated too harshly. The author had, no doubt, been greatly relieved to see his figures maintaining the desired progression from group to group. If it were assumed that the normal mortality was 70 % of A 1924-29, then the results in the right-hand column of Table 4 showed extra mortality of 29 %, 53 %, 81 % and 164 % compared with 45 %, 90 %, 250 % and 500 % on which the groups were broadly based. There appeared to be ample grounds for leniency in those figures.

The composition of the different rating-groups was unknown. Just as group 4 had been discontinued and most of the lives accepted under group 3, so there might well have been a continual but perhaps unconscious shift of certain impairments from higher to lower rating-groups, or even *vice versa*. The author hinted as much when he referred on p. 216 to 'changed standards', and it would be unreasonable to expect the methods and standards to have been unvarying over so long a period.

The feature of percentages falling as age at entry advanced, as shown in Table 4, was not easy to explain. Arbitrary limits of blood-pressure would, for example, result in stricter selection at the older ages. Moreover, if the expected deaths had been calculated on the basis of the office's own first-class experience for the appropriate periods, as well as on A 1924-29, the differences might have appeared more striking in view of the greater improvement at the younger ages, and the results would have given a more vivid impression of the accuracy of the ratings imposed. Standards of selection were stricter at higher ages, no doubt

because at young ages a substantial degree of extra risk required a comparatively small extra premium. The effect of proposals 'not taken up' might be much more important at the older ages; those preferring to be insured, even on apparently onerous terms, might be the prudent and careful persons who confounded the underwriter by triumphing over their impairments.

He disagreed with the author's conclusions on the value of past experience of impairments. The author seemed, in effect, to favour the assumptions of the Numerical Rating System, though it had to be admitted that different assumptions about the form of extra mortality could also be introduced into a numerical system; but the author appeared to regard as unnecessary the Medico-Actuarial Mortality Investigation and the Medical Impairment Study which were the bases of the Numerical Rating System. In the vast amount of work contained in those investigations there was no doubt great scope for difference of opinion about the validity of the conclusions; but it could not be denied that, for at least two of the most important impairments, those investigations had provided a measuring rod where none existed before, namely in respect of build and of blood-pressure. For other impairments the results might not be so valuable, because of the improved medical and surgical treatment to which the author referred; yet the speaker believed that the actuary, with a Numerical Rating System behind him, and the chief medical officer, with his knowledge of current developments, were able to make a more reasoned estimate of the importance of particular impairments.

He was a little sceptical of what the author called on p. 206 'those subtle indications in the proposal papers', but he saw no reason why either method need ignore them. Bearing in mind the absence of statistics on impaired lives mortality, members would all welcome the announcement (*J.I.A.* LXXVII, 448) that a pilot investigation was to be undertaken. It was an acknowledgment of the need for data. He hoped that the investigation would be successfully launched, so that its scope might be gradually widened to include more than a single office's experience, important in volume though that experience might be. The results would be awaited with interest, patience, and sympathy. A quotation from the *Transactions* of the Actuarial Society of America of 1919 seemed appropriate:

If those who are interested in the subject will avail themselves of the information already at hand, there should be little difficulty in establishing everywhere either the numerical or some other systematic form of medical selection.

**Mr H. O. Worgor** had made some calculations to verify the author's suggestion that the distribution of the extra mortality was relatively unimportant compared with its average amount. Before dealing with the results, he would refer to the approximate formula given on p. 207 for the extra premium equivalent to an extra mortality of  $k\%$ . From Lidstone's formula for the approximate value of a joint-life assurance premium,  $P_{[x][y]\overline{n}} \doteq 2P_{[x]\overline{n}} - P_{\overline{n}}$ , it was found by a simple transformation that  $P_{[x][x]\overline{n}} - P_{[x]\overline{n}} \doteq P_{[x]\overline{n}} - P_{\overline{n}}$ , and the right-hand side of the latter equation might therefore be substituted in the formula given for the left-hand side. If office premiums were used instead of net premiums, the total premium brought out would be near enough to the premium on the normal office basis for an endowment assurance on a life subject to the assessed mortality.

For his numerical experiments, using A 1924-29 and  $2\frac{1}{4}\%$ , he chose a 30-year endowment assurance on a life aged 30 subject to such extra mortality that the net premium was exactly equal to that of a joint-life endowment assurance on



two lives aged 30. Assuming that the joint-life table exactly represented the correct sub-standard mortality, the initial debt, decreasing by equal amounts each year throughout the term of the policy, equivalent to the extra premium came to 52.45 %, which compared favourably with the value of 50 % brought out by the formula  $k/(100+k)$ , since  $k$  ought obviously to be taken as 100 in the example quoted.

There was a method of representing the mortality of sub-standard lives which was particularly convenient for calculation and which had not, he thought, been referred to in actuarial writings. The assumption was that the sub-standard mortality of a group of lives aged  $x$  at entry could be represented by assuming that  $r\%$  of the group were normal lives aged  $x$ , and that  $(100-r)\%$  were normal lives aged  $x+n$ . On that assumption, all single-premium assurance functions and all annuity functions were the sums of  $r\%$  of the values at age  $x$  and  $(100-r)\%$  of the values at age  $x+n$ . By a suitable choice of  $r$  and  $n$ , the extra mortality could for a considerable duration be made to assume any form desired, though at durations approaching  $\omega-(x+n)$  the special mortality obviously became asymptotic to the normal. There was a plausible philosophic basis for that assumption. The underwriter, being human, was liable to make mistakes, and would therefore place in the sub-standard group a certain proportion of lives that should be in the normal group. When the rightly-classified sub-standard members of the group had, owing to their excess mortality, nearly died out, the bulk of the survivors would be the survivors of the wrongly-classified normal lives, reinforced by a certain number of lives that had recovered and might be regarded as normal. To represent an extra mortality which was highest in the early years and which faded out fairly rapidly, he put  $x+n=80$  and  $r$  at the appropriate figure to give the same extra premium as before. On that mortality assumption, the initial debt came out at 51.58 %.

To test the most extreme distribution of extra mortality, he then assumed that the excess mortality was entirely confined to the first year of assurance, and found what it had to be to give the same extra premium. On that basis, the debt came out at 50.6 %. Those results justified the assumption that for a given extra premium the equivalent debt was nearly independent of the distribution of the extra mortality, though there was a tendency for the equivalent debt to diminish, as the extra mortality was experienced earlier.

When he investigated the actual amount of excess mortality involved by those assumptions, some startling results emerged. The average value of  $q'$  involved during the whole expected life of the policy was  $\left( \sum_{t=0}^{29} l'_{[30]+t} - \sum_{t=1}^{30} l'_{[30]+t} \right) / \sum_{t=0}^{29} l'_{[30]+t}$ . For the first assumption, of joint-life mortality, the excess mortality was 92.61 %. The difference between that figure and the assumed excess mortality of 100 % arose from the fact that if, as was assumed, the value of  $\mu_x$  was doubled, the value of  $q$  was increased not to  $2q$  but to  $2q - q^2$ ; also the extra mortality reduced the number of lives exposed to risk at the longer durations, where the higher rates of mortality operated, thus reducing the average.

For the second assumption the excess mortality was 36.46 %, and for the third assumption the extra mortality was only 28.62 %. It would be seen, therefore, that, according to the assumption made as to its distribution, an extra mortality of 93 %, 36 % or 29 %, might require the same extra premium and practically the same debt. It seemed, therefore, that the distribution of extra mortality could not be entirely ignored.

There was another conception of sub-standard mortality which might be

useful, at least with regard to endowment assurances—and most rated-up proposals were accepted for endowment assurances. The assurance on a sub-standard life might be regarded as a joint-life assurance on a normal life and an imaginary life, the latter being subject to the excess mortality only. If special tables were constructed for each pattern of excess mortality which it might be desired to impose, the total premium required might be found by using Lidstone's approximate formula for a joint-life endowment assurance premium for the normal and the imaginary life involved. If any multiple of the excess mortality was required, the Lidstone formula might be extended by adding additional imaginary lives to get a joint multi-life endowment assurance premium for one real life and any number of imaginary lives. The extra premium so brought out might be converted into a lien by the approximate formula:

$$\begin{aligned}\text{Initial debt \%} &= 100 (\text{extra premium}) / (\text{extra premium} + P_{[x]\overline{n}} - P_{\overline{n}}) \\ &= 100s (P_{y\overline{n}} - P_{\overline{n}}) / (P_{[x]\overline{n}} + sP_{y\overline{n}} - \overline{s + 1}P_{\overline{n}})\end{aligned}$$

where  $s$  was the number of imaginary lives brought in and  $P_{y\overline{n}}$  was the endowment assurance premium for an imaginary life subject to excess mortality only of the required pattern (this premium being obtained from the appropriate special table).

He was, however, convinced that, in whatever way the information was used to rate up sub-standard lives, more satisfactory information would be obtained if medical advisers were asked to indicate, for such lives, how the proposer's excess mortality could be expected to compare with the normal mortality, expressed as a percentage of the latter, and how the percentage might be expected to vary, if at all, as the proposer advanced in age.

**Mr P. R. Smith** suggested that in considering the treatment of sub-standard lives actuaries must clarify their minds on why it was that they rated up certain lives. The author had pointed out that the financial effect on the office if the lives which were at present rated up were accepted at normal rates would be comparatively small, but he had also pointed out, of course, that it was necessary to rate up certain lives in order to avoid selection against the office. If that were the main reason for charging extra premiums, then it seemed to be of little importance what extra premiums were charged or what debts were imposed.

Most actuaries, however, probably felt that it was inequitable to accept at normal rates of premium lives which they considered to be inferior to the usual assured life. The author pointed out that offices did in fact accept at normal rates quite a broad range of lives, and that the lives accepted at normal rates were by no means homogeneous; but probably it would be felt that there was something wrong about accepting at normal rates a man who was seriously ill. It seemed to be one of those awkward problems which were constantly being encountered where a line must be drawn somewhere, though it was difficult to provide any logical justification for drawing the line at any particular place.

In the absence of statistical data on which estimates could be based, it was impossible to say whether offices were being equitable. Once the idea of equity between different classes of life was brought into consideration, it was necessary to ask whether the actual premiums which were being charged or the debts which were being imposed were fair, and whether they really paid for the extra mortality.

He noticed in the paper several references to 'estimates' of extra mortality. He felt that the word 'estimate' was rather ambitious; it sounded much better

than 'guess', but he suspected that 'guess' would be the more appropriate word. The estimates of the underwriter were rarely checked by statistical records against the actual experience; underwriters probably succeeded not too badly in grading the extra mortality—if on an endowment assurance one man was charged 5s.% and another 10s.% it was likely that the second man was a worse life than the first—but he doubted whether much more could be claimed.

Although he appreciated the force of the author's arguments against a detailed investigation into sub-standard lives, it seemed to him that some investigation was essential as a basis for underwriting; otherwise it would be impossible for any reasonable estimate to be made.

**Mr G. F. Llewellyn** agreed that there was a good deal to be said for the author's contention that refinement in underwriting was out of place, and that to take lives and to place them—perhaps some people might say force them—into one or other of a limited number of groups was a good idea.

It was necessary, then, to choose some basis for dealing with extra mortality which was convenient for calculation, if nothing else. If, from choice or necessity, the Numerical Rating System were used, or if decreasing liens only were granted, then presumably the uniform percentage extra mortality was a convenient assumption; but if it were the practice to settle the extra premiums by consultation between the actuary and the doctor—and, whatever else might be said for or against it, the practice provided a pleasant interlude in the week's work—it was a good idea if the doctor and the actuary could have some definite picture in their minds of the extra mortality in relation to the particular life under consideration. It might not be accurate or clear, but if it was much the same picture, with the hills and valleys in the same places, it would help.

Mr Worger was asking a good deal in suggesting that the medical officer should indicate what percentage extra mortality was likely to be experienced year by year; he, an actuary, found it difficult to visualize mortality in that form. There was, however, one form of extra mortality where the doctor and the actuary met, and met with some confidence. Considering a man of 50 who appeared to have an arterial system more like that of a man of 60, the medical officer knew what he was talking about when he said 'Ten years on this life'—and perhaps he even knew what sort of extra premium was involved. A rating in age from 50 to 60 was more powerful than a rating by the same number of years from age 30 to 40. What could be called 'intuitive underwriting' might have been built up on the basis of people who were considered older than their real ages, and the various other forms of extra premium might have been, consciously or not, founded on that standard, so that possibly the customary standards of underwriting, for that reason, were not so far wrong as the last speaker had suggested.

On the subject of incidence, there was no doubt that the underwriter's view of the extra premium to be charged was coloured by the class of the assurance. It seemed to him that a fairly clear idea of the incidence of the extra risk was necessary to underwriting.

**Mr A. S. Clarke** said that in general he supported the author's views, as expressed on p. 206 of the paper, with regard to the relative unimportance of the incidence of extra mortality, provided that the uniform extra percentage mortality technique was employed in underwriting. In his experience, however, that technique was not generally used by medical referees; the more usual

medical approach was to recommend a rating-up in age, the imposition of a diminishing lien, or the charging of an extra premium. All those methods of assessment resulted in mortality ratings differing widely for the main classes of assurance, such as whole-life, whole-life by limited premiums, and endowment assurances of varying terms.

For example, considering a life aged 25 which was assumed to be subject to 75 % extra mortality, the equivalent rating-up in age varied from 6 years, for a whole-life contract, up to 14 years, for a 10-year endowment assurance, being 8 years for a 35-year and 11 years for a 20-year endowment assurance. The equivalent liens running off throughout the premium-paying term, taking 60 years for the whole-life contract, varied from about 65 % on the whole-life contract down to 35 % for the 10-year endowment assurance. Those percentages compared with a lien of 43 % based on the straight-line assumption referred to by the author at the top of p. 207. In practice, however, the running-off period for liens was normally limited to, say, 30 years. If that were done, the theoretical lien on the whole-life contract was 150 %, and a lien so limited would not be an appropriate method of dealing with the extra risk. Even on a 40-year endowment assurance the lien, if running off in 30 years instead of the full term of the contract, would be 80 % instead of 50 %. The equivalent extra premiums corresponding to the assumed 75 % extra mortality varied from 7s. % for the whole-life contract down to 2s. % for the 10-year endowment assurance.

In view of those figures, he thought that it was desirable to accept with some caution the author's suggestion on p. 211 that

the initial amount of diminishing liens might suitably be fixed on the basis of the assumed percentage extra mortality, but that the lien might be allowed to run off over two-thirds or three-quarters of the term of the policy rather than persist throughout the term,

with a comparable limitation for whole-life assurances.

In the mortality statistics which the author had submitted—unless he was dealing solely with endowment assurances for terms 30 years and less—the grouping according to rate of lien would result in a wide spread of mortality ratings in each group, and a considerable overlapping between the groups. That feature might partly account for the remarkably smooth progression of the results of the experience.

Clearly, where the diminishing lien was the most common method of dealing with sub-standard lives, a grouping according to size of initial lien was the simplest, and that, he regretted to say, had been the method which his own office had adopted in the past. In fact, their grouping would be more heterogeneous than that of the author, since only two groups had been used, namely liens of less than 40 % and liens of 40 % and over. The over-all results were available for the two years 1946-47.

For the first group, the liens of less than 40 %, for which the exposed to risk were 65,039 and the deaths 1,299, the percentages of actual to expected, on the A 1924-29 select and ultimate rates, were 89 % for durations 0-4 and 97 % for durations 5 and over. The estimated percentage for all durations, using the 'all offices' experience of assured lives for 1947-48 (*J.I.A.* LXXVII, 117), worked out at 130 %. The average percentage mortality rating for the group was approximately 140 %, so that a slight over-assessment of the risk had taken place.

For the second group, liens of 40 % and over, the exposed to risk were 37,630 and the deaths 712. The percentage of actual to expected deaths on the

A 1924-29 basis was 105 % for durations 0-4 and 119 % for durations 5 and over. The all-durations percentage was 116 % on A 1924-29 and was estimated at 155 % on the 1947-48 experience. The average percentage mortality rating for the group had been assessed at approximately 190 %, and the over-assessment of the risk was rather more marked than in the lighter impairment group.

Incidentally, that experience of his office was based entirely on male lives. He could not find any reference to whether the author's experience was on male lives only. If the author had included female lives, it might account for the rather favourable results which he had shown, and for the assumption on p. 215 of the paper that the over-all post-war mortality experience for normal lives was 70 % of A 1924-29. For the age distribution contained in the speaker's company's experience on male lives, about 75 % of A 1924-29 would be nearer the mark.

Those results were no doubt as gratifying to his own company as the author's were to his, but any comparison between the two results would be useless without some knowledge of the underwriting methods of the two companies. It was regrettable, therefore, that the author had not seen fit to include an appendix to his paper indicating broadly and briefly the types of risk which were placed in his four rating groups. That omission was understandable after reading the author's remarks on causes of rating, beginning with the last paragraph on p. 216.

His own office had recently commenced a fairly detailed mortality investigation according to type and degree of impairment. Whilst appreciating that when the data were subdivided into a large number of groups the time that elapsed before a sufficient volume of data was built up might cause the results to be out of date before they were published, he thought that an examination of the deaths occurring each year should throw considerable light on the relationship between various impairments and causes of death, and in fact the investigation was already doing so.

**Mr Kingsley Read** thought that a previous speaker had hit the nail on the head. It was desirable to be quite frank and to admit that underwriting was largely a hit-or-miss business. Reference had been made to 'guesswork'. It might be called 'educated guesswork', or, as Mr Llewellyn had put it, 'intuitive underwriting'.

Some years ago, when he had been introduced to the Numerical Rating System, he thought that it might be a good idea—all that was required was the addition of a few figures for the various impairments and the answer came out at the end of the table. Practical experience of underwriting, however, showed that that was not quite possible. Some impairments were related to each other and there were differing degrees of impairment. It all came down to the fact that somebody had to make a guess about what the degree of impairment was. He challenged anyone—he did not know whether there was a doctor in the house—to say whether the extra mortality was so much per cent. for a particular man. The difficulty might be that the underwriting was of one life at a time. For a group of 100 lives, all of them asthmatics, it might be possible to get somewhere near the right answer, but a single life could only be assessed in a somewhat arbitrary way. Whether an addition was made to the age or a certain debt was imposed, the underwriter had in mind some sort of average.

It used to be suggested that some formula should be worked out on the

assumption of extra mortality increasing, decreasing or level over the period, but once again he felt that that would be found to be difficult. If the extra mortality was increasing, at what rate was it increasing? If it was decreasing, at what rate was it decreasing? He did not profess to be to any extent scientific in his underwriting, but so long as he did not risk ruining his office he was happy.

**Mr R. A. Culley, F.F.A.**, said that they had all been aware of the improved mortality since the war, and it was interesting to study the statistical material provided in the paper. By reason of the continued improvement in mortality, and the changes in the treatment of disease, the standard of comparison was of value for a limited period only, and the assumptions which were made as to the extra risk, whether based on statistical evidence or otherwise, had to be under even more frequent review.

The author would place all extra risks in a Procrustean bed. He would regard them as being represented by a uniform percentage addition to mortality. Bearing in mind that the proposals accepted at other than ordinary rates were a small percentage of the whole—10%, in the author's view—that would give satisfactory underwriting results, because any error would be absorbed in the whole. The author, however, referred to a paper by Keppie and Stepney in which they showed the difference in the extras required for constant additions to mortality and uniform percentage additions to mortality. Those tables showed that for constant additions to mortality the extra premium did not vary a great deal as between whole-life and endowment assurance, nor according to age at entry; but for a uniform percentage addition to mortality the extra premiums for whole-life were substantially greater than for endowment assurance and varied considerably as age at entry increased.

He supported the author's opinion that refinements in underwriting were quite out of place. When the difference in the extra premium required for a constant and a percentage addition to  $q$  was considered, he thought that it was not a refinement to take account of the incidence of extra risk, and from the point of view of the policyholder he thought it was important. Certain of the stress diseases and degenerative conditions could be classed as increasing risks while quiescent infective states were reducing risks. He was not prepared to say whether it was better to represent the increasing risk by a uniform percentage addition to  $q$  or by an increase in age. The increase in age assumed that the extra risk was deferred later than did the uniform percentage addition to  $q$ .

The author held that the incidence was of secondary importance to the general level of extra risk. That might be so if the method of underwriting was by way of lien, but if offices were to give proposers what was good for them, life assurance, they should load by extra premiums, and, if that was so, he thought that the tables produced by Keppie and Stepney clearly demonstrated that the incidence of the extra risk was as important as the general level.

The author seemed to be allergic to the large policy. He produced convincing arguments for more favourable treatment of the small policy, but when he dealt with the large policy his courage seemed to fail him, and it would appear that he would quote less favourable terms for a large assurance than for a small one on a similar life. It was necessary to be more careful with the large assurances, but he suggested that offices should proceed by more stringent selection rather than by differentiation in the terms quoted. It was safe, he considered, to accept small policies without medical examination. Experience showed that non-

medical business was satisfactory business. For larger sums assured, however, offices should intensify their requirements by way of medical examination, private medical attendant's reports, and sometimes specialist's reports. If the information was comprehensive, he considered that it was safe to quote the same terms whatever the size of the assurance.

The importance of underwriting policy and its relation to the mortality experience of the company should not be exaggerated; he quoted some remarks made by Arthur Pedoe in his paper on *The trend of adult mortality in England and the United States* (J.I.A. LXXIII, 216):

In comparing the mortality rates even in the same company over an extended period the results might be questioned as being influenced by changes in the underwriting standards of the company. In my opinion the effect of this factor has been much exaggerated. A more important factor is whether there has been any change in the type of applicant by social class. Expressed in another way, a change in sales organization is of more importance than one in underwriting procedure as affecting the mortality experienced by a company.

He thought that Pedoe was right, but he would add that the general improvement in mortality rates would also obscure the effect of any change in underwriting policy.

**Mr E. A. J. Heath** said that both Mr Llewellyn and Mr Read had referred to the question of guessing or using intuition, whichever was preferred. He wondered how many actuaries realized that, in addition to the medical examination and the extra tests and even the lie-detector which Mr Perks suggested, it might be of advantage to have a crystal in assessing extra risks. He was quite sure that few actuaries appreciated how much depended on the actual moment of time at which a man took out a policy.

He was fortunate because in his office almost every life assurance was accompanied by a permanent sickness policy, so that he was able to see how a man's health progressed during the years his life assurance was in force. Trouble never came from the man who had an impairment at the time of proposal but always from the one who was perfectly fit by all accepted medical standards. It was astonishing to see how many normal lives developed a severe disability within a year or two of acceptance. He had just seen a case where a man was in hospital with tuberculosis within three months of being passed as perfectly fit. There was no possible way in which that could have been found out—even by a lie-detector—and there had been no suspicion of tuberculosis beforehand.

That was only one example of what happened, and showed that even normal lives might, quite unknown to life office underwriters, develop some serious trouble in a short time.

He felt that in modern conditions it was difficult to say what was an early risk and what was a late risk. He had twice come across cases of coronary thrombosis in men of 31 within a short period of medical examination, and had met a third case within three months of seeing an X-ray of the chest and an electrocardiogram which were perfectly normal.

Many years ago he had written an article in which he said that he did not see that medical examination did much good. Although that had been looked upon as heresy he was coming more and more to the conclusion that he was right. Medical examination served as a help in turning down a proposal where there was a serious impairment but underwriters would continue to rely on guesswork or intuition in assessing extra risks.

**Mr A. P. Maitland Hawes** had been a little surprised to find the statistics classified according to the size of the debt. The classification of the statistics of the heavy debts—over 85 % in the last category—would be affected considerably by the type of policy, particularly by the period of the assurance. The debts might be described as ‘refreshingly high’, for the lowest group went up to 45 %; his own experience was that a number of offices quoted 15–20 % debts, for instance, when, in his opinion, the debt should be at least 30 %.

On p. 210 the author said:

From the point of view of all three of the parties, the office, the individual proposer and the other policyholders, it seems that if the proposer does not know that he is sub-standard then, whatever is wrong with him, it might be safe to include him in the first-class group.

That was probably feasible with regard to the younger lives, say under age 40, but in underwriting lives over that age, and certainly over 50, most actuaries would want a little more information, particularly about the blood-pressure. Presumably the author’s suggestion would apply also to the man who was double the average weight, if he thought himself fit.

Not much had been said that evening about underwriting the so-called ‘top hat’ or group schemes. There the underwriter was faced with rather a new technique, and often had to approach his medical adviser with a fresh question, because, if a member had to be admitted to the scheme, he had to be dealt with on some practical basis. So the question became: ‘This life is clearly unassurable: on what terms can we accept him?’

He suggested that there was scope for inquiry into a rather wider range than that envisaged in the quotation from Mr Penn given at the beginning of the paper, where it was suggested that the investigation should relate to ‘a block of lives that are rated-up, except, perhaps, the very heavily rated-up cases.’ It was desirable to have for ‘scheme’ purposes an inquiry relating in addition to the very heavily rated-up cases and to obtain, so far as they were available, statistics in relation to the so-called unassurable class.

**Mr J. M. Beattie** put two questions to the author. The first was, how did he come to plump for the uniform percentage addition to mortality? That assumption gave rise to continual divergence between normal and increased mortality throughout life; yet he thought, on general grounds, that normal mortality and increased mortality would tend to converge as life went on, and possibly in the later years become little different.

The second question was one of arithmetic. On p. 209 the author visualized an office which accepted 90 % of its proposals at normal rates and put the other 10 % into different extra-rated categories. Later, on the same page, the author said

If, on the other hand, the office imposes diminishing liens appropriate to the group to which each life is assigned, the total sums at risk would be reduced in the proportion of approximately 100 to 110.

That was about 9 %. If the 90 % were accepted at normal rates with no lien, even if the remainder were accepted with 100 % liens the answer would be nearly the same as the author gave. In fact, imposing the liens which seemed to be appropriate according to the rule which the author quoted earlier, Mr Beattie made out that the sums assured at risk would be reduced by something like  $2\frac{1}{4}$  %, and if reserves were taken into account the net sum at risk might be reduced by about 4 %.



It might be inferred from something which was said in the paper that the author disapproved of large policies under which the premiums were paid out of capital. When he spoke of policies with diminishing liens of 85 % and more, it seemed that he did not disapprove of pure endowments with income tax relief on the premiums.

Mr Maitland Hawes had said that it might be quite reasonable to accept lives without medical examination or without any evidence of health at all at the younger ages, but that at the older ages some kind of selection was necessary. Mr Beattie was inclined to agree with the author's views on the desirability or feasibility of leniency in underwriting, and he thought that Mr Maitland Hawes's view about selection at the older ages might be modified by a consideration of annuitant lives mortality as compared with assured lives mortality. That comparison showed that the self-selection of the annuitant was just as potent as the medical selection exercised by the offices in the case of assured lives, if not more so. The office must guard itself against exploitation by the few, but, if that could be cut out by some means, any other kind of medical selection might well be dispensed with.

He agreed with what had been said by the opener about the possibility, practicability and usefulness of trying to analyse mortality according to the nature of the impairment. The author gave the experience of certain groups of rated-up lives, and it was obvious that the underwriting in that instance had been done with skill and judgment; the extra mortality did increase from group to group in a most impressive way. In giving those figures, the author had successfully refuted the suggestion made by C. S. Penn in the quotation given at the head of the paper. The speaker had often felt inclined to agree with Penn's suggestion, but the author's figures refuted that suggestion and showed that the underwriting had been skilful indeed. It had been correct in direction, if rather severe in degree.

In doing the underwriting, however, the author and his collaborators would have fallen back on some kind of experience of what happened to people with certain kinds of impairment. They would have known from experience that a man who had a chronic gastric ulcer was in a worse category than a man who was merely 30 % over the average weight—that was using experience according to the type of impairment. He thought, therefore, that it was desirable to analyse the experience of lives which had been rated up according to specific impairments. It might turn out to be beyond their powers to do it, but at least the job should be undertaken; it was better to fail in the attempt than never to try at all.

**Mr N. Benz** remarked that after reading the paper he felt that he had had an interesting and enjoyable tour of the author's office, though he had not been invited into the doctor's room, nor into all sections of the statistical department. He said that the only passage that brought him up with a jerk was that on p. 207, where the author indicated his views as to the general level of extra premiums which ought to be charged in lieu of decreasing liens. There was a strong and surprising contrast between the firmness, which amounted almost to fierceness, shown towards sub-standard lives who wished to pay an extra premium and the leniency advocated later in the paper for those willing to accept a lien.

On p. 207 it was stated that the body of lives accepted at normal rates was obviously not a homogeneous group. It was probably fair to go further and say that, if the proposals had been made six months earlier than their actual dates,

there would have been a noticeable change in the composition of the four groups mentioned in the paper.

The speaker found it difficult to follow the second complete paragraph on p. 209, but he thought that it was meant to convey merely that, in the particular circumstances of the office before the war, the financial results were affected only to a negligible extent. That, he suggested, was not likely to be the effective counterpoise to any substantial alteration in the underwriting standard; if it were to become too stringent the branch managers would soon make their views heard, and if the standard were to move in the opposite direction it would not be long before it became necessary to explain death claims to directors in greater detail.

With reference to the larger policies mentioned on p. 212, there were many occasions when it would still be perfectly proper for a large policy to be effected; for example, life tenants might wish to deal with settled income. Possibly the author had in mind what might be called the 'managing director type' whose mortality might be suspected to be unfavourable compared with the general run of mortality, particularly in the age-group 55-65.

The author was perhaps optimistic in thinking that any large proportion of the sub-standard lives could be put into the investigation contemplated at the end of the paper. For well-defined groups, such as sufferers from peptic ulcers, the information might well prove to be of real value, but many lives had a number of unfavourable features.

Mr Benz thought that the author had done a real service by presenting his paper. Apart from war risks, the mortality rates of assured lives had steadily decreased, but it would not be right to assume that such a state of affairs would always continue. For that reason alone, he thought that the author was being too modest in his opening paragraph.

**Mr C. D. Sharp** observed that a number of speakers had argued in favour of intuition as a basis for underwriting. There seemed to be a good deal to be said for that procedure provided arrangements were made, such as had been instituted in the author's company, to check the results and to modify future intuitive decisions accordingly.

The underwriting of endowment assurance pension schemes provided an opportunity of studying the most sub-standard lives. When a really bad case came before an assurance company as an individual proposal it was usually declined or the terms were unacceptable to the proposer; but in endowment-schemes business such cases were accepted with a heavy debt, thus providing an opportunity to follow the history of those bad lives for a number of years. It was surprising how long they survived and if there were to be a general investigation into sub-standard lives, endowment-schemes business would provide interesting information regarding types of risk which would not otherwise be observable. Again in endowment-schemes business individual selection against the life office was largely eliminated and there was, therefore, a good case for taking a much broader view in underwriting.

**Mr C. L. Jagers** thought that perhaps the greatest difficulty in underwriting was to be fair and at the same time to seem fair. On a short-period endowment assurance, an extra premium which looked small in relation to the normal premium might yet be extortionate, whereas on a temporary assurance an extra premium might appear excessive and yet be no more than adequate.

He agreed with the author that the basis of normal acceptance might well be broadened, particularly for endowment assurances in view of the relatively favourable mortality experience of that class. For a 20-year endowment assurance on a life aged 30 at entry the annual premium for the risk was about £3% on the A1924-29 table. If an annual extra premium of 5s. % was charged—and anything less seemed hardly worth charging—then, after making some allowance for expenses, a mortality was assumed of  $2\frac{1}{2}$  times the normal. He believed the extra risk on endowment assurances was often overstated even with what appeared to be quite small extra premiums. He also agreed with the suggestion that extra premiums should be limited, at any rate for whole-life assurances, not only for the reason that the author gave, that for long-term policies the rating was speculative, but also because of the dissatisfaction caused by continuing to charge extra premiums for lives that had outlived their expectation. Anyone who had had the task of trying to convince a policy holder of the justice of that would, he felt sure, agree. To remove the extra only under pressure was unfair to those who paid without protest.

After the author's broad-minded treatment of medical impairments, it had been surprising to find him so nervous about moral hazard. There was a great deal of difference between moral hazard in life assurance and in, say, sickness insurance. Death was a much more conclusive criterion than sickness, and few people were anxious to make money by dying. It would have helped if the author had said precisely what he had in mind when referring to 'exploitation' on p. 212. The speaker could only think of concealment of material fact, and suicide. A proposer would not necessarily get away with concealment, even if it were not discovered at the outset, and a man who had so much money that he had to give some away to reduce death duties would be an unlikely person to commit suicide.

**Mr T. M. Springbett** agreed with the author that there was not much point in making an elaborate investigation into the extra mortality of sub-standard lives, but still maintained the view which he had expressed in his paper to the Faculty (*T.F.A.* XIX, 260) that there were several common impairments on which useful information could be obtained.

The author worked on a hypothesis, and his hypothesis would be based on something more than intuition. No doubt it was based on medical advice, but directly or indirectly it was probably also based on the results of the Medical Impairment Study. It was reassuring to read in the paper the results of the author's experience, because to some extent that afforded a justification for using the Medical Impairment Study as a rough guide to what the extra risk was for various impairments. If it were possible to get any British data for a few common impairments, it would make it possible to arrive at an even better hypothesis than could be reached from the Medical Impairment Study, and might enable underwriters to use the ratings of the Medical Impairment Study with a good deal more confidence.

**Mr P. F. Hooker** congratulated the author on having had the courage to put into print thoughts which had no doubt been in the minds of most actuaries, though they might not have gone so far as to express them in words. In making that remark, he was referring especially to the ideas developed on pp. 209-10; he regarded those ideas as being the central theme of the paper and he was surprised that they had not received much attention in the discussion.

He would draw special attention to two important and rather startling conclusions which the author had reached on p. 210.

The first was that

It seems, therefore, that an office can be as lenient as it likes provided that it does not thereby attract an undue proportion of sub-standard lives or encourage its agents to seek out sub-standard lives.

It would be generally agreed that there was a great deal of truth in that sentence, but he felt that a note of warning should be sounded because the proviso which the sentence contained was lacking in precision. Before an actuary set out on a policy of leniency, he should set himself a standard and make up his mind to adhere rigidly to it; there was a real danger that if he did not do this the standard would gradually deteriorate until it got out of control.

The second conclusion was even more startling than the first. It was that

From the point of view of all three of the parties, the office, the individual proposer and the other policyholders, it seems that if the proposer does not know that he is sub-standard then, whatever is wrong with him, it might be safe to include him in the first-class group.

He thought that the author must have had his tongue in his cheek when he wrote that sentence and it was to be hoped that it would not be taken out of its context and quoted in the insurance press against the author and against all those who were present that evening. Life-office actuaries had all had experience, from time to time, of the proposer who had been charged an extra premium and who was highly indignant about it, being quite satisfied that he was a first-class life. If, as so frequently happened, they were told that he was a very important connexion, those of them who worked in composite offices were placed in an awkward dilemma since it seemed that the interests of the shareholders were diametrically opposed to those of the with-profit policyholders. It would be a great comfort to them in future to know that 'from the point of view of all three of the parties' the action which they were always tempted to take on those occasions was the right one!

**Mr C. F. Wood**, in closing the discussion, observed that it was said of some actuaries that they used their statistics like a drunken man used lamp-posts—for support, rather than illumination. He did not think that they could accuse the author of that, for he had been careful to make it clear that he did not regard his hypothesis as having been established by statistics; but he did suggest that his hypothesis was at least supported by the statistics.

The author had expressed the view that it was futile to attempt to investigate the mortality of particular impairments. Might not the idea that a particular impairment required a certain rating be discarded in favour of the allocation of individual proposals to heterogeneous rating groups? If the lives comprised in the business of a particular period, say a year, could be arranged in order of merit with the most acceptable at one end of the scale and the least acceptable at the other, the division of the lives between the first-class group, various rating groups and a declined group would be simplified. A degree of control could be exercised by considering from time to time the proportions in the various groups.

The successful application of the technique rested on two factors: first the arrangement of the lives in an approximate order of merit, and second the determination of the relative size of the groups for purpose of control. Neither presented any difficulty to an experienced underwriter, but to some people the

idea of placing the lives in an approximate order of merit might present a problem, particularly as the decisions needed to be made from day to day. They required what might be called an 'apprentice underwriter's manual' to assist in the arrangement of the lives in order of merit. He would hazard a guess that the author devised one for himself many years ago and that it was now lying in a dusty corner of his office. If he would shake the dust off, bring it up to date and present it to the Institute he would be putting the members still further in his debt. Meanwhile, an alternative readily available was the schedule of numerical ratings published in connexion with the Medical Impairment Study. By giving a rough numerical value to each risk the arrangement of a number of lives in order of merit would be considerably simplified.

He then referred to the use of the lien system as a method of dealing with sub-standard lives. He had come to the meeting with considerable apprehension. He feared that some people would infer from the paper that the lien system was the usual method, and perhaps the best method of dealing with sub-standard lives. The original purpose for which life assurance offices had been formed was to provide assurance protection to widows and children. When a man was sub-standard he needed that protection more than ever and, though the placing of a lien might appeal to the proposer's selfish instincts, might save the agents work and might reduce the risk to the office, he, himself, did not think that actuaries were acting in the best interests of the public by recommending the lien system.

He was in entire agreement with the author's plea for the extension of the first-class standard and for more leniency for sub-standard cases. He thought that the general discussion supported that view. In an individual office the decision might have to be made whether to have high bonuses or to extend the benefits of life assurance to the widest possible circle. He favoured the latter, because he did not think that the two were of necessity mutually exclusive. They had been given an interesting discussion by the author on the possible results of more lenient treatment of the sub-standard business of his office. Before assuming that the same results would apply in other circumstances, certain features should be borne in mind: the size of the average policy, the type of sales organization and the effect, particularly on the 'not-taken-up' business, of using the lien system.

In conclusion, he would take some words out of the context in which they had been written and quote them in a manner in which they were not intended. The author said, in connexion with the calculation of the ages of the exposed to risk, that 'meticulous accuracy is less important than a consistent system'. That might apply very well to life assurance underwriting. Members had all been through the phase of the attempt at accuracy, the realization that accuracy was unattainable, and the conclusion that the best that could be achieved was consistency. Oscar Wilde said that

Consistency is the last refuge of the unimaginative.

In underwriting it might be said that accuracy was the first resolve of the unimaginative and that consistency was the ultimate resort of the experienced.

**The President (Mr F. A. A. Menzler, C.B.E.),** in proposing a vote of thanks to the author for preparing such a practical paper and so generating a useful discussion, said that in his other capacity as Chairman of the Sessional Meetings Committee the author must have been gratified by the large audience which he

had succeeded in attracting. He had once again demonstrated, if there was any need of it, that he was as authoritative in the practical bread-and-butter matters from which most actuaries earned their living professionally as in the more esoteric delights of graduation and probability. Members ought also to be grateful to the particular office to which the author referred for making available the body of data which had formed the statistical basis of the paper.

Personally, he had been called on to study proposal forms only a long time ago, from the point of view of the examinations, and later from the point of view of completing them. He had never had to adjudicate on the actuarial significance of the medical facts which might or might not appear on the forms. It had long appeared remarkable to him, however, that there had been so little statistical research, and indeed so little discussion at the Institute, on that important subject. He had made some researches in the *Journal*, and found that the last major discussion on extra risks took place in 1923, when Sir William Elderton presented his paper *Notes on the treatment of extra risks* (*J.I.A.* LIV, 24).

The author had given some solid reasons for thinking that an investigation of the combined experience of the offices would be difficult enough, and of doubtful utility. The Joint Mortality Committee seemed to have their own hesitations. The Committee had got as far as deciding on a pilot investigation 'for the purpose of estimating the quantity of data likely to be available within various classes of impairment'. There might be encouragement in that.

**Mr W. Perks**, in reply, thanked the members for their kind acceptance of his paper and for their vote of thanks.

Mr Beattie had asked how he had come to plump for the constant percentage addition form of extra mortality. He thought that it was a mixture between an interpretation of the mortality data he had seen on sub-standard lives, including the experience summarized in the paper, and a realization that the earlier actuaries knew what they were doing. In the old days the practice had been to rate up lives by an addition to the age. He thought that in those days—from fifty to a hundred years ago—that had been a fairly sound basis because mortality at the younger ages was then considerably higher and the Gompertz formula had not been altogether a bad fit. Rating-up the age on a Gompertz formula was the same thing as a uniform percentage addition to the force of mortality. As mortality had changed, the rating-up of the age had become less and less appropriate, but the uniform percentage addition to  $\mu_x$  or  $q_x$  still remained a suitable basis. It was roughly equivalent to a rating-up in age plus a constant addition to  $q_x$  in modern conditions.

Mr Beattie had also asked about the ratio 100 to 110 on p. 209. The assumption was that with 10 lives with 200% mortality for every 90 lives with 100% mortality, the combined mortality would be about 110%, and if the liens were fixed on the basis of a uniform percentage extra mortality the sums at risk on the claims would have been reduced in the ratio of 100 to 110. The wording in the paper was perhaps a little ambiguous; anyhow Mr Beattie's figures were correct for the sums at risk on the total policies in force but his figures were not relevant to the argument in the paper.

On the question of the heavy liens in the fourth rating-group—which had been discontinued early in the war—it was worth remembering that bonus rates before the war had been high and that on a young or middle-aged life an endowment assurance with profits was a valuable investment apart altogether from the death risk and the income tax rebate. For the 7% limitation on the income tax

rebate to be ignored, it was necessary for the contract to contain a significant amount of insurance cover.

The opener had referred to 'subjective' underwriting, but he (the author) did not accept the suggestion that the methods he had described were any more 'subjective' than other methods. Underwriters, of course, had regard to all the information at their disposal, in the medical books, in the Medical Impairment Study and elsewhere, but what they did not do was to accept any of that out-of-date information as a rule-of-thumb guide to decision. They came to a judgement in the light of all the facts in the papers of the individual case and the relevant information in the reference books. There had been some confusion between those methods and his own personal views expressed on pp. 209-10.

It had been suggested that the paper might have been improved if it had included an appendix describing some typical examples and the sort of ratings that might have been imposed. The paper, however, was not concerned with underwriting from the point of view of particular medical impairments; its purpose was to present the mortality statistics and to argue the case for leniency in current conditions. There was a great deal of descriptive material available on various types of impairment and he had not wanted to add to the weight of that material, nor to the length of his paper.

One speaker had referred to the difficulty of interpreting a chief medical officer's rating in terms of a uniform percentage extra mortality. Whatever the form of the doctor's recommendation, whether 'plus 5 years' or 'plus 10 years', or whatever it might be, it was not difficult to appreciate that he meant simply a small, a medium or a heavy extra risk and, once the proposals had been sorted in that way, it was not difficult to do the translation into 50 % extra mortality, 100 % extra mortality, and 200 % extra mortality or whatever it might be.

**Mr Colin S. Penn** writes as follows:

When I heard from Mr Perks that he would be using as the text for his paper my interjection (almost equivalent to an interruption in a Parliamentary debate) in the discussion on a paper read by Keppie and Stepney before the Faculty in February 1949, I felt a certain apprehension which has been dispelled on reading the paper. Seldom can so little have given inspiration to so much.

I find that, quite unconscious of my remark on that occasion, I repeated myself a year later in the discussion on a paper by Dr Kenneth Dickson (*T.F.A.* XIX, 317). Very properly, on neither occasion did the authors in their replies take notice of my *jeu d'esprit*. On reading Mr Perks's paper, I find many things said with which I thoroughly agree and which I should like to have said myself; in particular I agree with the author's somewhat negative opinion regarding the value of an investigation sub-divided according to cause and degree of impairment. Such an investigation would involve a vast amount of work and the results if used in the assessment of lives would give a fallacious illusion of accuracy. I cannot help feeling, however, that the author is being somewhat optimistic in his reference to the medical and sociological value of the information obtainable from the papers of life offices, and I hope he will expand this reference in due course.

The statistics given by Mr Perks appear to supply an affirmative answer to my question whether the mortality of moderately rated-up lives is really higher than of those accepted at ordinary rates, and, rather to my disappointment, they give no authority for any marked departure from present levels of assessment.

**Mr W. Perks** has written as follows in amplification of his reply to the discussion:

There has been some misunderstanding about the proportion of lives rated up and the proportions in the four rating-groups. These proportions are not pre-determined; they are the result of the totality of individual decisions. Their stability over time is a gratifying indication of stable practice. A new level of proportions has been established following a deliberate decision to lower the underwriting standard about three years ago in the light of the post-war mortality results. Mr Steeds seems to have overlooked that the mortality experience of sub-standard lives has been regularly examined by the office in question and that this has provided a statistical background to its underwriting.

In suggesting the possibility of an underwriting technique which would set out the lives in an order of merit as a preliminary to allocating them in pre-determined proportions to appropriate rating groups, Mr Wood is pursuing my attitude to investigating mortality further than I would be prepared to go. I still think that each proposal should be decided upon its merits.

There has also been some misunderstanding about the reduction in the mortality. Not only has there been a fall in the mortality both of the first-class lives and of the sub-standard lives but the absolute and relative gap between them has narrowed. This is a most significant phenomenon and there is reason to suppose that the range of mortality in relation to other factors, e.g. social class, has also narrowed. With experience both of industrial and ordinary life assurance mortality I do not agree with the emphasis that, by quoting Mr Pedoe, Mr Culley appears to put on social class differences.

In reply to enquiries I may say that the great bulk of the policies in the experience were endowment assurances for terms of less than thirty years and that the experience included some female lives. I should have mentioned in the paper that the lien clause used by the office concerned normally provides for the lien to be inoperative if death arises from an accident. This, of course, affects the significance of the comparison between the actual and expected deaths, particularly at the younger ages, but it is more convenient to ignore this in the mortality investigation and to regard the practice as an additional piece of leniency.

Mr Clarke's figures provide a useful confirmation of the main features of the data summarized in the paper. While an examination of claims by cause of rating and by cause of death is a valuable proceeding it is, I think, undesirable for the underwriters to do this. I am puzzled by Mr Clarke's calculations. He appears to fix the extra mortality as +75 %, and computes the extra premiums for endowment assurance for various periods and for whole-life assurance. He then ascertains the rating-up in age which produces each of these extra premiums and computes the diminishing lien on this basis. Of course, he gets a wide range of liens because he has completely changed the form of the extra mortality. His liens are not, of course, appropriate to his initial assumption of a uniform percentage extra mortality of 75 %. I do not, therefore, agree with his suggestion that each of the rating-groups contains widely differing mortality ratings or with his fears about the suggestion that the liens might be allowed to run off over two-thirds or three-quarters of the term.

I do not understand Mr Smith's complaint about the word 'estimate' because I cannot trace the word anywhere in the paper. I have usually used the word 'assumption', but once, at least, I have used the word 'assessment'.

Mr Read seems to be allergic to any attempt at a scientific approach even to



testing his own underwriting. While not wishing to overstate the position I completely disagree with Mr Read's use of the words 'guesswork' and 'hit-or-miss'.

When a rich man reaches the point of giving away a substantial part of his capital assets with the view to reducing his death duties he has also reached the stage of contemplating his own demise. Human nature is such that a man does not lightly give away large sums of money. When a donor or donee after a year or two desires to insure the donor for the balance of the statutory period for gifts *inter vivos* the possibility of death has clearly become more real than ever. As a realist myself, I recognize these facts of human nature. Otherwise, I have no allergy against large cases such as was suggested by Mr Jaggars. I am not helped by the thought of the legal remedies for concealment of material facts, because no office, I am sure, relishes the thought of repudiating its contracts.

I can perhaps help Mr Hooker by pointing out that once a proposer knows that an extra premium or lien has been imposed, he knows also that he is a sub-standard life; so Mr Hooker can stand firm even if he accepts the sentence which he quotes from p. 210.

In reply to Mr Wood, I can only say that agents and proposers both seem to have a strong preference for liens. The requests for quotation of alternative extra premiums are infrequent and that explains the use of a method of calculating the extra premium which brings out a somewhat loaded figure.

Both to those who have doubts about the usefulness of analysis of mortality by impairments and to those who have no such doubts I would strongly recommend a perusal of Aabakken's paper referred to on pp. 206 and 217.