

AN INVESTIGATION INTO THE MORTALITY EXPERIENCE OF THE POSTS AND TELEGRAPHS PENSIONERS (INDIA)

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THIS investigation was made with a view to providing a basis for the present values payable to Government pensioners on commutation of pensions.

2. From some old Government records it appears that a very old—perhaps the first—table of commuted values was prepared in 1882 and based on the mortality experience of the Bengal Uncovenanted Services Fund during 1837–72. The experience of this Fund with suitable changes in the period formed the basis of some of the later tables of commuted values also. The table in existence in 1926 was based on the mortality experienced in the Bengal Uncovenanted Services Fund during 1872–1901. The then Indian Government Actuary found that this experience was approximately equal to that of the British Government Annuitants during the period 1900–20 with a rating up of five years and a constant addition of .0024 to q_x . In order to allow for the improvement in mortality that should have taken place till then, the Actuary suggested the lowering of the rating-up from 5 to 4 years with the constant addition unchanged. The table prepared on this basis was put into effect on 1 April 1927 and continues to be in use with a small modification.

3. It will be seen that none of the above-mentioned tables meant for pensioners of Asiatic domicile had been prepared directly from the mortality experience of the body of pensioners to whom the table is meant to apply. With limited data the final table to be adopted may have to be some well-known table with the necessary modifications; nevertheless the selection of that standard table and the necessary modifications should be made with reference to the experience of the body of persons to whom the final table is to apply. With this end in view, the present investigation was undertaken.

The investigation was limited to the experience of the Posts and Telegraphs pensioners during the period of five years 1952–56. Ordinarily a table applicable to all Government pensioners should be based on the experience of the whole body. However, an investigation covering this wider group would have taken a long time to complete and it was, therefore, considered desirable to limit the scope of the investigation to a smaller unit which could fairly represent the whole

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body and also supply the data quickly. The unit 'Posts and Telegraphs' satisfied these requirements and it was decided in April 1958 to limit the scope to this unit at least as an interim measure.

There being only about 50 female pensioners, the investigation was confined to males.

4. Four types of pension are granted:

- (a) 'Superannuation' pensions on the attainment of age 55 or higher ages,
- (b) 'Retirement' pensions granted before the superannuation age after the completion of a stipulated period of service,
- (c) 'Compensation' pensions granted as a result of retrenchment, abolition of a post or other similar causes, and
- (d) 'Invalidity' pensions.

A pensioner is allowed to commute a part of his pension, the commutation value being determined by reference to his age next birthday at commutation. He is required to undergo a medical examination, and if he is not in good health his age is rated up by the medical examiners.

For the purpose in hand it was really the commuters' mortality experience that should have been examined. It was, however, anticipated that the number of commuters would be small and that their experience could be examined only against the background of and by reference to that of the larger body of which they formed a part. It was thus that the pensioners' experience came to occupy the principal place in the present work.

5. Pensioners' mortality can vary according to the type of pension, the level of earnings or the region in which they reside. An attempt was, therefore, made to ascertain

- (a) whether mortality varies according to the amount of pension, which reflects the level of the past earnings, the type of pension, the place of domicile,
- (b) whether superannuation or retirement involves a selection of any kind, and
- (c) whether the rating-up of ages used by the medical examiners at the time of commutation is adequate.

It was, however, not necessary to examine these questions with reference to all the zones mentioned in §7. These questions as well as the features to be discussed in §8 have, therefore, been examined with reference to only two zones, the Southern and the Central, which happened to supply the data early. There was no reason to believe that the conclusions based on their experience would be biased. As regards the final table, only one set of commuted values is to be used; it is, therefore, based on the experience of all the zones.

6. To arrive at the exposed-to-risk, the grouping was done by the pension anniversary in the pensioners' experience and by the commutation anniversary in the commuters' experience. These dates were the limiting dates for the investigation. For the pensioners' experience the age nearest birthday at the pension anniversary, and for the commuters' experience the age next birthday at the commutation anniversary were used.

The exposed-to-risk formulae were based on a tentative select period of five years.

7. The pensions are now paid by the post offices, and the registers relating to the pensions are maintained by six Accounts Offices. It was these Accounts Offices that supplied the data for the investigation. Out of these six Accounts Offices two were very small and the data supplied by these were amalgamated with the data of the neighbouring offices. This gave a regional division into four zones designated (1) the Southern Zone, (2) the Central Zone, (3) the Eastern Zone and (4) the Northern Zone.

It was found that superannuation pensions formed the bulk, the distribution of all the pension cards by type of pension being as follows:

Superannuation	...	...	...	62.8%
Retirement	...	...	...	10.7%
Compensation	...	...	...	9.8%
Invalidity	...	...	...	16.7%

The types 'retirement' and 'compensation' taken separately did not give adequate data for further division by amounts of pension or by place of domicile. It was, therefore, necessary to amalgamate these with some other classes or with each other. It was thought that because of the circumstances in which these two types of pensions are granted they would be less akin to 'superannuation' than to each other. They were, therefore, amalgamated with each other to form the combined type 'retirement—compensation' for further analysis.

Relatively few persons commute their pensions, the number of commuters being only 20% of the number of pensioners; 6% of all commuters are rated up. Amongst invalidity pensioners, 7% commute their pensions, and 11% of these commuters are rated up.

8. It was found from the experience of the Southern and the Central Zones that about two-thirds of all commutations were made in the first year of the pension. This suggested that the commuter was keen to have his cash soon after retirement, and it was found that among those commuting in the first year, the most common period between retirement and commutation was two months. Amongst all commuters, the

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average interval between the date of commencement of pension and the date of first commutation was 1 year and 3 days in the Southern Zone and 1 year and 27 days in the Central Zone.

The average deviation of the exact age on a pension anniversary from the assumed age (i.e. age nearest birthday) was found to be only half a day. On the average, therefore, the assumed pension age almost coincided with the exact age at pension. This was due to the fact that about half the pensions commenced on a birthday; the other half were evenly spread over the year of life.

The commutation value is determined by reference to the age next birthday at commutation. It was found that the intervals from the date of commutation to the next birthday were spread almost evenly over the months, the average intervals for the Southern and the Central Zones being 5.9 and 5.3 months respectively. This showed that there was no marked attempt on the part of the commuter to postpone commutation till a little before the next birthday.

THE INFLUENCE OF LEVEL OF EARNINGS ON MORTALITY

9. The level of earnings is represented by the amount of pension. Adequate data could be obtained only if the pensions were divided into two groups. The range up to Rs.30 per month, called the lower pensions and denoted by 'L', and the range Rs.30 or more per month, called the higher pensions and denoted by 'H', gave groups of about equal size. Their mortality experience was compared separately for the two zones and also separately for superannuation and retirement-compensation. This and the following few comparisons were limited to pensions without commutation in their 'ultimate' period, the 'ultimate' period for these purposes being pension durations of five years and over. As the average interval between the pension date and commutation was one year, this was not likely to introduce any error in the examination of the differences in mortality in the 'ultimate' period.

10. The results of the comparisons are shown in the following tables of values of group rates of mortality $\times 100$.

Table 1. *Southern Zone, Superannuation*

Age-group	L	H
60-64	5.97	3.49
65-69	6.90	4.21
70-79	10.97	10.45
80-94	24.74	19.23

Table 2. *Southern Zone, Retirement-Compensation*

Age-group	L	H
58-66	5.23	4.91
67-70	6.07	10.55
71-79	13.51	11.07

Table 3. *Central Zone, Superannuation*

Age-group	L	H
60-64	2.74	3.49
65-69	3.65	5.18
70-74	7.24	6.27
75-89	14.13	9.47

Table 4. *Central Zone, Retirement-Compensation*

Age-group	L	H
57-62	4.23	4.81
63-69	5.22	3.00
70-78	9.50	4.59

It would appear from the above comparisons that the mortality rates of the lower pensions tend to be heavier than those of the higher pensions. An attempt was made to see what indication χ^2 tests gave when applied to the several age-groups and the totals. They indicated that the differences were not significant. It could, therefore, be assumed that even if the mortality rates of the lower pensions appear to be heavier than those of the higher pensions, the difference would not be serious enough to invalidate an amalgamation of the two for the purpose of some of the remaining part of the investigation.

VARIATION OF MORTALITY ACCORDING TO THE TYPE OF PENSION

11. For this purpose comparisons were made between the group mortality rates of superannuation pensions (denoted by 'S') and retirement-compensation pensions (denoted by 'RC'). The results are given in Tables 5 and 6, which show group rates of mortality $\times 100$.

Table 5. *Southern Zone, Lower pensions*

Age-group	S	RC
60-66	6.36	4.83
67-70	6.90	5.94
71-74	11.57	11.72
75-80	13.88	20.24

Table 6. *Southern Zone, Higher pensions*

Age-group	S	RC
60-68	4.05	5.86
69-72	8.33	12.00
73-81	11.96	17.79

These tables give the impression that the 'S' rates tend to be lower than the 'RC' rates. The χ^2 tests, however, indicate that the differences are not at all significant. To obtain a better idea of the comparative mortality, the 'L' and 'H' sections of the Central Zone were combined, so that the data could be divided into more age-groups as shown in Table 7.

Table 7. *Central Zone, Lower and Higher pensions*

Age-group	S	RC
60-62	3.19	4.73
63-65	3.60	3.20
66-68	4.25	4.69
69-71	4.94	5.78
72-74	8.77	8.41
75-77	10.38	7.11
78-84	14.61	11.57

This table gives a much clearer picture of the comparative mortality. The differences between the 'S' and 'RC' rates change sign sufficiently frequently to show that they are not significant in the ultimate period. In the select period the data were too scanty to permit any analysis and it has been assumed that in the select period the superannuation and retirement-compensation mortality rates are equal. In all the subsequent work these two types of pensions were, therefore, combined to form one class.

12. In Tables 8 and 9 the group rates of mortality ($\times 100$) for invalidity pensions (denoted by 'I') are compared with the 'S' rates in the Southern Zone and with the 'SRC' rates in the Central Zone. The 'I' mortality is generally heavier than the 'SRC' mortality as would be expected. It is not possible to say whether the relatively

Table 8. *Southern Zone, Lower pensions*

Age-group	S	I
60-62	7.26	12.21
63-65	6.07	11.32
66-71	6.81	6.48
72-79	13.57	8.02

Table 9. *Central Zone, Lower and Higher pensions combined*

Age-group	SRC	I
50-58	2.91	3.37
59-61	3.58	6.06
62-65	3.47	4.61
66-69	4.45	3.28
70-73	6.85	7.30
74-77	8.66	17.09
78-83	12.96	20.00

low 'I' rates in the age range 65-70 are a mere coincidence. The phenomenon of decreasing 'I' mortality in the age range 60 to 70 in both Zones may, however, not be a mere coincidence. The data were inadequate for the 'I' experience to be analysed by duration, but if it is assumed that the average duration roughly progresses with age, the phenomenon can be explained on the hypothesis that the bad lives of the 'I' group leave the field rather quickly, leaving progressively healthier people until ultimately the group is left with people subject to normal mortality.

13. That the final pensioners' table and the commuters' table, separate if possible, should be based on the experience of pensioners other than the invalids can be taken for granted. The question then to be considered is whether such a commuters' table should be applied to the invalids also without any change. The mortality of the invalid pensioners has been shown to be heavier than that of the other pensioners, but it is not clear that this applies to the comparative mortality of the commuters also. There being few invalid commuters a direct comparison is not possible but the figures given at the end of §7 show that whereas 20% of all pensioners commute, only 7% of invalids do so. This is probably because only those invalids who consider themselves to be good lives ask to commute and even out of these, those who have taken a rather too optimistic view of themselves get rejected. Only 11% of invalid commuters are rated up, and it therefore seems possible that there may be a strong element of self-selection on the part of the invalids who think of commutation, few venturing to face the medical board unless they feel sure of themselves. It was therefore decided to use the same table for the invalid commuters as for others, it being left to the medical selection to take care of the rating-up or rejection required.

REGIONAL MORTALITY

14. To investigate whether mortality varies with Region, the Southern and Central rates of mortality were compared. Out of 19 ages or age-groups, 18 showed that the Southern rates were heavier than those of the

Central. This was enough to show that mortality did vary with the Region.

15. Inside each region it has been seen that the pensioners' data are roughly homogeneous. While, therefore, it was possible to combine the various groups of pensions classified according to types and amounts of pension, it was necessary to make separate investigations by Region in order to decide whether the final commutation table should be in select or aggregate form and whether the table should be based on the experience of commuters alone or on that of all pensioners excluding the invalids.

SELECTION

16. The next question considered was whether any selection is involved in the process of retirement or superannuation. In life insurance, selection has a meaning because during the medical examination a selection is actually made by the medical examiner. The term 'selection' can, however, be used in a wider sense and as a technical term it may be applied to the event of retirement and superannuation.

17. It is believed in many quarters that, owing either to a sudden change in the way of life or to a fall in income or to a forced inactivity, the Indian pensioner suffers in health immediately after he retires. It is necessary to investigate whether such a type of selection does operate at retirement. It may be noted that the term 'retirement' is used here in its general sense and includes the category of superannuation also. The two regions were examined separately and the invalid pensions were excluded. All other groups with their sub-groups, viz. superannuation, retirement, compensation, lower and higher pensions, non-commuters and commuters, were amalgamated for this investigation.

18. The first step required was graduation of the ultimate mortality rates of the pensioners in each Zone. With the small data that a Zone gives, the best method of graduation was that by reference to a standard table. The only available Indian table was the Oriental which itself was graduated with reference to the English Table OM⁽⁵⁾. For the present purposes, therefore, an up-to-date table like A1949-52 or a(55) could be used with advantage. It might be argued that pensioners' mortality would follow the pattern of annuitants' rather than life insurance policyholders' mortality. Annuitants, however, are self-selected people with good prospects of longevity. Pensioners are selected at the beginning of their service careers and seem more likely to share the ordinary policyholders' experience rather than annuitants'. To check this, some calculations were made as a result of which it was felt

that A1949-52 would be preferable as the standard table of reference. The graduation of the ultimate rates was made separately for each Zone by the use of the formula

$$q'_x(\text{P. \& T.}) = aq_{x+n} + b.$$

19. The results of the investigation into the select experience are given in Tables 10 and 11.

Table 10. *Southern Zone: Select experience*

Duration	Age-group	Actual deaths ÷ deaths expected by the graduated ultimate table expressed as percentages
0	50-61	65
1	50-62	100
2	50-63	94
3	50-64	95
4	50-66	81

Table 11. *Central Zone: Select experience*

Duration	Age-group	Actual deaths ÷ deaths expected by the graduated ultimate table expressed as percentages
0	50-66	101
1	50-62	95
2	50-63	126
3	50-64	135
4	50-69	100

20. Even if the events of superannuation and retirement were to cause a disturbance in the mortality experience in the form either of an increase or of a decrease, that cannot be expected to be a permanent feature and the mortality rates would tend to the normal after some interval. It is also reasonable to assume that the nature of the disturbance will not vary from Zone to Zone. On these assumptions it appears from the above results that there is no evidence of a disturbance in mortality experience during the select period; for neither the hypothesis of a hump nor that of a trough is supported by both the Zones. In the absence of evidence in support of the existence of selection it was concluded that the pensioners' mortality table could be prepared from the experience covering all durations of all the pensioners excluding the invalids.

COMMUTERS

21. The last question was whether the table of commuted values should be based on the experience of commuters alone or on that of all the pensioners excluding the invalids.

It is sometimes believed that the mortality experience of commuters is unfavourable compared with that of all pensioners because on the average pensioners commute their pensions only if they do not hope for a long life. This may not, however, be wholly correct. There are probably quite a number of pensioners who require a large cash sum immediately after retirement and commutation in their case does not involve a profit motive. Another factor affecting commuters' mortality is the medical selection at the time of commutation. It is the combined effect of these factors that has to be examined. As the two Zones had different mortality experiences they were considered separately to avoid heterogeneity.

22. *Southern Zone.* For purposes of comparison, the graduated ultimate pensioners' table of the Southern Zone was used as the basis. The exact age at commutation, as seen from §8 is, on the average, half a year less than the age next birthday; for the expected deaths the rates $q_{x-\frac{1}{2}}$ were, therefore, used. All classes except Invalidity, and both Higher and Lower pensions were included. The combined exposed to risk of unrated-up commuters of durations 5 and over since commutation, together with their actual and expected deaths, are shown in Table 12.

Table 12. *Comparison of the mortality experience of Southern Zone unrated-up commuters (SRC-HL and duration since commutation 5 and over) with that of all Southern Zone pensioners (SRC-HL-non-commuters and commuters and duration since pension 5 and over)*

Age-group	Exposed to risk	Actual deaths	Deaths expected by Southern Zone Pensioners ult. mortality table with ages decreased by half a year	{(3) ÷ (4)} × 100
(1)	(2)	(3)	(4)	(5)
50-54	6	2	.14	1429
55-59	51	—	1.66	—
60-64	352.5	13	15.64	83
65-69	893	54	55.68	97
70-74	890	66	77.34	85
75-79	239	26	30.00	87
80-84	72	13	12.66	103
85-89	14	3	3.44	87
Total	2517.5	177	196.56	90

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The run of the various percentages is steady enough to lead to the conclusion that the mortality of commuters in the ultimate commutation period is lower than the pensioners' mortality, being on the average 90% of the latter.

23. *Central Zone.* The comparative rates of the Central Zone were examined in the same way as above and the results are shown in Table 13.

Table 13.

Age-group	Exposed to risk	Actual deaths	Deaths expected by Central Zone Pensioners ult. mortality table with ages decreased by half a year	$\{(3) \div (4)\} \times 100$
(1)	(2)	(3)	(4)	(5)
50-54	8	—	.11	—
55-59	63	1	1.27	79
60-64	550	13	16.12	81
65-69	1198.5	30	50.50	59
70-74	1040	67	64.65	104
75-79	362	30	33.21	90
80-84	107	16	14.52	110
85-89	8	2	1.54	130
Total	3336.5	159	181.92	87

Here the run of ratios is uneven. The bulk of the exposed to risk is available in the age-groups 65-69 and 70-74. These groups should have shown approximately equal ratios, but there is a large difference in the actual figures which can be ascribed to a fluctuation in the actual deaths. On the average, in this Zone also the commuters' ultimate mortality is lighter than the pensioners' ultimate mortality, being about 87% of the latter. This confirms the results of the Southern Zone.

24. *Select Commutation period.* The results of the examination of this question are given in Table 14.

Table 14. *Southern Zone*

Duration	Age range	Total exposed to risk	Actual deaths	Deaths expected by the ultimate commuters' rates, i.e. 90% of deaths expected by Southern Zone Pensioners ult. table
(1)	(2)	(3)	(4)	(5)
0	50-69	215	3	6.88
1	50-70	151	5	5.23
2	50-71	112	1	
3	55-72	113	3	
4	56-73	119	2	

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The expected deaths at durations one and zero might suggest that there is a selection at duration zero but none thereafter. The standard deviation of deaths at duration zero is $\sqrt{6.88} = 2.6$ and the actual deviation is less than one and a half times the standard deviation. Because of the small numbers, no conclusions can be drawn though, in fact, selection may exist at duration zero. The Central Zone gave similar results.

25. One of the objects of the present investigation was to find out whether the scale of rating-up of ages adopted by the medical examiners at the time of commutation was adequate. After obtaining all the figures, however, it has been found that it will not be possible to check the adequacy of the rating-up of ages because of the scantiness of data. In the Central Zone, for example, there were only 29 commuters with a rating-up of one year. After allowing for the select period and other exclusions, their exposed to risk may just approach one hundred years. If the age distribution of this section conforms to the general one, the expected deaths in this section would come to about 5.5 and the standard deviation of the deaths would be 2.4. A further rating-up of one year would increase the average mortality rate by .005, with the result that the increase in the total expected deaths would be only about .5 and the total expected deaths would be just 6. Now if there were 6 actual deaths, the question is whether we could say that the rating-up of one year was inadequate and that the proper rating-up should have been two years. From the value of the standard deviation it is seen that even a very ordinary fluctuation could account for a much greater deviation than the .5 that results from an increased rating-up, so that it would not be possible to say whether the deviation was due to a fluctuation or a defective estimate of the rating-up required. No attempt can, therefore, be made to test the adequacy of the present scale of rating-up from the data that are available.

26. The commuters' past mortality as revealed in §§22 and 23 is somewhat lighter than that of all pensioners (excluding invalids); the question is whether this lighter mortality should be used for commutation tables. The following considerations have a bearing on this question.

Many of the pensioners who have contributed to this experience had taken their pensions long before 1950 when the Government introduced the gratuity system. Many of such pensioners may have had a need to obtain immediate cash and therefore commuted without the motive of making a profit out of commutation. With the introduction of the gratuity system, there will be less need for commutation in future, so that in future commutations the element of profit motive on the part of those who commute will be relatively greater. It is true that the medical

examination defeats the adverse selection to some extent, but it does not eliminate it completely so that the relatively greater adverse selection of the future may reduce or even completely remove the margin between the two mortality patterns. In addition, any increase in the commutation values would attract such people to commutation as would add to the risk of adverse selection.

27. Further, the commuters' experience is a function of the standard of medical examination. Any variation in this standard will affect the mortality experience of the commuters. As the standard of the medical examination depends on subjective elements, it is open to change and it would be prudent to allow for adverse variations. Any such variation will take away the small margin, if any, that is still left after the operation of the factors discussed in the preceding paragraph. Taking all these factors into account, it was decided that the pensioners' table (excluding invalids) should be used for commutation values without a rating-up of age, or with it, as the case may be. As only one table is to be used for all cases, the Pensioners' Table covers the experience of all the Zones, S and RC, H and L, commuters and non-commuters, all durations.

GRADUATION OF THE PENSIONERS' MORTALITY RATES
(EXCLUSIVE OF INVALIDS)

28. Table 15 gives the exposed to risk, deaths and group rates of mortality; for the graduation, of course, individual ages were taken.

Table 15. *Mortality of Pensioners excluding invalids. (Superannuation, Retirement, Compensation, Higher and Lower Pensions, Commuters and Non-commuters, all Zones, all durations)*

Age-group	Exposed to risk	Deaths	Group rates of mortality
(1)	(2)	(3)	(4)
30-34	2		
35-39	12		
40-44	48		
45-49	304	2	.0066
50-54	1549	45	.0291
55-59	13238	296	.0224
60-64	20740.5	591	.0285
65-69	14467.5	668	.0462
70-74	8242.5	611	.0741
75-79	2804.5	288	.1027
80-84	881	142	.1612
85-89	143	28	.1958
90-94	4	1	.2500
Total	62436	2672	

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With this size of data, the graduation could best be made by reference to a standard table. Of the three tables, Oriental (1925-35), A1924-29 and A1949-52, the A1949-52 was found to be the most desirable as the table of reference. The graduation formula was $aq_{x+n}+b$, and taking $n = 3$ was found to be best. While arriving at the values of a and b by two summations, a small change was made in the usual method of fitting. The data were divided into two equal parts, two second summations were taken from the centre to the ends and the results added up.

On this basis,

$$q_x (\text{P. \& T. 1952-56}) = .950978 q_{x+3} (\text{A1949-52 ult.}) \\ + .0038632$$

The graduated rates of mortality of the P. & T. pensioners are given in Table 16.

Table 16. *P. & T. 1952-56 mortality rates*

Age	q_x	Age	q_x	Age	q_x
40	.00633	60	.02585	80	.14348
41	.00664	61	.02810	81	.15547
42	.00700	62	.03059	82	.16821
43	.00740	63	.03330	83	.18173
44	.00786	64	.03628	84	.19601
45	.00837	65	.03955	85	.21103
46	.00894	66	.04314	86	.22677
47	.00956	67	.04707	87	.24321
48	.01024	68	.05136	88	.26028
49	.01100	69	.05606	89	.27793
50	.01182	70	.06119	90	.29610
51	.01272	71	.06678	91	.31472
52	.01371	72	.07288	92	.33369
53	.01478	73	.07949	93	.35293
54	.01596	74	.08668	94	.37234
55	.01725	75	.09447	95	.39181
56	.01867	76	.10290	96	.41126
57	.02022	77	.11198		
58	.02192	78	.12176		
59	.02380	79	.13225		

29. *Tests for adherence.* By virtue of the method of graduation the total deviation was bound to be small; the following results are, however, interesting.

- (i) There were 58 positions for changes in signs of deviations of the

actual deaths from the expected deaths. In these 58 positions there were 27 changes of signs so that the number of changes was very nearly equal to the number of non-changes.

(ii) Table 17 shows the distribution of the variable (Actual deaths—expected deaths) $\div$ square root of expected deaths, as it actually exists and as it is expected on the assumption that the variable is a unit normal variable. For this purpose ages have been grouped in order to give sufficient deaths in a group.

Table 17

Value (1)	Actual frequency (2)	Expected frequency (3)	
Less than -3	—	.05	
-3 to -2	—	.73	
-2 to -1	6	4.62	Between the standard deviation -1 and +1 there are 21 cases against the expected 23.2
-1 to zero	15	11.60	
zero to +1	6	11.60	
+1 to +2	5	4.62	
+2 to +3	—	.73	
+3 and above	2	.05	
	34	34.00	

30. As an expedient limited to tables of commuted values and as a measure facilitating the use of the standard table with a modified rate of interest, q_x (P. & T.) was taken to be q_{x+3} (A1949-52 ult.) $+.00375$. This modification causes little change in the graduated table and provides a margin for safety.