NOTES ON NONCANCELLABLE HEALTH AND ACCIDENT RATEMAKING

BY

ALFRED V. FAIRBANKS

Many of the problems connected with noncancellable ratemaking arise from the indisputable fact that the existence of disability is very often a relative matter not readily susceptible to objective determination. For this reason the insured has a degree of control over the policy that he does not possess in other lines of insurance. Since even a very short period of malingering appreciably increases the cost, particularly for policies with short elimination periods and consequently high claim frequencies, it is imperative that the amount of indemnity payable in event of disability be fixed at a level reasonably below earned income so as to eliminate any temptation to prolong disability. It has been shown, in fact, that loss experience is better on policies with a low absolute benefit as well as on policies with a low benefit in relation to earned income.

At the present time noncancellable health and accident premiums are generally based upon the experience of each individual company writing such business. The lack of morbidity tables suitable for ratemaking purposes, based upon the combined experience of many companies, is due to the fact that benefits, underwriting rules, claim practices, and selling methods are not standardized. Therefore, the pooling of statistics necessary to obtain such a table has not been possible.

The actuary who undertakes noncancellable health and accident ratemaking must supply himself with suitable experience tables. In a company without previous experience on which to base such tables, this is no simple task. First the foundation upon which the rating structure will rest must be laid. The policy benefits to be granted by the proposed forms must be decided upon. The wording of the insuring clause and the definition of disability must be drafted and their possible interpretation by the courts and even by the claim department must be studied. Underwriting rules must be determined. The available agency force must be evaluated as to the caliber of the men, the quality of their supervision, and the adequacy of their training program. Poor risks, including those with pre-existing disabilities, will be only too eager to obtain this coverage. Agents must therefore be trained and continuously exhorted to actively solicit the more desirable risks; otherwise, conflict will develop between the agency force and the underwriting department which will be obliged to turn down a high percentage of applicants. Even then the experience developed in the future will reflect the class of business submitted by the agents. When all these factors have been considered, an appropriate existing table or suitable modification thereof is adopted.

The net annual cost of disability may be obtained from company

statistics in various ways. For policies with uniform benefits the net annual cost can be obtained as the product of the claim frequency and the average cost per claim. When benefits are provided for an indemnity limit of one year or less, interest on claim payments may reasonably be ignored and the net annual cost per $1 of daily indemnity may be determined by dividing the total number of days for which disability is paid on losses incurred during the experience period by the number of policies exposed.

Pension fund methods are sometimes employed to obtain net premiums for policies providing benefits for long periods of time in a manner similar to that employed by life companies for waiver of premium and income disability benefits.

Morbidity experience is often summarized in the form of a continuance table which displays the amount of disability in days, weeks, or months to the end of various periods of time based on a definite number of active lives exposed at selected ages. The net annual cost of disability may be obtained from such a table by dividing the amount of disability by the number of active lives exposed at the age for which disability is incurred.

Since only disabilities incurred after the issuance of the policy are to be covered, the net annual cost should include only disabilities originating at age x subject to the limit placed on the number of weeks or months for which payment will be made on any one claim with appropriate adjustment for the elimination period. Based upon a continuance table, the net annual cost of disability at age x for a policy providing a benefit of $1 per week with an indemnity limit of m years and a k week elimination period is

$$S_{(x)}^{\frac{k}{52}/m} = S_{(x)}^{\frac{k}{52}/1-\frac{k}{52}} + v S_{(x)}^{1/1} + v^2 S_{(x)}^{2/1} + v^3 S_{(x)}^{3/1} + \cdots + v^{m-1} S_{(x)}^{m-1/1} + v^m S_{(x)}^{/\frac{k}{52}}$$

where $S_{(x)}^{n/1}$ is defined as the amount of disability incurred at age x by an active life exposed at age x and experienced in the one-year period following an excluded period of n years.

Then $H_x^{\frac{k}{52}/m} = v^{x+\frac{1}{2}} l_{x+\frac{1}{2}} S_{(x)}^{\frac{k}{52}/m}$ and the one-year term premium for

the benefit can be expressed as $\dfrac{H_x^{\frac{k}{52}/m}}{D_x}$. Since computation of the net

annual cost is often a lengthy procedure, it is frequently derived for quinquennial or decennial ages only and an interpolation made for intermediate ages.

If it is found that the cost of disability does not vary substantially with age, the one-year term premiums may be averaged and used for a uniform pure premium. However, the cost of disability for accident and sickness combined generally has been found to increase with age.

If this increase is substantial, several methods are available for determining premiums. Since noncancellable disability insurance is guaranteed renewable to some age, such as 60 or 65, it is not desirable to have a premium increasing from year to year over the duration of the policy. A flat rate may be achieved by reducing the benefit at the higher ages so that the net one-year term premium will remain comparatively level at all ages. Another method, the step-rate plan, increases the premium at a stipulated age for all new entrants and also for all policyholders on attainment of this age.

The net level annual premium method is used frequently for obtaining noncancellable rates. Derivation of the net single premium equivalent to the present value of future annual term premiums requires definition of another commutation function $K_x^{\frac{k}{62}/m}$ where

$$K_x^{\frac{k}{62}/m} = \sum_{i=x}^{z-1} H_i^{\frac{k}{62}/m} = v^{x+\frac{1}{2}}l_{x+\frac{1}{2}} \, S_{(x)}^{\frac{k}{62}/m} + v^{x+\frac{1}{2}} \, l_{x+\frac{3}{2}} \, S_{(x+1)}^{\frac{k}{62}/m} + \cdots + v^{z-\frac{1}{2}}l_{z-\frac{1}{2}} \, S_{(z-1)}^{\frac{k}{62}/m}$$

Then the net level annual premium with benefits payable only for disabilities incurred prior to age z and based on the assumptions previously used to determine the one-year term premium, is obtained from the equation $P_x^{\frac{k}{62}/m} = \dfrac{K_x^{\frac{k}{62}/m}}{N_x - N_z}$.

It would seem logical to consider the persistency of the business as well as morbidity and mortality when computing gross premiums. When the first-year expense is higher than the renewal, as is almost always the case, the effect of lapsation is to increase the average expense over the life of the policy. Consequently, the effect of lapsation is to increase the expense element of the premium. On the other hand, if the age incidence of claim cost increases, as it usually does, the effect of lapsation is to lower the level pure premium. The net result of the interaction of these two factors may either increase or decrease the gross premiums. In any event, the effect of lapsation should not be ignored in determining premium levels.

A practical approach to the development of commutation symbols might assume a total termination rate combining the lapse and mortality rates. Commutation symbols based on this approach and the assumption that premium payments are made annually could be worked out as follows. From a table giving the number of new business policies paid for by age with the resulting number of policies in force each year from the first to the sixth or eighth policy year when persistency can be assumed ultimate, $D'_{[x]+n-1}$ can be computed based on the product of the number of policies in force in the nth policy year and v^{x+n-1}. The product of the number of new business policies paid for and v^x will therefore be denoted by $D'_{[x]}$. In the usual

fashion $N_{[x]+n}^{i}$ is equal to $\sum_{i=0}^{z-x-n-1} D_{[x]+n+i}^{i}$. The indications as to the selection in the rate of disability are such that it is advisable to ignore any possible saving from this source and use ultimate rates or net annual costs of disability. Therefore, the next step would be the determination of $H_{[x]+n}^{\frac{k}{52}/m}$ by the relationship $D_{[x]+n}^{i}\ v^{\frac{1}{2}}\ S_{(x+n)}^{\frac{k}{52}/m}$ and $K_{[x]+n}^{\frac{k}{52}/m}$ equal to $\sum_{i=0}^{z-x-n-1} H_{[x]+n+i}^{\frac{k}{52}/m}$. The formula for the net level annual premium for a policy providing a benefit of \$1 per week would be

$$P_{[x]}^{\frac{k}{52}/m} = \frac{K_{[x]}^{\frac{k}{52}/m}}{N_{[x]}^{i}}.$$

In order that the assumptions regarding expenses may later be verified, it is important that the expense rates be computed with care. Certain expenses, such as commissions and taxes, are functions of the gross premium. Other expenses may be related to the first-year premium, the number of policies issued, or the number of policies in force during the year. Where expense factors are based upon the number of policies, it is necessary to make assumptions as to the average size of the policy. If it is found that the average policy varies in size by age, this fact should be taken into consideration.

The following hypothetical expense rates will be used to show how gross premiums may be obtained, taking into consideration morbidity, mortality, persistency, and interest.

Commissions:

1st year	50%
2nd through 5th years	25
6th and later years	7½

Other compensation for obtaining new business—7½% of first-year premium.

Taxes—2½% of premiums received.

Other Expenses:

(1) \$7.50 per policy issued
(2) 50% of first-year premium
(3) \$3.00 per year per policy in force
(4) 7½% of total premiums received.

Since (1) and (3) above are based on number of policies, it is necessary to obtain an average size policy. The chart below shows for quinquennial ages the average size policy and the expenses per \$1 of weekly indemnity.

Age at Issue	Average Wkly. Ind. Per Policy	Expense per $1 of Wkly. Ind.	
		$7.50 Initial (a)	$3.00 Annual (b)
20	$23.70	$.316	$.127
25	30.10	.249	.100
30	36.10	.208	.083
35	38.00	.197	.079
40	39.20	.191	.077
45	37.60	.199	.080
50	36.00	.208	.083
55	33.00	.227	.091
Average	$36.10	$.208	$.083

Based upon above expense rates and combined morbidity table commutation columns, gross annual premiums denoted by $\pi_{\overline{[x]}}^{\frac{k}{52}/m}$ may be derived for a full benefit policy providing a benefit of $1 per week for m years with a k week elimination period subject to a limiting age z.

$$\pi_{\overline{[x]}}^{\frac{k}{52}/m}\left[N_{[x]}^{t} - .5D_{[x]}^{t} - .25(N_{[x]+1}^{t} - N_{[x]+5}^{t}) - .075N_{[x]+5}^{t} - .075D_{[x]}^{t} - .025N_{[x]}^{t} - .5D_{[x]}^{t} - .075N_{[x]}^{t}\right] = K_{[x]}^{\frac{k}{52}/m} + aD_{[x]}^{t} + bN_{[x]}^{t}$$

$$\pi_{\overline{[x]}}^{\frac{k}{52}/m} = \frac{K_{[x]}^{\frac{k}{52}/m} + aD_{[x]}^{t} + bN_{[x]}^{t}}{.65N_{[x]}^{t} - .825D_{[x]}^{t} + .175N_{[x]+5}^{t}}$$

where "a" equals the $7.50 initial expense and "b" equals the $3.00 annual expense, both per $1 of weekly indemnity.

This gross premium, of course, does not contain provision for profit or contingencies.

The basic premiums at the younger ages, taking into consideration disability, interest, persistency, and expenses, may not appreciably increase or they may even decrease somewhat. It probably would not be satisfactory to have premiums which decrease with age over a period. However, in both cases it may be desirable to have a flat premium for the younger ages or one which will be constant for age groups. In order to arrive at the average premium for such groups, the premiums for the individual ages should be weighted by the age distribution of new business.

The final element in the premium is a margin for profit and contingencies. All of the assumptions made in the premium structure are subject to change in the future. Although rates for new policies issued may be changed, the premium for existing policies is guaranteed and therefore cannot be increased if conditions should warrant. The business is subject to epidemics and catastrophe to a varying degree if business is concentrated in geographic locations or occupation groups. During periods of depressed business, coupled with high un-

employment, benefit payments will increase. The ratio of the contingency margin to the premium should be higher where the claim frequency is low and the average claim value is large, such as would be experienced under forms with a long limit and large elimination period, than for forms with a high claim frequency and small average claim.

Thus far premiums have been graded by age only. There are two other factors which influence the premium, probably to a greater extent than age. These are sex and occupation. The cost of disability on females is considerably higher than that on males and rates should probably be worked out independently. Although the risk of occupational injury has materially lessened over the years, occupation is still an important factor. The economic level and resulting living habits associated with an occupation have an important bearing on health. The occupational classification differential may be based on the aggregate experience for all ages.

Elimination period differentials are not appreciably affected by age, but may vary somewhat by occupational classification. The inclusion of an elimination period will not only reduce the cost by the amount which would be paid over the period eliminated but tends also to reduce the cost over the period immediately following such elimination period.

Optional benefits providing reimbursement to the insured for medical expenses, such as hospital or nurse expense for a fixed maximum daily benefit or surgical expense according to a schedule are subject to not only the control as exercised by the insured over claim costs but to the additional effect of third party control; namely, the hospital, nurse, or doctor.

Since there is a maximum limit on the amount of hospital daily benefit, the price level will have little effect on the cost. However, the average number of days spent in the hospital is subject to fluctuation. For example, the average stay in a hospital was eight days in 1953 whereas a decade and a half ago it was thirteen days. This change has been brought about by the use of new drugs and a shorter convalescent period prescribed by doctors. This is a very marked change and the reduction in the average period of hospital confinement should be watched carefully since it has taken place during a period in which there has been a shortage of nurses and other trained technicians to staff our hospitals.

Benefits providing blanket reimbursement up to a specified limit are affected also by the general price level. Therefore, since rates are guaranteed renewable for noncancellable coverage, this type of benefit has been restricted to low maximum amounts or to expenses for accidental injury.

One solution to the problem of maintaining equitable rates for policies providing primarily reimbursement for hospital, surgical, and other medical expenses is to include a clause in such policies giving the company the right to change the premium. Such a premium

change would be effective for all policies, not selectively for individual policies.

Once a rating system has been put into effect, it is important to maintain a continuous check on the resulting experience. This can be done by means of loss ratios based upon earned premiums and incurred losses or a study of the basic assumptions underlying the rating structure. The "Health and Accident Experience Exhibit," which is now a requisite part of the Annual Statement for companies writing health and accident business, is of doubtful value to the companies as an internal check since outstanding losses at the year-end are shown for an estimated amount rather than the amounts actually developed.

Since a paper on noncancellable health and accident ratemaking would not be complete without at least touching upon the subject of reserves, a few brief notes on this subject are included.

At one time the convention statement blank called for an unearned premium reserve equal to one-half of the gross premiums in force as of the statement date for all unexpired policies running one year or less from the policy date and a pro-rata part of the gross premiums for all unexpired policies running more than one year from the policy date. Most states now take a more realistic approach to the unearned premium reserve on policies running one year or less by requiring the pro-rata portion of the unexpired gross premium. For a policy issued on the one-year renewable term basis, the unearned portion of the net premium is just sufficient to pay claims incurred during the period covered by such unearned premium, and since most of the expenses are paid when such premium is received, the setting up of a reserve equal to the pro-rata portion of the gross premium creates a reserve which is somewhat larger than theoretically necessary.

Policies issued on the net level or full preliminary term basis require an additional reserve due to the fact that the net premium in the early years of the policy is more than sufficient to pay the losses incurred; therefore, this excess must be set up as a reserve for the later years when the net premium is not sufficient to meet the losses. As the unearned premium has already been set up as a reserve, the mid-terminal reserve is used for this additional reserve rather than a mean reserve. This additional reserve is required by most states on all noncancellable business providing benefits for loss of time due to sickness, the minimum standard usually being the Conference Modification of Class III Disability Table, although a table based upon a company's own experience may be used if the aggregate results are at least as high as the minimum prescribed.

In addition, reserves must be set up for disabilities incurred prior to the statement date and which are still outstanding. These disabilities fall into two categories— (a) disabilities which have been reported and (b) those which have not been reported. A further separation is required of those companies reporting on the Life and Accident and Health Convention Blank. This is the separation between the amount set up as a liability and the amount considered to be a reserve. The

liability portion includes the amount of liability applicable to assumed accrued payments, that is, the amount which would be immediately payable if disability were approved. The Life and Accident and Health Blank also segregates the liability for due and unpaid claims comprising claim payments which have been approved but are unpaid at statement date.

If maternity benefits are provided, a reserve for deferred maternity benefits must be maintained since such claims are not due until approximately nine months after they are incurred. This reserve is considered a claim reserve if based on the assumption that the claim has been incurred but will not be due until some time in the future, a premium reserve if considered the portion of the net premium for the benefit not yet earned.

The statutes of the various states provide in essence that the reserves for reported claims with a duration of one year or more and life indemnity claims shall be valued on the basis of the Conference Modification of the Class III experience or shall be an amount equal to the indemnity payable for a period of three and one-half times the elapsed duration of disability, whichever is less, with a minimum reserve on each life indemnity claim of seven weeks' indemnity. The experience of the individual company may be used to value claims with less than one year's disablement and for unreported and resisted claims.

For more detailed development of commutation symbols and formulae for net premiums and reserves, reference is made to papers previously presented to this Society.[1]

---

[1] P.C.A.S., Vol. XVII, p. 51
P.C.A.S., Vol. XXVII, p. 18
P.C.A.S., Vol. XXXII, p. 27