

EX-MEDICAL COVERAGE—WORKMEN'S
COMPENSATION

BY

STEFAN PETERS

INTRODUCTION*

A workmen's compensation risk written on an ex-medical basis is a risk for which the employer obligates himself to assume the liability for medical payments to injured employees and to save the insurance carrier harmless therefrom, by means of a specific endorsement attached to the workmen's compensation insurance policy. Such risks shall be called in this paper briefly ex-medical risks.

Before entering in detail upon the different aspects of ex-medical coverage, some of the advantages and disadvantages of this form of coverage will be briefly discussed.

Ex-medical coverage is usually taken either by hospitals or by risks having plant hospitals of their own. Often these risks are equipped to treat employees in case of disease or injury, whether due to accident or not, and the medical care for workmen injured in the course of employment adds relatively little work to the normal medical care afforded and can therefore be given at reduced cost for the employer. Advantages of ex-medical coverage to such risks are:

- (a) Some of the larger risks find themselves in a location where medical aid and hospital care is not easily available and are therefore forced to maintain plant hospitals for their employees. Injured workmen availing themselves of these hospitals save the trouble of traveling over long distances when injured.
- (b) Insured hospitals or employers maintaining hospitals often are able and willing to supply a greater amount of medical care and use more elaborate equipment than an injured employee is normally able to obtain. The better medical care is provided either for humanitarian reasons or as a matter of professional pride or simply with the aim of maintaining the efficiency of the employee.
- (c) The employee and his medical history are known to the plant physician.
- (d) Lower cost to the employer.

* The author is indebted to Mr. James M. Cahill for having suggested that he investigate many of the problems dealt with in this paper. He is, however, solely responsible for the conclusions drawn.

Against ex-medical coverage the following arguments can be brought forth:

- (a) The employer enters into the private life of the employee.
- (b) The employer can eventually bring pressure on an employee to content himself with inferior medical care or to resume work before he is thoroughly recovered. He might also, without intention, create fear in the employee that his position may be endangered if he does not limit the demand for the medical care afforded him.

In New York, these two arguments are, however, weakened by the fact that according to Section 13(a) of the Workmen's Compensation Law, the employee has a free choice of the physician and hospital by whom he wants to be treated, and would consequently in some cases find no difficulty in electing not to be treated in the hospital of his employer.

Under normal circumstances the granting of ex-medical coverage to risks of the above described category seems therefore to be justified by the particular nature of these risks.

Ex-medical coverage is permitted in the following states:

Alabama	Iowa	Nebraska
Arizona	Kansas	New Mexico
California	Kentucky	New York
Colorado	Louisiana	North Carolina
Connecticut	Maryland	Rhode Island
Florida	Michigan	South Carolina
Idaho	Minnesota	South Dakota
Illinois	Missouri	Vermont
Indiana	Montana	

States in which workmen's compensation is insured by a monopolistic state fund have not been taken into consideration in this list.

The choice of a statutory or ex-medical coverage policy is optional with the employer, except that hospitals are often forced by underwriters to take ex-medical coverage in order to protect the carrier against excessive medical claims. The choice of ex-medical coverage, if written in New York, is subject to the approval of the Compensation Insurance Rating Board which has issued certain rules stating the qualifications to be met by a risk

desiring ex-medical coverage. Such rules were first promulgated by the Board in Bulletin R. C. 233, dated May 2, 1918, and have since remained substantially unchanged. The qualifications which at present must be met in New York may be quoted from the New York Manual:

- “(a) Dispensary or Emergency Hospital. A suitably equipped dispensary or emergency hospital shall be maintained. A physician or a nurse who is either a graduate nurse or has had two years experience in surgical nursing shall be employed at the plant and shall be available at all times during working hours. The duties of such physician or nurse, except when called for the purposes of rendering medical or surgical attention, shall not necessitate his presence elsewhere than in the dispensary.
- (b) Arrangements with Physician. Where a nurse is employed but no physician is in constant attendance, the assured shall maintain permanent arrangements with a physician who shall visit the plant not less frequently than three times a week and who shall be available on call at all times. Such physician shall supervise and direct the first aid work.
- (c) Arrangements with Hospital. Permanent arrangements for necessary medical and surgical service shall be made with a hospital not more than a half-mile distant from the plant unless an emergency hospital is available on the assured's premises.”

Similar conditions apply in most other states in which ex-medical coverage is permitted. Ex-medical coverage is chiefly desired by risks of considerable size, since small risks usually cannot meet the qualifications. There are, however, some notable exceptions: Small hospitals and private clinics often take ex-medical coverage.

The extent to which use has been made of this form of coverage in the State of New York is shown by the following table:

TABLE I
WORKMEN'S COMPENSATION — NEW YORK

Policy Year	Ex-Medical		TOTAL Ex-Medical and Statutory		Ratio Ex-Medical ÷ Total	
	Payrolls	Premiums Exclusive of Con- stants	Payrolls	Premiums Exclusive of Con- stants	(2) ÷ (4)	(3) ÷ (5)
					(6)	(7)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1934	\$105,644,401	\$ 899,985	\$3,308,863,806	\$44,204,228	3.2%	2.0%
1935	113,850,812	1,362,189	3,567,692,362	57,506,563	3.2	2.4
1936	137,153,236	1,762,540	4,029,171,639	70,177,547	3.4	2.5
1937	129,948,269	2,280,091	4,150,812,062	72,912,512	3.1	3.1
1938	121,051,871	2,620,273	4,186,556,474	74,373,020	2.9	3.5

The standard workmen's compensation insurance policy provides that the insurance carrier takes over the liability of the employer under the state workmen's compensation and employer's liability laws for compensation and medical claims of injured employees and agrees to furnish all services required in connection with this liability. If an employer is covered on an ex-medical basis an endorsement is attached to the policy in which it is stated that the employer will comply with all requirements of the law regarding the medical treatment of injured employees and will save the insurance carrier harmless from any medical claims which might be made against it.

In New York, since August 1, 1928, the following standard endorsement has been attached to policies written on an ex-medical basis:

STATUTORY MEDICAL AID ENDORSEMENT

For attachment to Policy No.....

In consideration of the reduced premium rates for which this policy is issued in connection with operations at or from _____, it is agreed as follows:

(give location)

This Employer will undertake and comply with all the requirements of Section 13 of the Workmen's Compensation Law respecting medical, surgical or other attendance or treatment, nurse and hospital service, medicine, crutches or apparatus, and will save the Company harmless therefrom.

This Employer agrees that he will maintain upon the premises above described either a dispensary or an emergency hospital during the entire period of the policy and will therein render the medical or surgical service, attendance or appliances prescribed by the Company in conformity with rules of the Workmen's Compensation Rate Manual applicable thereto.

In the event of the insolvency or bankruptcy of this Employer, which necessarily and unavoidably prevents him from complying with the provisions of this endorsement, all expenses incurred by the Company under Section 13 shall become the immediate obligation of this Employer and shall constitute a valid and incontestable claim against his insolvent or bankrupt estate.

As appears from the last paragraph of this endorsement, the carriers assume voluntarily the liability for medical claims arising

from coverage of ex-medical risks in the case of insolvency or bankruptcy of the employer, with the provision, however, that their payments shall constitute a valid and incontestable claim against the bankrupt estate. This paragraph has been included in the Statutory Medical Aid Endorsement upon a suggestion made by the New York Insurance Department in order to give injured employees fuller protection.

The first rules dealing with ex-medical coverage in New York appeared in the Manual of June 30, 1916. These rules, which were subsequently several times amended, present today a merely historical interest and may therefore be omitted from this paper.

In the Manual which became effective on December 31, 1920 a procedure for the derivation of ex-medical rates was established based on principles similar to those of the procedure used at present. The rule reads as follows:

“Rates for policies excluding Statutory Medical Aid shall be calculated by the Board in accordance with the following rule:

Determine the percentage reduction for each risk by comparing 80% of the medical portion of the manual rate for the governing classification with the total manual rate for the classification.

In determining rates for any risk, the manual rates adjusted by schedule and/or experience rating less the percentage reduction as above indicated shall be considered as the final rates for the risk.”

A similar procedure was adopted by the National Council on Compensation Insurance.

On August 1, 1928 the revised standard form of the Statutory Medical Aid Endorsement quoted above was adopted. This endorsement does not abrogate the obligation of the carrier to service and administer medical claims. It has been the practice of insurance carriers in New York and in other states to afford full claim service for medical claims arising from the coverage of risks written on an ex-medical basis. This service is, however, subject, in New York, to certain restrictions imposed by the Workmen's Compensation Law, which provides, in Section 13j, that an insurance carrier shall not participate in the treatment of injured workmen, except that it may employ medical inspectors

and that it may maintain rehabilitation bureaus. In order to recognize the fact that full claim service for medical claims is rendered by the carriers even if the policy is written on an ex-medical basis and also that administrative expenses are not reduced, the method of determining ex-medical rates was amended at a meeting of the Actuarial Committee of the National Council on Compensation Insurance held on November 5, 1926. The relative section of the minutes of the Committee may be quoted in part:

"At present ex-medical rates are determined by deducting 80% of the medical rate from the full manual rate. Accordingly, only 20% of the medical rate remains to cover the above listed items.⁽¹⁾ The Committee felt that this 20% was entirely inadequate to meet the needs. After due consideration the following resolution was adopted:

Resolved: That effective concurrently with the next general revision of rates in each state, the ex-medical rates be determined by deducting 60% of the medical rate from the total manual rate."

In accordance with this resolution a corresponding procedure was adopted in New York effective October 1, 1927.

THE DETERMINATION OF RATES FOR EX-MEDICAL RISKS

Previous Method

It was mentioned in the introduction that previous to the adoption of the present method of calculating rates for ex-medical risks, these rates were determined by subtracting from the manual rate 80% of the medical portion of the manual rate:

$$(1a) \text{ ex-medical rate} = \text{manual rate} - .80 \times \text{medical rate}$$

or

$$\begin{aligned} (1b) \text{ ex-medical discount} &= 1 - \frac{\text{ex-medical rate} - \text{cat.}}{\text{manual rate} - \text{cat.}} \\ &= \frac{.80 \times \text{medical rate}}{\text{manual rate} - \text{cat.}} \\ &= .80 \frac{\text{medical pure premium}}{\text{total pure premium}} \end{aligned}$$

The theory underlying this method was that the ex-medical pure

(1) This refers to certain points formulated by the Committee which are quoted later in this paper. In particular see point (3) on page 120.

premium was to be considered equal to the total pure premium less 80% of the medical pure premium and that the expense loading for ex-medical risks was the same, percentagewise, as that for risks written on a statutory basis. Since, on November 5, 1926, this method was abandoned in favor of the present method of calculation of ex-medical rates, the underlying assumptions will be analyzed when discussing the present method.

Present Method

In the introduction it was mentioned that the Actuarial Committee of the National Council on Compensation Insurance decided on November 5, 1926 to adopt an ex-medical rate according to the formula

(2a) ex-medical rate = manual rate — .60 × medical rate
or a corresponding ex-medical discount of

$$(2b) \text{ ex-medical discount} = .60 \times \frac{\text{medical pure premium}}{\text{total pure premium}}$$

The motive for this change, as expressed in the resolution, was the desire to give recognition to the fact that not all expense items for ex-medical risks are reduced in the same proportion as the pure premium. There is no indication in the minutes of the Actuarial Committee of the National Council of the detailed considerations or calculations which must have led to the present formula for the ex-medical discount. However, from the provisions relating to ex-medical risks which, at a later date, have been incorporated in the Experience Rating Plan and in part also from the provisions governing ex-medical risks under the Retrospective Rating Plan it can be inferred that the new formula for the ex-medical discount is based on the following fundamental assumptions:

Assumption A:

The ex-medical pure premium is equal to the total pure premium less 80% of the medical pure premium.

Assumption B:

Expenses, except for acquisition and taxes, are not reduced by exclusion of medical coverage. The acquisition and tax expenses, being a fixed percentage of the final premium, are reduced in proportion to the latter.

These two assumptions lead to the following derivation of the ex-medical rate:

$$(1 - \text{acq.} - \text{tax.}) \times (\text{ex-medical rate} - \text{cat.}) = (1 - \text{acq.} - \text{tax.}) \times (\text{manual rate} - \text{cat.}) - .80 \times \text{medical p.p.}$$

hence

$$(3a) \text{ ex-medical rate} = \text{manual rate} - \frac{.80}{1 - \text{acq.} - \text{tax.}} \times \text{medical p.p.}$$

$$\text{ex-medical discount} = \frac{.80}{1 - \text{acq.} - \text{tax.}} \times \frac{\text{medical p.p.}}{\text{manual rate} - \text{cat.}}$$

$$(3b) \quad , \quad = \frac{.80 \times \text{permissible loss ratio}}{1 - \text{acq.} - \text{tax.}} \times \frac{\text{medical p.p.}}{\text{total p.p.}}$$

Assuming an average provision of .025 for taxes, .175 for acquisition and an average permissible loss ratio of .600, this leads to

$$(4a) \text{ ex-medical rate} = \text{manual rate} - \text{medical pure premium}$$

$$(4b) \text{ ex-medical discount} = \frac{\text{medical p.p.}}{\text{manual rate} - \text{cat.}} = .60 \times \frac{\text{medical p.p.}}{\text{total p.p.}}$$

These are the formulas which are in use at present in New York and all other states except California. In California the ex-medical discount is determined according to the formula:

$$\text{ex-medical discount} = \frac{.80 \times \text{medical rate}}{\text{manual rate} - \text{cat.}}$$

It appears from the derivation given that, on the basis of Assumptions A and B mentioned before, the present formula for the ex-medical discount is only approximately correct. It is, so to say, an average formula, uniformly applied in almost all states which permit ex-medical coverage. If an exact agreement with Assumptions A and B were desired the formula would have to be corrected in each state in accordance with the different compositions of manual rates. Numerical examples may be given for New York and for Connecticut and many other states in which manual rates have the same structure as in Connecticut. Since in the course of this paper several other numerical examples will be based on the manual rate formulas for these states, it will be good to give, for the convenience of the reader, a comparative table of

the expense items entering into the structure of manual rates in New York and Connecticut:

TABLE II

Item	Connecticut	New York
Acquisition .....	.175	.150
Taxes .....	.025	.035
Claim Adjustment .....	.083	.080
Ind. Comm. & Social Security Tax..	..	.024
Inspection .....	.026	.025
H. O. Administration.....	.057	.071
Payroll Audit .....	.009	.017
Total Expense .....	.375	.402
Permissible Loss Ratio.....	.625	.598

Substituting in formula (3b) the numerical values shown in Table II, it appears that the correct value for the ex-medical discount in New York would be

$$.587 \times \frac{\text{medical p.p.}}{\text{total p.p.}}$$

which is about 2% smaller than the discount according to the present formula, and in Connecticut

$$.625 \times \frac{\text{medical p.p.}}{\text{total p.p.}}$$

or about 4% more than according to the present formula.

Assumptions A and B preceding may now be examined in order to determine to what extent they are backed by experience. In this examination the following points may be discussed which were formulated by the Actuarial Committee of the National Council on Compensation Insurance on November 5, 1926 as points involved in any consideration of the ex-medical allowance:

- (1) A selection against the insurance carriers.
- (2) Payment of some medical even though the policy is written ex-medical.
- (3) A major portion of the expense is not reduced by the exclusion of medical.

To these points the following may be added:

- (4) Obligation of the insurance carrier to pay medical losses if the employer is unable or refuses to do so.

Points (1), (2) and (4) are related to Assumption A. Point (3) expresses the principle underlying Assumption B.

While it is possible that risks choosing ex-medical coverage may

have a medical loss ratio lower than average, it cannot be maintained that their insurance on an ex-medical basis leads to a selection against the carriers. As a matter of fact, medical pure premiums are based only on the experience of risks with statutory medical coverage and reflect, therefore, any increase of the overall medical loss ratio which may result from the coverage of a group of risks with under-average medical loss ratio on an ex-medical basis. Only in times of a rapid increase in the proportion of risks covered on an ex-medical basis the increase in medical pure premiums which are based on past experience may be insufficient to compensate the entire effect of an eventual increase in the overall medical loss ratio. This may have been the situation at the end of 1926 when point (1) above was formulated but, at present, the proportion of ex-medical risks is fairly steady as illustrated by Table I, based on New York experience. Therefore, any existing increase in the overall medical loss ratio due to ex-medical coverage is compensated by a corresponding increase in medical rates. This point must hence be ruled out as a justification for the retention of 20% of the medical pure premium in ex-medical pure premiums as formulated in Assumption A.

In so far as experience for New York indicates, the second argument in favor of Assumption A, namely that some medical is paid even though the policy is written on an ex-medical basis, cannot have much weight either. Indeed, from Table III below it appears that the amounts of medical paid for ex-medical risks are negligible and do not justify the retention of any substantial part of the medical pure premium for ex-medical coverage. Since the New York Workmen's Compensation Law provides no limit for medical benefits, it is likely that the indication of the experience for New York applies *a fortiori* in states with less liberal medical benefits.

TABLE III
WORKMEN'S COMPENSATION — NEW YORK

Policy Year	Premiums Excluding Constants		Medical Losses		Ratios		
	Statutory Coverage	Ex-Medical Coverage	Statutory Coverage	Ex-Medical Coverage	(4) ÷ (2)	(5) ÷ (3)	(7) ÷ (6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1937	\$70,632,421	\$2,280,091	\$11,954,222	\$4,235	16.92%	.186%	1.1%
1938	71,752,747	2,620,273	12,282,459	1,706	17.12	.065	.4

In my opinion, therefore, the only remaining argument in favor of the retention of a part of the medical pure premium in ex-medical rates is the contractual liability of the carrier to supply medical aid if the employer does not live up to his obligations. This event will chiefly take place in case of bankruptcy of the employer. Recently the question has been raised whether the insurance carrier is also liable to provide medical benefits if the employer refuses to pay a medical bill or to submit it for arbitration. Although it is likely that no such obligation exists, no absolute certainty on this point has yet been reached and it may be that carriers can incur or may assume some liability in these circumstances. No experience is available regarding the frequency and the extent of the type of liability for medical losses just described, but it can safely be estimated that a provision of 5% of the medical pure premium will amply take care of this contingency.

For this reason I propose that Assumption A underlying the determination of ex-medical rates and discounts be replaced by

Assumption C:

The ex-medical pure premium is equal to the total pure premium less 95% of the medical pure premium.

With respect to Assumption B, it is evident that the amount of expenses for inspection, payroll audit and home office administration will be about equal for risks insured on statutory or ex-medical bases. Acquisition and taxes, being a fixed percentage of the final premium, will be reduced in the same proportion as the manual rate. The only expense items which need more detailed consideration are the expense provisions for industrial commissions, labor departments, insurance departments or similar institutions and claim adjustment.

Where the expense for the Industrial Commission or similar institution is levied in proportion to indemnity losses (as is the case in New York), it is evident that the amount of this expense is the same whether medical coverage is afforded or not. If instead this expense were levied on premiums, it should be reduced for ex-medical risks in the proportion of the ex-medical to the manual rate and therefore be considered and treated as an additional tax expense.

Claim adjustment has been considered in the present formula for ex-medical rates, in the Experience Rating Plan and in the Retrospective Rating Plan as an expense item which is not reduced by the exclusion of medical liability. The reason for this procedure is to be found in the fact, already discussed in the introduction, that insurance carriers have always rendered to ex-medical risks full claim service for all claims including medical. It may, however, be questioned whether the cost of servicing medical claims incurred by ex-medical risks is actually as high as that for risks with statutory coverage, since the carriers save some clerical and telephone expense connected with the payment and control of medical bills and since also investigations of physicians are reduced in number or entirely eliminated.⁽²⁾

In view of the foregoing consideration it is likely that the claim adjustment expense is somewhat reduced by exclusion of medical liability. Lacking some more detailed experience regarding this point, however, the amount of this reduction cannot be stated with certainty. A rough estimate would be that claim adjustment expense for medical claims incurred by ex-medical risks runs about 10% lower than the corresponding expense for risks written on a statutory basis. It is proposed that the full claim expense provision be retained in ex-medical rates until specific experience regarding the cost of claim service for ex-medical risks has become available.

Summarizing the preceding considerations about the effect of the exclusion of medical liability on the various expense provisions in compensation rates, it seems that Assumption B underlying the derivation of the present formula for ex-medical rates reflects the actual conditions, provided that in those states in which a specific charge for the expenses of an industrial commission or similar institution is levied in proportion to premiums such expense item should be included in the provision for taxes. If, in the future, a specific study should reveal that claim expense for ex-medical risks is reduced, say, from the proportion c of the manual rates (normally .080) to the proportion c' , Assumption B should be replaced by

(2) For the information regarding a reduction in the medical claim adjustment expense for ex-medical risks, I am indebted to Mr. S. L. Hanson.

Assumption D:

Expenses, except for claim adjustment, acquisition and taxes are not reduced by the exclusion of medical liability. Claim adjustment is reduced to the proportion c' of the manual rate. Acquisition and taxes being a fixed percentage of the final premium, are reduced in proportion to the latter.

The revised formula for ex-medical rates and discounts derived on the basis of Assumptions C and B are the following:

$$(5a) \text{ ex-medical rate} = \text{manual rate} - \frac{.95}{1 - \text{acq.} - \text{tax.}} \times \text{med. p.p.}$$

$$(5b) \text{ ex-medical discount} = \frac{.95}{1 - \text{acq.} - \text{tax.}} \times \frac{\text{medical p.p.}}{\text{manual rate} - \text{cat.}}$$

$$= \frac{.95 \times \text{perm. l. r.}}{1 - \text{acq.} - \text{tax.}} \times \frac{\text{medical p.p.}}{\text{total p.p.}}$$

If instead of Assumptions C and B, Assumptions C and D were adopted, the formulas would have to be modified in the following manner:

$$(6a) \text{ ex-medical rate} =$$

$$\text{manual rate} \left(1 - \frac{c - c'}{1 - \text{acq.} - \text{tax.}} \right) - \frac{.95 \times \text{med. p.p.}}{1 - \text{acq.} - \text{tax.}}$$

$$(6b) \text{ ex-medical discount} =$$

$$\frac{c - c'}{1 - \text{acq.} - \text{tax.}} + \frac{.95 \times \text{perm. l. r.}}{1 - \text{acq.} - \text{tax.}} \times \frac{\text{medical p.p.}}{\text{total p.p.}}$$

In order to give an idea of the effect of the proposed changes, the numerical values of the ex-medical discount computed on the present basis and on the basis of Assumptions B and C or D and C are given in the following table. For the application of formula (6b) the assumption is made that claim adjustment for ex-medical risks is reduced to .065 of the statutory premium in both states.

TABLE IV

	Connecticut	New York
Present Formula	$\frac{.60 \times \text{med. p.p.}}{\text{total p.p.}}$	$\frac{.60 \times \text{med. p.p.}}{\text{total p.p.}}$
Assumptions B and C — Formula (5b)	$\frac{.742 \text{ med. p. p.}}{\text{total p.p.}}$	$\frac{.697 \text{ med. p.p.}}{\text{total p.p.}}$
Assumptions D and C — Formula (6b) .023 +	$\frac{.742 \text{ med. p.p.}}{\text{total p.p.}}$	$.018 + \frac{.697 \text{ med. p.p.}}{\text{total p.p.}}$

Both the proposed decrease of the portion of the medical pure premium to be retained for ex-medical risks and the proposed decrease in the provision for claim adjustment (if justified by the results of some future study) tend to increase the ex-medical discount and, consequently, to decrease the rates to be charged for ex-medical coverage.

THE TREATMENT OF EX-MEDICAL RISKS UNDER THE EXPERIENCE RATING PLAN

Under the Experience Rating Plan a weighted average of the actual and expected losses of a risk for the experience period is compared with the expected losses; the ratio is the experience modification which is applied to the manual or schedule rates to determine the adjusted rates for the ensuing year. It is evident that for ex-medical risks whose actual losses do not include any medical losses or but a very small amount of such losses, the expected losses must be determined in such a manner as to exclude likewise all or almost all expected medical losses. This principle was indeed followed in setting up the rules governing the treatment of ex-medical risks under the Experience Rating Plan by making the expected ex-medical losses equal to payrolls extended at ex-medical pure premiums.

During the period in which the ex-medical discount was equal to

$$\frac{.80 \text{ medical pure premium}}{\text{total pure premium}}$$

the unweighted subject premium was determined by extending the payrolls of each classification by the latest ex-medical rates and expected losses were obtained by multiplying the subject premium with the permissible loss ratio. In formulas:

ex-medical expected losses =

$$\text{payroll} \times \text{manual rate} \times \left(1 - \frac{.80 \text{ med. p.p.}}{\text{total p.p.}}\right) \times \text{permissible loss ratio}$$

$$= \text{payroll} \times \text{total pure premium} \times \left(1 - \frac{.80 \text{ med. p.p.}}{\text{total p.p.}}\right)$$

$$= \text{payroll} \times (\text{total pure premium} - .80 \text{ med. pure prem.})$$

and this is, following Assumption A,

$$= \text{payroll} \times \text{ex-medical pure premium}$$

as it should be.

Shortly after the adoption on November 5, 1926 of an ex-medical discount equal to $\frac{.60 \text{ medical pure premium}}{\text{total pure premium}}$,

namely on July 15, 1927, the Actuarial Committee of the National Council on Compensation Insurance adopted the following resolution:

Resolved: That for experience rating purposes 20% of the medical pure premium be retained in determining expected losses instead of the 40% retained in establishing ex-medical ratios.

In accordance with this resolution, the following rule has been inserted in the Experience Rating Plan:

"For that part of the experience period during which the risk has been insured without medical, the premium subject to experience rating shall be reduced by an amount equal to the subject premium times 1.33 times the ex-medical ratio shown on the rate sheet for each classification."⁽³⁾

The factor 1.33 is obviously the ratio $.80 \div .60$. For the determination of the ex-medical expected losses the statutory expected losses are therefore reduced by a discount of

$$1.33 \times \frac{.60 \text{ med. p.p.}}{\text{total p.p.}} = \frac{.80 \text{ med. p.p.}}{\text{total p.p.}}$$

as before. Since statutory expected losses are equal to the payrolls extended at total pure premiums, this reduction has the effect of making ex-medical expected losses equal to payrolls extended at ex-medical pure premiums.⁽⁴⁾ From this derivation it can be seen that Assumptions A and B have been used also in establishing the rules governing ex-medical risks under the Experience Rating Plan.

When discussing the present method of establishing ex-medical rates, it was shown that the present formula for the ex-medical discount is only approximately correct and that the correct for-

(3) Quoted from rule 13 of the New York Experience Rating Plan effective October 5, 1930.

(4) In New York the subject premium is really not multiplied by .598 but by $.598 \times 1.012 = .605$. The factor 1.012 represents a charge for the Security Funds which is divided into the payroll projection factors. The product of .605 and the modified subject premium does therefore not include the Security Fund factor which is also omitted from the modified actual losses with which the modified expected losses are to be compared.

mula would be formula (3b). If, therefore, this formula were adopted, the subject premium for ex-medical risks would have to be reduced by the ex-medical discount multiplied by the ratio

$$(7) \quad \frac{1 - \text{acq.} - \text{tax.}}{\text{permissible loss ratio}},$$

in order to arrive at the correct expected ex-medical losses in agreement with Assumption A. This ratio would amount to 1.36 for New York and 1.28 for Connecticut as compared with 1.33 in the present plan.

The same formula (7) would apply if the ex-medical discount were calculated according to proposed formula (5b) which was based on Assumption C, that is, on the assumption of an ex-medical pure premium equal to the total pure premium less 95% of the medical pure premium. Indeed, in this case we would have:

$$\begin{aligned} \text{expected ex-medical losses} &= \\ & \text{payroll} \times \text{manual rate} \times \text{permissible l. r.} \\ & \times \left(1 - \frac{1 - \text{acq.} - \text{tax.}}{\text{permissible l. r.}} \times \frac{.95 \times \text{permissible l. r.}}{1 - \text{acq.} - \text{tax.}} \times \frac{\text{med. p.p.}}{\text{total p.p.}} \right) \\ & = \text{payroll} \times \text{total pure premium} \times \left(1 - .95 \times \frac{\text{med. p.p.}}{\text{total p.p.}} \right) \\ & = \text{payroll} \times (\text{total p.p.} - .95 \text{ med. p.p.}) \\ & = \text{payroll} \times \text{ex-medical pure premium} \end{aligned}$$

If at some later date Assumption D should be adopted instead of Assumption B, that is, if some reduction of claim adjustment should be taken into consideration in establishing ex-medical rates, formula (7) would have to be replaced by a slightly more complicated formula which is omitted from this paper, since at present it would have only limited interest.

The split of expected ex-medical losses into a normal and excess portion is made in the following manner: First the statutory excess subject premium is determined in the customary way by extending payrolls at manual rates and applying to these premiums the average excess ratio. Then, the ex-medical reduction of the subject premium is computed by multiplying the statutory subject premium by $1.33 \times$ the ex-medical discount. Finally this ex-medical reduction is multiplied by the medical excess ratio and subtracted from the statutory excess subject premium. The result is the ex-medical excess subject premium which, multiplied by the

permissible loss ratio, furnishes the expected ex-medical excess losses.⁽⁵⁾ Since the ex-medical reduction of the subject premium represents medical losses which are excluded for ex-medical risks, it was necessary to apply to this reduction the medical excess ratio in order to arrive at the correct ex-medical excess subject premium. The expected ex-medical normal losses are the difference between the total expected ex-medical losses and the expected ex-medical excess losses. This procedure appears to be appropriate except for a possible correction of the factor 1.33 which was previously discussed.

EX-MEDICAL RISKS UNDER THE RETROSPECTIVE RATING PLAN

In order to explain more easily the provisions of the Retrospective Rating Plan relating to ex-medical risks, it will be advisable to mention briefly some of the more essential sections of the Plan dealing with its technical set-up. The introduction of the Plan may therefore be quoted:

“Retrospective Rating is a plan or method which permits adjustment of the final premium for a risk, variable between a specific Minimum and Maximum percentage of the Standard Premium for such risk, on the basis of its own developed loss experience.

The rating formula is as follows:

- (a) A specified percentage of the Standard Premium is charged to provide for expenses that are independent of the loss ratio and to cover any losses in excess of those contemplated by the Maximum Retrospective Premium. The percentage of the Standard Premium is designated the “Basic Premium.”
- (b) The losses incurred by the risk, increased for claim expense and taxes not provided for in (a), are added to the Basic Premium.
- (c) The total of these items is the Retrospective Premium to be charged, subject to limitation by specified Minimum and Maximum Retrospective Premiums.”

From (a) it can be seen that the basic premium includes provisions for home office administration, payroll audit and inspection; in New York, also for the expenses of the Department of Labor and for Social Security Act taxes. For risks under the Retrospec-

(5) See note (4).

tive Rating Plan acquisition is based on the minimum premium. The provision for acquisition is, therefore, independent of the loss ratio and hence is included in the basic premium. Another element in the basic premium is the insurance charge, which is a net premium for the coverage of any amount of loss in excess of the loss provision in the maximum premium (as stated in (a) above), but reduced for the excess loss provision in the retrospective premium for those risks to which the minimum premium applies. In California and New York, the insurance charge is slightly increased to cover also losses in excess of \$10,000 per claim (see below). The claim adjustment on the insurance charge is also included in the basic premium, as is the amount of taxes to be paid on the basic premium portion of the retrospective premium.

The amount mentioned in (b) above is obtained by multiplying actual incurred losses by the loss conversion factor. In California and New York a limit of \$10,000 applies to losses arising from any single claim. In some states a small portion of claim adjustment is transferred from the loss conversion factor to the basic premium. In certain other states a small portion of the provision for home office administration expense is transferred from the basic premium to the loss conversion factor.⁽⁶⁾

Basic, minimum and maximum premiums are the product of the standard premium, that is, the premium that would apply if the risk did not come under the Retrospective Rating Plan, and the basic, minimum and maximum ratios. These ratios are equal for all states and vary by size of standard premium, except that the California and New York basic ratios are slightly higher than those for other states, because of the increase in the insurance charge due to the \$10,000 limit per claim in force in these states.

The basic premium ratio and the loss conversion factor may be expressed by the following formulas:

$$(8) \text{ basic premium ratio} = \frac{1}{1 - \text{tax.}} \left[\text{H.O. Admin.} + \text{P.A.} + \right. \\ \left. \text{Insp.} + \text{acq.} \times \text{minimum premium ratio} \right. \\ \left. + (\text{Ind. Comm.} + \text{partial claim exp.}) \right. \\ \left. + \text{insurance charge} + \text{contingency margin} \right] \\ 1 + \frac{\text{cl. adj.} + (\text{partial h.o. admin.})}{\text{permissible loss ratio}}$$

$$(9) \text{ loss conversion factor} = \frac{\text{permissible loss ratio}}{1 - \text{taxes}}$$

(6) See S. D. Pinney: *The Retrospective Rating Plan for Workmen's Compensation Risks*. P.C.A.S., Vol. XXIV, part 2.

The items in parentheses may not apply in some states. The expense provisions in these two formulas are intended to be expressed as ratios to the standard premium. Claim expense and partial home office administration (if any) in the loss conversion factor are therefore divided by the permissible loss ratio in order to express them in terms of losses.

In the application of the Retrospective Rating Plan to ex-medical risks, Assumption B regarding the expense provision has been used exactly as in the establishment of ex-medical discounts. With respect to Assumption A, regarding the ex-medical pure premiums, no consistent attitude has been taken as shall be shown later on.

The rules relating to ex-medical risks may be quoted from paragraph 2 of Section III of the New York Retrospective Rating Plan in the form which is in effect since July 1, 1940:

As applied to risks written on an ex-medical basis, the Retrospective Premium shall be determined as follows:

- (a) The ex-medical coverage premium will be established by application of the approved ex-medical rates, the Experience Rating Plan, and the Schedule Rating Plan where the latter is applicable.
- (b) The statutory medical coverage premium will be calculated by dividing the ex-medical coverage premium for each classification by the complement of the ex-medical discount for such classification.
- (c) The Basic Premium ratio will be determined from the regular table of such ratios upon the basis of the statutory medical coverage premium, but shall be adjusted for ex-medical coverage. Such adjustment shall be obtained from the Board and shall be expressed as a percentage of the Minimum Premium ratio.

The Minimum and Maximum Premium ratios will be determined from the regular table of such ratios upon the basis of the statutory medical coverage premium.

- (d) The Basic Premium will be determined by application of the adjusted Basic Premium ratio to the statutory medical coverage premium.

- (e) The Minimum and Maximum Premiums will be determined by application of the Minimum and Maximum Premium ratios respectively to the ex-medical coverage premium.
- (f) The Loss Conversion Factor shall be adjusted to compensate for any deficiency in expense resulting from the application of ex-medical factors, and shall be obtained from the Board.
- (g) Determination of losses, incurred during the Rating Period. Actual incurred losses shall be used subject to a limit of \$8,000 for the indemnity cost of any claim.⁽⁷⁾

In keeping with Assumption B, the basic premium is essentially the same for risks insured on ex-medical and statutory bases, and therefore the basic premium for ex-medical risks is obtained by applying the basic premium ratio to the statutory coverage standard premium. There are, however, two components of the basic premium which are affected by ex-medical coverage. The first is the provision for acquisition. This expense item is based on the ex-medical minimum premium which, according to point (e) above, is obtained by application of the minimum premium ratio to the ex-medical standard premium; it must therefore be smaller for ex-medical risks than for statutory coverage risk. For this reason the adjustment of the basic premium ratio mentioned in point (c) has been introduced effective July 1, 1940. Previous to this date, ex-medical risks were charged for acquisition on a statutory basis although the actual acquisition payable was reduced. A derivation of the formula used for this adjustment of the basic premium ratio is given below. The second component of the basic premium which will be affected by the exclusion of medical liability is the insurance charge. No attempt has been made as yet to correct the basic premium for a change in this item, chiefly because no statistical material is available to determine the exact amount of the ex-medical insurance charge. At the end of this part of the paper an attempt will be made to arrive at some estimate of the error involved.

Before discussing point (f) above, the adjustment of the basic premium ratio on account of the redundancy in the provision for acquisition shall be determined. The provision for acquisition of

(7) Only in effect in New York.

risks under the Retrospective Rating Plan expressed in terms of the statutory coverage standard premium is the following:

for statutory coverage

$$\text{acq.} \times \text{min. prem. ratio}$$

for ex-medical coverage

$$\text{acq.} \times \text{min. prem. ratio} \times (1 - \text{average ex-med. disc.})$$

The average ex-medical discount is the proportion by which the statutory coverage standard premium of the ex-medical risk must be reduced in order to obtain the ex-medical standard premium. It is, hence, a weighted average of the ex-medical discounts of the various classifications of the risk. The redundancy for acquisition in the basic premium ratio is, therefore, equal to the difference of the amounts shown above, then loaded for taxes. Hence:

(10) redundancy =

$$\left(\frac{\text{acq.}}{1 - \text{tax.}} \right) \times \text{average ex-med. disc.} \times \text{minimum premium ratio.}$$

The ratio $\frac{\text{acq.}}{1 - \text{tax.}}$ is a constant for each state, for instance equal

to .155 in New York and .179 in Connecticut. In order to be able to inform the insured at the beginning of the policy period of the reduction of the basic premium ratio which will apply to his policy, the expected average ex-medical discount is computed on the basis of past experience, namely, on the basis of the experience of the last year of the experience period used in experience rating. In New York this average ex-medical discount is computed as a weighted average of the ex-medical discounts for all classifications involved. In other states the ex-medical discount corresponding to the governing classification is used. This latter method is somewhat simpler but less accurate. Since the minimum premium ratio varies between .750, for risks with a statutory coverage standard premium of \$5,000, and .500, for risks with a statutory coverage standard premium of \$75,000 and over, the correction of the basic premium ratio for an ex-medical risk with an average ex-medical discount of .20 will vary between $.155 \times .20 \times .75 = .023$ and $.155 \times .20 \times .50 = .016$ in New York and between $.179 \times .20 \times .75 = .027$ and $.179 \times .20 \times .50 = .018$ in Connecticut. The correction is, as one sees, quite substantial.

In point (f) above it is stated that the ex-medical loss conversion factor shall be adjusted to compensate for any deficiency in expense resulting from the application of ex-medical discounts. More precisely this factor is adjusted in such a manner that the amount in dollars of claim expense and partial home office administration expense (if included in the loss conversion factor) is equal, over all, for risks written on statutory and ex-medical bases. This principle is in exact agreement with Assumption B. In order to translate this principle into formulas the following abbreviations may be made: cl. adj. shall designate that portion of claim adjustment expense and partial home office administration expense (if any), expressed in terms of manual rates, which is included in the loss conversion factor. L. and E.L. shall designate the regular and the ex-medical loss conversion factors respectively. From formula (9) it can be followed that

$$(11) \quad \text{cl. adj.} = [(1 - \text{tax.}) \times L. - 1] \times \text{permissible loss ratio.}$$

According to the principles stated above, the expense provision in the ex-medical loss conversion factor multiplied by ex-medical losses shall provide the same amount in dollars overall, as

$\frac{\text{cl. adj.}}{\text{permissible l. r.}}$ multiplied by statutory coverage losses. This

means:

$$\begin{aligned} & \text{cl. adj. prov. in E.L.} \times \\ & \qquad \qquad \qquad \Sigma \text{ classification payrolls extended at ex-med. p.p.'s.} \\ & = [(1 - \text{tax.}) \times L. - 1] \times \Sigma \text{ classification payrolls} \\ & \qquad \qquad \qquad \qquad \qquad \qquad \text{extended at total p.p.'s.} \end{aligned}$$

or

$$(12) \quad \text{cl. adj. prov. in E.L.} = [(1 - \text{tax.}) \times L. - 1] \times \frac{\Sigma \text{ class payrolls extended at tot. p.p.}}{\Sigma \text{ class payrolls extended at ex-med. p.p.}}$$

Here Σ indicates the summation over the different classifications of the risk.

In order to express the second factor as a function of the ex-medical discount an assumption must be made regarding the ex-medical pure premium. If, in agreement with the present method employed in the determination of ex-medical rates, Assumption A is used, the formula above can be transformed by

means of formula (2b) for the ex-medical discount in the following manner:

$$(13) \text{ cl. adj. prov. in E.L.} = \frac{1}{1 - \frac{.80}{.60} \times \text{average ex-med. disc.}} \\ = [(1 - \text{tax.}) \times L. - 1] \times \frac{.60}{.60 - .80 \times \text{aver. ex-med. disc.}}$$

If instead of the present formula for the ex-medical discount the more accurate formula (3b) were used one would obtain

$$(14) \text{ cl. adj. prov. in E.L.} = [(1 - \text{tax.}) \times L. - 1] \times \frac{\text{permissible I. r.}}{\text{permissible I. r.} - (1 - \text{acq.} - \text{tax.}) \times \text{aver. ex-med. disc.}}$$

This same formula would result if both the determination of ex-medical discounts and of ex-medical loss conversion factors were based on the proposed Assumption C instead of Assumption A.

At present none of the foregoing formulas is used; the provision for claim adjustment in E.L. is instead calculated as equal to

$$(15) [(1 - \text{tax.}) \times L. - 1] \times \frac{.60}{.60 - \text{average ex-med. disc.}}$$

This formula is a consequence of the assumption that for risks under the Retrospective Rating Plan the ex-medical pure premium is equal to the total pure premium less 100% of the medical pure premium. Indeed, on the basis of this assumption one obtains from (12)

$$\text{cl. adj. prov. in E.L.} = [(1 - \text{tax.}) L. - 1] \times \frac{1}{1 - \frac{1}{.60} \text{ average ex-med. disc.}}$$

which is identical with (15). In New York formula (15) is modified by substituting .598 for .60.

There is no apparent reason why, in the case of ex-medical risks under the Retrospective Rating Plan, a different assumption regarding the ex-medical pure premium should be made than for other ex-medical risks, even if the assumption made in this case corresponds more closely to reality as discussed previously. The method used at present tends to increase the provision for claim expense in the ex-medical loss conversion factor, and, consequently,

this factor itself, beyond the amount which would follow from a consistent application of Assumption A. Nevertheless the ex-medical loss conversion factors calculated by the present method are probably nearer to the "true" factors than those which follow from the more consistent formulas (13) or (14). The best solution would be to adopt Assumption C and then to calculate ex-medical discounts according to formula (5b) and the claim expense provision in the ex-medical loss conversion factor according to formula (14).

From formulas (15) and (14) for the claim expense provision in the ex-medical loss conversion factor, expressed in terms of ex-medical losses, the following formulas for the complete ex-medical loss conversion factor are derived:

$$(16) \text{ E.L.} =$$

$$\frac{1}{1 - \text{tax.}} \left([(1 - \text{tax.}) \times L. - 1] \times \frac{.60}{.60 - \text{average ex-med. disc.}} + 1 \right)$$

for the ex-medical loss conversion factor as used at present and

$$(17) \text{ E.L.} = \frac{1}{1 - \text{tax.}} \times \left([(1 - \text{tax.}) \times L. - 1] \times \frac{\text{permissible l. r.}}{\text{permissible l. r.} - (1 - \text{acq.} - \text{tax.}) \times \text{aver. ex-med. disc.}} + 1 \right)$$

for the revised ex-medical loss conversion factor if the proposed Assumption C regarding ex-medical pure premiums should be adopted also for the calculation of ex-medical rates.

Assuming average ex-medical discounts of .15, .20 and .25 and considering that $L. = 1.18$ for New York and 1.12 for Connecticut, the following ex-medical loss conversion factors would be obtained in these two states according to the present and to the proposed method:

TABLE V
EX-MEDICAL LOSS CONVERSION FACTORS

	Connecticut L. = 1.12			New York L. = 1.18		
	.15	.20	.25	.15	.20	.25
Average ex-medical discount (Form. 3b)						
Loss conversion factor						
Present method (Form. 16)	1.151	1.167	1.187	1.228	1.252	1.283
Proposed method (Form. 17)	1.143	1.153	1.164	1.218	1.234	1.255
Average ex-medical discount (Form. 5b)	.18	.24	.30	.18	.24	.30
Loss conversion factor						
Proposed method (Form. 17)	1.149	1.162	1.178	1.227	1.251	1.280

The first two sets of loss conversion factors are really not comparable since the revised method for the calculation of the ex-medical loss conversion factor is coupled with the proposal that the ex-medical discounts be also revised on the basis of Assumption C. Risks which at present have average ex-medical discounts of .15, .20 or .25 will have ex-medical discounts of .18, .24 and .30 respectively on the basis of Assumption C

$$\left(\text{new discounts} = \frac{.95}{.80} \times \text{old discounts} \right).$$

The loss conversion factors on the basis of the proposed method for risks with average ex-medical discounts of .18, .24 or .30 are those in the last line of Table V. These loss conversion factors are almost equal to those obtained from the present method which is due to the fact that the former are based on ex-medical pure premiums excluding 95% of the medical pure premium while the latter are based on ex-medical pure premiums excluding 100% of the medical pure premium. The examples confirm that the present method of calculating ex-medical loss conversion factors, although inconsistent with the method used in the derivation of ex-medical rates, yields factors which are in fair agreement with the factors theoretically more correct. The error lies in the present method of calculating ex-medical discounts, and a consistent treatment of all ex-medical risks, whether subject to the Retrospective Rating Plan or not, can be achieved only by revising the method of calculating ex-medical discounts on the basis of the proposed Assumption C.

If in the future also a reduction of claim adjustment expense from the proportion c to the proportion c' of the statutory coverage standard premium should be taken into consideration in the calculation of ex-medical discounts, the term $[(1-\text{taxes}) \times L.-1]$ in formulas (16) and (17) would have to be reduced by

$$\frac{c - c'}{\text{permissible l. r.}}$$

An attempt will now be made to calculate for some representative examples the difference in the insurance charges and claim adjustment and taxes thereon for risks written on statutory and ex-medical bases which develop the same statutory coverage standard premium. For this purpose it may be remembered that the

insurance charge, in terms of standard premium, for risks written on a statutory basis in states other than New York or California is equal to

$$(18) \text{ permissible l. r. } \times \left[\frac{\text{losses in excess of loss prov. in max. prem.}}{\text{total losses}} + \frac{\text{losses not in excess of loss prov. in min. prem.}}{\text{total losses}} \right] - \frac{\text{loss prov. in min. prem.}}{\text{standard premium}}$$

The fractions inside the square brackets are taken from the charts used in the structural analysis of the Retrospective Rating Plan,⁽⁸⁾ which show the proportion of losses in excess of any given loss ratio for different premium size groups. These charts are based on statutory coverage losses. The term "losses not in excess of (any given) loss provision," used in formula (18) and hereafter, is intended to mean all losses for risks whose losses amount to no more than the given loss provision, and losses equal to the given loss provision for risks whose entire losses amount to more than the given loss provision.

The formula for the ex-medical insurance charge, in terms of the statutory coverage standard premium, is:

$$(19) \text{ ex-medical insurance charge} = \text{permissible l. r. } \times \left[\frac{\text{ex-med. losses in excess of loss prov. in ex-med. max. prem.}}{\text{total stat. cov. losses}} + \frac{\text{ex-med. losses not in excess of loss prov. in ex-med. min. prem.}}{\text{total stat. cov. losses}} \right] - \frac{\text{loss prov. in ex-med. min. prem.}}{\text{stat. cov. standard premium}}$$

No charts for indemnity losses only or for total losses of ex-medical risks are available which would permit the exact computation of the ex-medical insurance charge by means of formula (19). Therefore, in order to permit the use of the existing charts

(8) New charts based on experience of policy years 1934 to 1937 inclusive are in course of preparation by the Compensation Insurance Rating Board.

for ex-medical coverage, some assumption regarding the distribution of ex-medical losses in excess of given loss ratios will have to be made. This will be done by formulating a minimum assumption and a maximum assumption with the aim of obtaining lower and upper limits for the ex-medical insurance charge.

All loss ratios in the following are intended to be ratios of losses to the statutory coverage standard premium.

The simplest minimum assumption is the following:

Assumption E:

The average ratio m of medical losses to total losses does not vary with the loss ratio of the risk.

If e designates the average ratio of ex-medical losses to statutory coverage losses, and $l.r.$ any loss ratio in terms of statutory coverage standard premium, then e does not vary with the loss ratio $l.r.$ of the risk and is therefore equal to

$$\frac{\text{ex-medical p.p.}}{\text{total p.p.}}$$

and we have consequently, according to Assumption C,

$$e = 1 - .95 m$$

From the invariance of e follows:

(20)

$$\frac{\text{ex-med. losses in excess of } l.r.}{\text{tot. stat. cov. losses}} = e \times \frac{\text{stat. cov. losses in excess of } \frac{l.r.}{e}}{\text{tot. stat. cov. losses}}$$

The latter expression can be derived from existing charts. Assumption E is incorrect for high loss ratios because these are often caused by claims involving a relatively high indemnity cost and a medical cost not correspondingly high. The ratio is therefore probably underestimated for high loss ratios.

A maximum assumption which over-compensates this defect would be:

Assumption F:

The average ratio m' of medical losses to total losses for that portion of losses which does not exceed

$g \times$ statutory coverage standard premium,

where $g = 1.20 \times$ permissible loss ratio,

does not vary with the loss ratio of the risk. Losses in excess of

$g \times$ statutory coverage standard premium
are considered to consist of indemnity losses only.

$g = .720$ and $.750$ for permissible loss ratios of $.600$ and $.625$ respectively.

This assumption certainly overestimates the ratio; the truth will be somewhere between Assumptions E and F. Both assumptions permit the use of the existing charts and, hence, allow the calculation of numerical examples.

If e' designates the average ratio of ex-medical to statutory coverage losses for that portion of statutory coverage losses which does not exceed $g \times$ statutory coverage standard premium, then e' does not vary with the loss ratio of the risk and must be smaller than e , because for the portion of statutory coverage losses exceeding $g \times$ statutory coverage standard premium (if any) the ratio of ex-medical to statutory coverage losses is equal to unity according to Assumption F, and because this ratio, over all, must be equal to

$$\frac{\text{ex-med. p.p.}}{\text{total p.p.}} = e$$

Indeed, let p be the proportion of statutory coverage losses in excess of $g \times$ statutory coverage standard premium to total statutory coverage losses for all risks combined. This ratio can be derived from the existing charts. Then according to Assumption F, one has:

Ex-medical losses for all risks combined =

$$[(1-p) \times e' + p \times 1] \times \text{statutory coverage losses for all risks combined}$$

and this, according to what was said above, is equal to

$$e \times \text{statutory coverage losses for all risks combined.}$$

From this follows:

$$(21) (1 - p) e' + p = e \text{ or } e' = \frac{e - p}{1 - p} < \frac{e - e p}{1 - p} = e$$

Then, if a risk written on a statutory basis has a loss ratio $L.R.$, on the average the corresponding loss ratio in terms of the statutory coverage premium which would result on the basis of Assumption F, if the risk were written on an ex-medical basis, would be:

(22a)

$$e' \times L.R. \quad \text{for } L.R. \leq g$$

(22b)

$$e' \times g + 1 \times (L.R. - g) = L.R. - (1 - e')g \text{ for } L.R. \geq g$$

If, vice-versa, the loss ratio of an ex-medical risk in terms of the statutory coverage premium is $l.r.$, on the average the corresponding loss ratio which would result, on the basis of Assumption F, if the risk were written on a statutory basis would be:

(23a)

$$\frac{l.r.}{e'} \quad \text{for } l.r. \leq e'g$$

(23b)

$$\frac{e' \times g}{e'} + 1 \times (l.r. - e'g) = l.r. + (1 - e')g \text{ for } l.r. \geq e'g$$

Hence, for $l.r. \leq e'g$

(24a)

$$\begin{aligned} & \frac{\text{ex-med. losses not in excess of } l.r.}{\text{total stat. coverage losses}} \\ &= e' \times \frac{\text{stat. cov. losses not in excess } \frac{l.r.}{e'}}{\text{total stat. coverage losses}} \end{aligned}$$

and for $l.r. \geq e'g$

(24b)

$$\begin{aligned} & \frac{\text{ex-med. losses in excess of } l.r.}{\text{total stat. med. losses}} \\ &= \frac{\text{stat. cov. losses in excess of } [l.r. + (1 - e') \times g]}{\text{total stat. med. losses}} \end{aligned}$$

The right hand expressions can be calculated from existing charts.

Formula (20) or formulas (24a) and (24b) will be substituted for the fractions inside the square brackets in formula (19) for the ex-medical insurance charge according to whether minimum Assumption E or maximum Assumption F is used. In either case this substitution permits the evaluation of formula (19) with the help of the existing charts for the distribution of statutory coverage losses by loss ratio.

The numerical examples in Table VI are calculated with the help of this formula and Assumptions B, C, E, and F for statutory coverage standard premiums of \$5,000, \$50,000 and \$150,000 and average ex-medical discounts of .15, .20 and .25. The calculations are performed for the State of Connecticut in order to avoid the complicating influence of the limit per claim imposed on incurred losses in New York and California. In view of the relatively small size of the insurance charge, it is assumed, for the purpose of this calculation, that any change in the insurance charge provision would not alter the basic premium ratio but only affect the contingency margin therein.

These calculations show that the insurance charge increases by .02 to .05 of the statutory coverage standard premium for risks with \$5,000 statutory coverage premium, from .00 to .01 for risks of \$50,000 and not at all for risks of \$150,000. The correct increase is probably nearer to the higher figures and relatively larger for risks with larger average ex-medical discounts. As one sees, the increase in the insurance charge is not negligible, particularly for risks of smaller sizes and for high ex-medical discounts. The result of the calculation probably applies equally well to states other than Connecticut. There is a contingency margin in the basic premium which varies from .05 to .07 for risks with a standard premium of \$5,000 to .00-.01 for risks with a standard premium of \$150,000. This margin appears to be just sufficient to absorb the indicated increase in the insurance charge of ex-medical risks. Special care should be taken in states where risks with standard premiums down to \$1,000 are eligible for the Retrospective Rating Plan. The numerical amount of the increase in the insurance charge due to ex-medical coverage may change after adoption of new charts for the ratio of excess losses to total losses as a function of the loss ratio which are being calculated by the New York Compensation Insurance Rating Board. In view of

the substantial increase in the insurance charge due to ex-medical coverage which is indicated by the example shown above, it would be advisable that the study on which the new charts are to be based be enlarged to prepare the basis for charts dealing with indemnity losses only.

INFLUENCE OF EX-MEDICAL EXPERIENCE ON THE RATE MAKING PROCEDURE

The use of ex-medical experience for the determination of classification relativities, rate levels and loss constants does not cause any distortion of the results, because in each case medical losses are adjusted to bring ex-medical experience to a statutory basis.

RETROSPECTIVE RATING PLAN
ESTIMATE OF EX-MEDICAL INSURANCE CHARGE

Statutory Coverage Standard Premium	Average Ex-Medical Discount	Basic Ratio	Minimum Ratio	Maximum Ratio	Ex-Med. Adjustment of Basic Ratio (Form. (10)) $\frac{.175}{.975} \times (2) \times (4)$	Ex-Med. Basic Ratio (3) - (6)	Ex-Med. Minimum Ratio in Terms of (1) (4) x [1 - (2)]	Ex-Med. Maximum Ratio in Terms of (1) (5) x [1 - (2)]	Stat. Coverage Loss Conversion Factor	Ex-Medical Loss Conversion Factor Form. (14)	Loss Provision in Ex-Medical Minimum Premium [(8) - (7)] ÷ (11)	Loss Provision in Ex-Medical Maximum Premium [(9) - (7)] ÷ (11)	$e = \frac{\text{ex-med. p.p.}}{\text{tot. p.p.}}$ $= 1 - 1.28x(2)(a)$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
\$ 5,000	.15	.300	.750	1.750	.020	.280	.638	1.488	1.12	1.143	.313	1.057	.808
50,000	.15	.275	.550	1.350	.015	.260	.468	1.148	1.12	1.143	.182	.777	.808
150,000	.15	.225	.500	1.250	.013	.212	.425	1.063	1.12	1.143	.186	.745	.808
5,000	.20	.300	.750	1.750	.027	.273	.600	1.400	1.12	1.153	.284	.977	.744
50,000	.20	.275	.550	1.350	.020	.255	.440	1.080	1.12	1.153	.160	.716	.744
150,000	.20	.225	.500	1.250	.018	.207	.400	1.000	1.12	1.153	.167	.688	.744
5,000	.25	.300	.750	1.750	.034	.266	.563	1.313	1.12	1.164	.255	.899	.680
50,000	.25	.275	.550	1.350	.025	.250	.413	1.013	1.12	1.164	.140	.655	.680
150,000	.25	.225	.500	1.250	.022	.203	.375	.938	1.12	1.164	.148	.631	.680

g = 1.20x.625	p From Chart	e' = e - p 1 - p Form. (21)	e'g (17)x(15)	Assumption E		Assumption F		From Charts (b)			
				Assumption E		Form. (23b)		Assumption E		Assumption F	
				(12) ÷ (14)	(13) ÷ (14)	Form. (23a) (12) ÷ (17)	Form. (13) + .750[1 - (17)]	l. not in exc. of (19) total losses	l. in exc. of (20) total losses	l. not in exc. of (21) total losses	l. in exc. of (22) total losses
(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
.750	.346	.706	.530	.387	1.308	.443	1.277	.460	.160	.503	.168
.750	.136	.778	.534	.225	.962	.234	.943	.363	.063	.376	.066
.750	.078	.792	.594	.230	.922	.235	.901	.378	.020	.386	.023
.750	.346	.609	.457	.382	1.313	.468	1.270	.455	.158	.518	.170
.750	.136	.704	.528	.215	.962	.227	.938	.348	.062	.366	.067
.750	.078	.722	.542	.224	.925	.231	.896	.369	.020	.380	.024
.750	.346	.511	.383	.375	1.322	.499	1.266	.450	.156	.540	.171
.750	.136	.630	.473	.206	.953	.222	.932	.335	.062	.359	.069
.750	.078	.653	.490	.218	.929	.227	.891	.360	.019	.374	.025

Assumption E		Assumption F		Net Insurance Charge (b)			Gross Insurance Charge			Difference	
Ex-Med. l. not in exc. of (12) ÷ tot. stat. cov.l. (23)x(14) Form. (20)	Ex-Med. l. in exc. of (13) ÷ tot. stat. cov.l. (24)x(14) Form. (20)	Ex-Med. l. not in exc. of (12) ÷ tot. stat. cov.l. (25)x(17) Form. (24a)	Ex-Med. l. in exc. of (13) ÷ tot. stat. cov.l. (26) Form. (24b)	Assumption E .60[(27) + (28)] - (12) Formula (19)	Assumption F .60[(29) + (30)] - (12) Formula (19)	Stat. Cov. (c)	Assumption E (31)x(11)	Assumption F (32)x(11)	Stat. Coverage (33)x(10)	Assumption E (34) - (36)	Assumption F (35) - (36)
(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)
.372	.129	.355	.168	-.012	.001	-.021	-.014	.001	-.024	.010	.025
.293	.051	.293	.066	.024	.033	.028	.027	.038	.031	-.004	.007
.305	.016	.306	.023	.007	.011	.011	.008	.013	.012	-.004	.001
.339	.118	.315	.170	-.010	.007	-.021	-.012	.008	-.024	.012	.032
.259	.046	.258	.067	.023	.035	.028	.027	.040	.031	-.004	.009
.275	.015	.274	.024	.007	.012	.011	.008	.014	.012	-.004	.002
.306	.106	.276	.171	-.008	.013	-.021	-.009	.015	-.024	.015	.039
.245	.042	.228	.069	.022	.037	.028	.026	.043	.031	-.005	.012
.245	.013	.244	.025	.007	.013	.011	.008	.015	.012	-.004	.003

- (a) Ex-medical discount for Connecticut: $\frac{.95x.625 \text{ med.p.p.}}{.800 \text{ tot.p.p.}}$ (Form. (5b)). $e = 1 - .95 \frac{\text{med.p.p.}}{\text{tot.p.p.}} = 1 - .800 \frac{\text{med.p.p.}}{.625 \text{ ex-med. disc.}} = 1 - 1.28x(2)$
- (b) The procedure is that followed by the National Council in its analysis of the basic premium for numerous states. Since the charts used are based on a permissible loss ratio of .600, it would be more correct to key the indications of (19), (20), (21) and (22) to a permissible loss ratio of .600 and then to express the excess pure premium ratios obtained from the charts in terms of statutory coverage standard premium by multiplying with .625 instead of .60. The National Council procedure has been followed in order to avoid a recalculation of the statutory coverage insurance charge.
- (c) See Calculation of Distribution of Basic Retrospective Premium for Connecticut issued by the National Council on July 6, 1939 (pages 2 and 2a.).