

THE ACTUARIAL ASPECTS OF BLUE CROSS PLANS

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(I) FOREWORD

As most readers are aware, the growth of Blue Cross plans in the last fifteen years has been phenomenal.

Not only have such plans grown in terms of numbers of persons covered but also in terms of complexity of operation.

The actuarial problems of Blue Cross plans have also increased. There is a large variety of coverages available and premiums must be computed so that they are both adequate and competitive.

The purpose of this paper is to outline the actuarial aspects of a typical Blue Cross plan.

Contrary to the belief of some, there is no national Blue Cross organization for underwriting this form of protection.

There are 86 separate Blue Cross organizations in the United States, one in Puerto Rico and five in Canada. Each of these organizations has a fixed, defined geographical area of operation and each operates autonomously.

Some of the Blue Cross plans are incorporated as non-profit institutions, while others are incorporated as insurance companies. Some plans fall under the supervision of the State Insurance Departments in the states where they operate; while others do not. Where plans are supervised by insurance departments the degree of supervision varies because state laws are different.

The United States and Puerto Rico have been divided into 11 districts while Canada is one district. The plans in each district meet regularly to discuss problems in their areas of operation.

Each plan provides coverage to those living in their geographical area of operation. They may also cooperate with other plans in their district or with plans that are not in their districts in providing groups with Blue Cross protection.

For example, the St. Louis Blue Cross plan would cooperate with the Columbus, Ohio Blue Cross plan in underwriting a St. Louis, Missouri employer who has a plant or branch in Columbus, Ohio.

The actuary for a specific Blue Cross plan therefore is not only confronted with the problem of pricing programs covering only those in a given area but also programs that will be written on a district or multiple district basis.

This paper, however, will confine itself to the problems of rating local programs.

Blue Cross plans are rather unique in that they cover such a large percentage of the population nationally and locally as the following table reveals:

<i>Percentage of Population Covered by Plan</i>	<i>Number of States</i>
1% to 20%	19
20% to 30%	12
30% to 40%	6
40% to 50%	3
50% to 60%	3
60% and over	3

In other words, in 19 states Blue Cross plans cover from 1% to 20% of the population; in 12 states they cover 20% to 30% of the population; etc.

For the United States as a whole, Blue Cross plans cover 31.2% of the population and the plan which serves as a statistical basis for this paper covers 30% of the population in its operating area. As can be deduced from the above table, Blue Cross data form a very credible basis for rate-making. Indeed, how many insurance companies write as much as 30% of the potential market for a given form of coverage in a given area?

It is fortunate that Blue Cross plans have this high degree of credible experience because the gross premium formula is such that the net premiums must be extremely accurate.

Nationally, and for the plan which serves as a statistical basis for this paper, benefit payments amount to about 90% of Gross Income, Operating Expense is 6.0% to 6.5% of Gross Income and Underwriting Gain is 3.5% to 4.0% of Gross Income.

The net premium obviously must be determined with extreme care.

The following discussion of rate-making procedures applies to coverages written on a Group basis such as thru an employer or union. 75% of those covered by Blue Cross plans are covered thru Group Plans. Only 3% of those covered by Blue Cross plans are covered under Non-Group contracts which are made available to those individuals who are not members of a group which qualifies under enrollment requirements of Group coverage.

22% of those covered by Blue Cross plans are covered under Group Conversion Contracts which are made available to those who leave a Group plan and are individually issued contracts.

(II) BLUE CROSS BENEFITS

Blue Cross contracts may differ in detail from one Blue Cross plan to another but all of them in essence have the following features: The charge of the hospital for a semi-private room is provided up to a specified number of days per hospital confinement or per contract year. Charges made by the hospital for other services such as X-ray, operating room, drugs, etc. are covered.

Blue Cross reimburses the hospitals for the care of their members on the basis of a predetermined reimbursement formula. In other words, benefit payments are not made to the policyholder. Group Hos-

pital Expense Insurance contracts underwritten by insurance companies provide a certain maximum number of dollars per day (e.g. up to \$10) for Room and Board charges for a fixed number of days and a fixed number of dollars (e.g. \$250) for hospital charges other than for Room and Board.

Under Group Hospital Expense Insurance payments in cash to the limits of the contract are made to the certificate-holders. In recent years, however, there has been an increased use of assignment forms whereby the certificate-holder assigns his benefits to the hospital so that the insurance company may pay the hospital directly.

(III) THE RATE-MAKING PROCESS

(A) *Ascertaining Calendar Year Incurred Losses & Current Rate Level*

Since Blue Cross rates are quite sensitive to current economic conditions the latest calendar year's or fiscal year's experience is a good basis for rate-making.

Since the rates must be revised before the close of the calendar or fiscal year the first step is to estimate the annual loss ratio on the basis of a partial year's experience.

In estimating the annual income care must be exercised to take into account the effect of any rate changes made during or before the calendar or fiscal year. For all practical purposes earned income equals written income since most of the premiums are on a monthly payment basis.

Incurred losses for the year may be estimated from the paid losses for a part of the year by several methods. Two of these methods are set forth below.

(1) *Loss Development Method*

<i>Month of Calendar Year or Fiscal Year</i>	<i>Percent of Incurred Losses Represented by Payments to End of Month</i>
1st	2.3%
2nd	8.2%
3rd	17.0%
4th	25.0%
5th	32.8%
6th	41.9%
7th	49.8%
8th	59.6%
9th	67.0%
10th	74.3%
11th	83.8%
12th	91.9%

The above table is representative of the experience of one large Blue Cross plan, as is the following table under "Seasonal Trends":

(2) *Seasonal Trends*

By using the incurred losses for each calendar month and a table such as the following, an estimate of the annual incurred losses can be made:

<i>Month of Year</i>	<i>Incurred Losses for Month as a Percent of the Incurred Losses for the Year</i>
January	8.2%
February	8.5%
March	9.2%
April	8.6%
May	8.5%
June	8.1%
July	8.4%
August	7.8%
September	8.4%
October	8.2%
November	8.0%
December	8.1%

An evaluation of the estimated incurred losses for the year under study could be made at the end of the 6th, 7th, 8th and possibly 9th month under each of the above methods and the mean or median of indications could be taken as the final estimate of the annual incurred losses.

With the estimate of the Earned Income and Incurred Losses for the year the expected loss ratio can be determined.

This expected loss ratio for the year divided by the desired permissible loss ratio gives the adjustment needed to bring current income to current loss levels.

Thus far, the over-all change in loss level has been determined.

The next step is to determine the current rate level for each type of contract issued by the plan. Two rates must be determined for each contract—an Individual rate and a Family rate. The Individual rate applies to all unmarried employees and the Family rate applies to those who have their eligible dependents covered.

In the case of Group Hospital Expense Insurance, Employee rates apply to employees whether they be single or married and Dependent rates apply to dependents of employees.

The difference between these two rating systems will be analyzed in detail later in this paper.

The loss ratio for Individuals and for Families for each type of contract is then determined. Current rates are then multiplied by the ratio of the loss ratio to the permissible loss ratio (e.g., 90%).

By knowing the number of Individual and Family contracts under each type of contract the over-all adjustment to income is determined.

If this over-all adjustment is different from the over-all adjustment first determined above, each of the above rates are adjusted so that the first over-all adjustment is obtained.

(B) *Future Rate Level*

After having brought the Individual and Family rates to the level of current losses, the next step is to bring them to the level expected during the period of time the rates will be effective.

It may be expected that future loss levels could be estimated on the basis of the reimbursement formula between the hospital and Blue Cross plan since these formulae provide for a maximum amount of reimbursement per day for Blue Cross members. This is an unsatisfactory projection method since the average payment per patient-day tends to increase more rapidly than the increase in the maximum per diem reimbursement allowance.

Much experimentation was done to find a criterion for forecasting future loss levels.

It was found that economic indices such as the Consumer Price Index could not be used because hospital costs do not lag or change with the cost of living but usually run concurrent with changes in living costs.

It was found, after much research, that one of the best criteria for measuring losses is the Average Annual Cost per Participant (person covered) for the previous 12 months. This is determined each month by dividing the total losses paid in the previous period of 12 months by the average number of participants covered.

These monthly values are plotted on a graph such as shown in Exhibit I. In the graph on Exhibit I the ordinate is the average annual net cost per participant for the previous 12 months and the abscissa is the terminal date of the 12-month period.

In order to estimate future loss levels all that needs to be done is to extrapolate the curve graphically out to the terminal date during which rates are to be effective.

The rates determined in Section (A) above are then multiplied by the ratio of the value of the Average Net Annual Cost per Participant for the terminal date during which rates are to be effective to the value at the end of the experience period under study.

For example, let us assume that the rates in Section (A) above were developed from experience for the 12-month period prior to January 1, 1958 and that the new rates are to be effective until January 1, 1959.

The Average Net Annual Cost per Participant for the 12-month period prior to January 1, 1958 from the graph is \$21.50. By extrapolating the curve it appears this value will be \$23.50 for the 12-month period prior to January 1, 1959. The rates in Section (A) above would then be multiplied by the ratio of \$23.50 to \$21.50 or by 1.093.

As is the case of any rate-making process good judgment must supplement statistical data. For example, an increase in the number of hospital beds in the area served by the Blue Cross plan should be taken into account in fixing future rates.

(IV) SHOULD BLUE CROSS RATES VARY BY THE SIZE OF THE GROUP?

Most insurance companies writing Group Accident and Health Insurance grade their rates by the volume of premium expected to be generated by the group during the year. These discounts increase with premium volume and can be as much as 15%.

These discounts are based on the theory that the administrative cost of insuring a person decreases as the size of the group increases. This is true because the fixed cost represents a smaller percent of the premium volume as the premium volume increases. Furthermore, in the case of Group Accident and Health Insurance, the commission rate decreases with an increase in premium volume.

In the case of Blue Cross there are no commissions paid so that the sales expense can be considered to be proportional to premium volume on each group. The cost of handling claims also can be considered to be proportional to the number covered in the group and therefore to the premium volume.

There are certain administrative costs which are fixed and which do not vary with the number in the group.

Theoretically these fixed administrative costs could be expressed in terms of a fixed number of dollars regardless of the size of the group covered. While this would produce some graduation by size of group, it would not be as severe a graduation as can be justified for Group Hospital Expense Insurance.

Blue Cross rates usually are not graduated by size of group and in view of the above discussion this creates little, if any, inequity.

(V) AN ANALYSIS OF BLUE CROSS RATES

As pointed out above, an Individual and Family rate is developed for each type of contract underwritten by a given plan. These rates usually do not vary by the age, sex or marital status of the members of the group.

In order to study the effect of these factors a comprehensive study was made of the experience of a large Blue Cross plan.

63,960 contracts were studied. Data was collected on paid losses during the calendar year of 1956.

The net annual premiums were found for each age bracket, sex and marital status and were divided by the appropriate net annual premiums for Individual and Family contracts.

The following table was obtained:

Ratios to Net Premium for all ages and both sexes

<i>Age of Subscriber</i>	<i>Individual Contracts</i>			<i>Family Contracts</i>	
	<i>Male</i>	<i>Female</i>	<i>Female/Male</i>	<i>Male</i>	<i>Female</i>
up to 25	0.55	0.55	1.00	1.05 (0.60)	0.60 (0.45)
26 to 35	0.55	0.55	1.00	1.00 (0.70)	0.90 (0.85)
36 to 45	0.65	0.80	1.23	0.95 (0.95)	1.00 (1.05)
46 to 55	0.90	0.85	0.94	0.95 (0.95)	1.00 (1.05)
56 to 65	1.35	1.00	0.74	1.05 (1.20)	1.40 (1.65)
66 and over	1.65	1.65	1.00	1.40 (1.65)	1.40 (1.65)

An illustration of the calculation of the ratios for males under individual agreements is set forth in the Appendix at the end of this paper. All other factors and ratios cited in this paper were obtained from data of a similar nature.

Under the Family contracts, in this study, maternity benefits are provided on the same basis as non-maternity benefits.

The ratios under Family contracts shown above in parentheses are for a plan without maternity and the ratios are to the rates for a plan without maternity benefits. The other ratios for Family contracts are for a plan which includes maternity benefits and the ratios are to rates with maternity benefits.

The following are some other facts that the study revealed:

- (1) For all ages combined the net cost for the single male is about equal to that for the single female.
- (2) The cost of married male employees is 55% of the cost of single male employees.
- (3) The cost of married female employees, excluding maternity benefits, is 90% of the cost of single female employees.

In the case of coverage for single employees, there is a distinct graduation in cost by age. The cost of those over age 65 is about three (3) times the cost for those under age 35.

The cost pattern for single persons between the sexes by age is also interesting. Up to age 36 the cost for both sexes is about the same. Between ages 36 and 46 the female cost is greater than the male cost; between ages 46 and 65 the male cost is greater than the female cost, and over age 65 the cost for both sexes is about the same.

As pointed out above, the cost for a married male employee is about 55% of the cost for a single male employee. It could be that a single male is more inclined to go to the hospital since he usually cannot rely on home care when he is ill or injured, as can a married male. By contrast, it is interesting to note that the cost for a single female employee is about the same as the cost of married female employees excluding maternity benefits.

The cost pattern by age for Family coverage is of interest. In the table set forth above the column entitled Male means that the husband is the employee and the wife, if any, is covered as a dependent whereas the column entitled Female means that the wife is covered as an employee and the husband, if any, is covered as a dependent.

Where the husband is the employee, and where pregnancy is covered the same as a non-maternity hospital confinement, it is interesting to note that the cost of Family coverage is practically constant up to age 65.

Where the wife is the employee under a Family contract it will be noted that the cost under age 25 is quite low. This is due to the fact that the cost of maternity coverage under age 25 for the employed wife is only about one-third the cost where the wife is covered as a dependent under her husband's contract.

The Family cost where the female is the employee is relatively constant between ages 26 and 55.

Where maternity coverage is not provided there is the same marked graduation of cost by age for Family coverage as there is for Single Person coverage.

The ratio of the cost for those over 65 to the cost for those under 25 is about the same 3 to 1 ratio that exists for Single Person coverage.

The relative importance of these costs on the total cost of a group can be seen from the following table based on the 63,960 contracts studied.

<i>Coverage</i>	<i>Percent of all Contracts</i>
Single Males	11%
Single Females	25%
Male Employee with Family coverage	54%
Female Employee with Family coverage	10%

Family contracts issued to male employees constitute about 85% of all Family contracts. Since the cost for Family coverage issued to a male employee is fairly constant up to age 65, it is reasonable and equitable that the rate for Family coverage is the same for all ages up to age 65 where maternity confinements are payable on the same basis as non-maternity confinements.

Single Person contracts constitute 36% of the total number of contracts.

Although charging the same rate for all age groups for Family contracts is fairly equitable, the above analysis justifies grading rates for Single Person coverage by attained age.

(VI) BLUE CROSS RATING SYSTEM VERSUS GROUP HOSPITAL EXPENSE INSURANCE RATING SYSTEM

As pointed out before, Blue Cross plans have one rate for single employees and another rate for employees with dependents.

Insurance companies under Group Hospital Expense policies provide Employee coverage and Dependent coverage. Therefore, they have a rate for Employee coverage and a rate for Dependent coverage.

The rate for coverage for a family equals the rate for Employee coverage plus the rate for Dependent coverage in the case of Group Hospital Expense Insurance.

There are actually two Employee rates, a female employee rate and a male employee rate. The rate for a female employee, without maternity benefits, is usually 150% of the male employee rate.

From the data developed from the study of the 63,960 contracts mentioned above in Section (V) it was possible to determine a male employee rate, a female employee rate and a dependent rate.

The following results were obtained:

- (1) The Male Employee rate is 65% of the Single Employee rate and 35% of the Family rate with maternity coverage.
- (2) The Female Employee rate is 95% of the Single Employee rate and 50% of the Family rate with maternity coverage.
- (3) The Dependent rate, where the male is the employee, is 70% of the Family rate.
- (4) The Dependent rate, where the female is the employee, is 50% of the Family rate.

The Single Employee and Family rates referred to above are according to the definition used by Blue Cross plans.

The above reveals several interesting facts.

The ratio of the female employee rate (without maternity) to the male employee rate is 95/65 or 1.46, which confirms the validity of the use by the insurance companies of a factor of 1.50, as pointed out above.

The percent of females in a group has a significant effect on the cost of Employee coverage, but a negligible effect on Single Employee coverage.

The following table shows the comparative cost of Single Employee coverage as provided by Blue Cross and the Employee cost as provided by insurance companies under Group Hospital Expense policies assuming the cost of Single employee coverage to be \$100:

Age	<i>Relative Cost of</i>			
	<i>Single Male</i>	<i>Single Female</i>	<i>Male Employee</i>	<i>Female Employee</i>
Up to 25	\$ 55	\$ 55	\$ 65	\$ 95
26 to 35	55	55	65	95
36 to 45	65	80	65	95
46 to 55	90	85	65	95
56 to 65	135	100	65	95
66 and over	165	165	65	95

The above table shows at what ages the Employee rate used by insurance companies is more or less than the Single Person rates used by Blue Cross if they were graded by age.

The following is a similar table showing a comparison in cost of Family coverage as provided by Blue Cross and the Employee plus Dependent coverage as provided by insurance companies under Group Hospital Expense policies assuming the cost of Family coverage to be \$100:

Age	<i>Relative Cost of</i>			
	<i>Male— Family Coverage</i>	<i>Female— Family Coverage</i>	<i>Male Employee With Dependents</i>	<i>Female Employee With Dependents</i>
Up to 25	\$105	\$ 60	\$105	\$100
26 to 35	100	90	105	100
36 to 45	95	95	105	100
46 to 55	95	95	105	100
56 to 65	105	140	105	100
66 and over	140	140	105	100

Note: Male—Family Coverage means the husband is the insured employee whereas Female—Family Coverage means the wife is the insured employee.

In summary, it can be said that the rate for all employees, married and single, is less than the rate for single employees only, but that the Employee plus Dependents rate is greater than the Family rate.

APPENDIX

(1) Computation of Ratios for Males under Individual agreements.

(a) Male Employees without dependents— Blue Cross Benefits excluding Ancillaries.*

<i>Age Group</i>	<i>Blue Cross Benefits Paid</i>	<i>Number of Agreements</i>	<i>Net Annual Premium (N.A.P.) per agreement</i>
up to 25	\$ 8,677.80	517	\$16.78
26-35	14,994.55	1,236	12.13
36-45	18,493.89	1,047	17.66
46-55	32,581.08	1,285	25.35
56-65	43,930.31	1,185	37.08
66 and over	80,306.22	1,548	51.88
Total	\$198,983.85	6,818	\$29.18

* The term Ancillaries as used above, includes professional services rendered by physicians in a hospital such as X-ray, pathology, anesthesia, etc.

(b) Male Employees without dependents—
Blue Cross Ancillary Benefits.*

<i>Age Group</i>	<i>Blue Cross Benefits Paid</i>	<i>Number of Agreements</i>	<i>Net Annual Premium (N.A.P.) per agreement</i>
up to 25	\$ 1,212.60	329	\$3.69
26-35	1,744.00	690	2.53
36-45	1,656.50	549	3.02
46-55	2,972.50	719	4.13
56-65	3,558.00	616	5.78
66 and over	3,149.00	565	5.57
Total	\$14,292.60	3,468	\$4.12

Special Note: Due to the relatively small exposure for the age group Up to 25 and because other studies have shown a rather constant ratio up to age 35, it was decided to combine the Up to age 25 and the 26-35 age groups into one group Up to age 35, as follows:

(i) from (a) above

Benefits paid Up to 35	=	\$23,672.35
Number of agreements	=	1,753
Net Annual Premium per agreement	=	\$13.50

(ii) from (b) above

Benefits paid Up to 35	=	\$2,956.00
Number of agreements	=	1,019
Net Annual Premium per agreement	=	\$2.90

(c) Combination of (a) and (b) above

<i>Age Group</i>	<i>Net Annual Premium per agreement</i>	<i>Net Annual Premium (N.A.P.) ÷ \$31.87**</i>
up to 35	\$16.40	0.52 (rounded to 0.55)
36-45	20.68	0.65
46-55	29.48	0.92 (rounded to 0.90)
56-65	42.86	1.34 (rounded to 1.35)
66 and over	57.45	1.80 (combined with female exposure)
Total	\$33.30	

* The term Ancillaries as used above, includes professional services rendered by physicians in a hospital such as X-ray, pathology, anesthesia, etc.

** \$31.87 equals the combined N.A.P. for single males and females for Blue Cross benefits (\$27.76) and for Ancillaries (\$4.11).

Note: Due to the relatively small exposure for those over 65 and because other studies have tended to show that there is little if any difference between male and female costs over age 65 the costs for males and females over 65 were combined.

EXHIBIT I

