

DETERMINING ULTIMATE CLAIM LIABILITIES FOR HEALTH INSURANCE COVERAGES

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I. INTRODUCTION

The purpose of this paper is to add another chapter to the fund of knowledge being accumulated on loss reserving techniques. Except for Paul Otteson's paper on Group Accident and Health Hospital Therapeutic Benefits (*PCAS XLI*, 1954), nothing has been published in the *Proceedings* in recent years on the methods employed to develop ultimate health insurance loss costs.

The *Proceedings* of the Society have analyzed and presented various methods of establishing ultimate loss costs for various lines of insurance. Generally, the same techniques are used in developing ultimate loss costs for health insurance benefits. The items of most interest are probably the settlement patterns of the various health coverages and any seasonal or cyclical patterns which they display.

II. RESERVES FOR VARIOUS LINES OF BUSINESS

The lines of business for which loss reserves are developed within the author's scope of operation are:

1. Hospital Benefits
2. Physician Benefits
3. Extended Benefits (Superimposed Major Medical)
4. Dental Benefits

Hospital benefits refer to those benefits provided by a general hospital on an inpatient and outpatient basis.

Physician benefits are those medical and surgical benefits rendered by a physician in a general hospital (inpatient or outpatient), physician's office, or patient's home, excluding such items as routine physicals, immunization, etc.

Extended benefits deal with such items as admissions to a mental institution, physician home and office visits, private duty nursing, drugs, prosthetic devices, etc. In addition, complementary programs to Medicare are considered as an extended benefit.

Dental benefits refer to those procedures performed by a dentist, primarily in an office setting, for the dental needs of the insured such as cleanings, fillings, extractions, prosthodontics, etc.

Beside the fact that these are considered as separate lines of business, they are reserved separately as each displays a different development pattern. If these lines were not segregated, a significant change in one of the elements could affect the overall results. This same problem can arise within a line of insurance if there is a significant variation in the development of ultimate values due to different reporting and settlement patterns for certain types of claims. This is the case for hospital claims, where the reporting and processing of inpatient claims differs dramatically from outpatient claims.

One might question the separation of physician and dental benefits for reserving purposes. Dental is a new and expanding line of insurance. Dental claims have shown a faster development pattern than medical/surgical claims, probably reflecting the more efficient billing systems employed by dentists which make it possible to report and collect low dollar but high volume claims from their patients on a timely basis.

Within the Extended Benefit category, Medicare complementary programs for age 65 and over and complementary programs for under age 65 are reserved separately as each develops a different reporting and settlement pattern.

To illustrate the different time span required for full development, we have taken an incurred calendar quarter (first quarter of 1975) and aged or tracked it for eight quarters (24 months), calculating each stage of paid development based upon the ultimate incurred liability. Claim payments are assigned to the month and year in which the claim occurred. The results are shown in tabular as well as graphical form.

No. of Quarters Developed	Hospital				Extended Benefits	
	Inpatient	Outpatient	Physician	Dental	Under 65	65 and Over
0	49.36%	39.60%	19.79%	43.25%	1.86%	32.02%
1	94.39%	82.54%	84.44%	88.73%	26.38%	80.25%
2	98.35%	91.64%	94.67%	95.93%	43.41%	90.16%
3	99.11%	94.64%	97.22%	98.17%	51.26%	93.90%
4	99.85%	96.55%	98.68%	99.48%	68.81%	96.43%
5	100.03%	98.15%	99.41%	99.61%	77.05%	98.07%
6	99.98%	98.89%	99.68%	99.87%	80.96%	98.77%
7	99.95%	99.33%	99.78%	100.00%	83.64%	99.32%
8	99.96%	99.67%	99.91%	100.00%	86.50%	99.61%

The table and especially the graphs (see Exhibits 1 and 2) depict quite vividly the variance in development patterns for each of the lines of insurance.

It should be noted that the data used is taken from the actual records of the corporation for which the author provides actuarial services.

Under "Hospital Inpatient" you will note that the factor at the fifth quarter of development is in excess of 100% and then drops for subsequent quarters to below 100%. The aberration is a result of coordination of benefits, subrogation, and Workers' Compensation recoveries which were recorded after the fifth quarter.

The different patterns displayed most likely reflect the benefit structure and the attitudinal differences of the providers (who bill the corporations directly) and the insureds. The reporting patterns generally reflect the cash flow needs of the providers and the insureds which are at times influenced by the general economy.

It should be noted that individual case reserves are not used in developing total estimated incurred claims liabilities. Ultimate loss costs are determined by formula. At one time case reserves were established but, due to the volume of claims and the attendant maintenance of the values and files, the company chose to discontinue the method.

III. METHODS USED TO ESTABLISH ULTIMATE INCURRED VALUES

Before describing briefly the methods used in establishing ultimate loss cost values, some comments as to the overall approach in setting reserves are appropriate.

In establishing loss reserves the results produced can be segmented into two categories. The categories are defined by the age of the claim and are determined by the historic pattern of development displayed for each line being evaluated. The two breaks are:

1. claims for which subsequent development is predictable, and
2. claims in the early stages of development which are subject to distortions of reporting and processing.

The primary method used to develop ultimate values is the use of completion or projection factors developed from triangulation or completion tables.

If the amount for incurred period A_{y-1} is assumed to be fully developed at

time period m , then the projection or completion factor for time period $y - 1$ would be

$$\sum_0^{m-1} A_{y-1} \left(\frac{\sum_0^m A_y}{\sum_0^{m-1} A_y} \right).$$

The factor for time period $y - 2$ would be

$$\sum_0^{m-2} A_{y-2} \left[\frac{\sum_0^{m-1} A_{y-1} \left(\frac{\sum_0^m A_y}{\sum_0^{m-1} A_y} \right)}{\sum_0^{m-2} A_{y-1}} \right].$$

This calculation is carried on until the value for y_0 is determined. The completion factor for y_0 can apply to a single month, a quarter, a year, or a series of months where each month in the grouping is at the equivalent stage of reporting and development.

The broader the base used in developing these completion factors, the more stable are the results for months with reasonable degrees of development. The use of broader time bases obviously requires the use of older data. As a result, these factors are less responsive to current changes in reporting and payment patterns when applied to more recent reporting periods. In situations where it is known that reporting or processing has shown a new and stable trend, more reliance can be placed upon the factor developed using more recent time frames. For incurred periods with low and slow development, such as the initial incurred period, results based upon completion factors are erratic and generally unreliable. For these periods an alternate technique is used which we call the ratio method.

The ratio method, as the name implies, develops historic ratios or indices of various incurred periods to a base period for which the ultimate values are considered to be most accurate. These indices are then applied to more recent time periods to develop estimates of current ultimates. For example, if the ultimate incurred amount to be estimated is the 3rd quarter of 1975, which we will denote as 3Q75, and we have data going back to the fourth quarter of 1971 (4Q71), the following ratios of incurred amounts would be calculated:

3Q72/4Q71	3Q73/4Q72	3Q74/4Q73
3Q72/1Q72	3Q73/1Q73	3Q74/1Q74
3Q72/2Q72	3Q73/2Q73	3Q74/2Q74

By applying the factors in the first row to 4Q74, the second row to 1Q75, and the third row to 2Q75, a set of values representing the estimated amounts for the 3rd quarter of 1975 are produced.

If exposure, utilization, and cost trends have some consistency during the historic and current periods, there will be a clustering of values. It is obvious that if any of these elements departs dramatically from or shows no consistency with prior patterns, then this method is rendered misleading. In many cases it is possible to adjust the value for changes in exposure, utilization, and cost trends and to produce a meaningful result.

Variations of the completion method and, where appropriate, the ratio method are used to produce first estimates of the total incurred liability. In some situations, especially for new benefit offerings, a loss ratio method is used. Here the earned premium is multiplied by the expected loss ratio to produce the estimated incurred amount. Inherent in the process is the reevaluation of previously estimated incurred values. The analysis is extended back into time to a period where no additional development is expected.

IV. CALCULATION OF RESERVES

Estimated ultimate claim amounts are calculated using for the most part some or all of the previously described methods. In the first pass at the estimations there is no adjustment to the values. The initial results are then tempered or adjusted to reflect conditions which render the results useless or suspect for certain periods of time. Such conditions include the imposition of cost controls, the removal of cost controls, dramatic changes in exposure, or extraordinary inflationary factors as they apply to medical care. At this point there is the blending of the art and science of reserving.

In the development of total ultimate loss cost for each line of insurance, those methods which historically have produced the most consistent results are used.

At this stage of the review we attempt to refine the calculations, or our selection of a value, based upon internal and external forces which may have had an influence upon the calculation.

Internal forces affecting the values would be claim receipts, claim inventories, and processing cycles. External forces from providers would be such items as reporting cycles and increases in hospital and physician costs. Other external conditions such as government controls, weather, and postal strikes have an impact upon the insured, insurer, and provider. An evaluation of internal processing cycles is made to determine if the values calculated via the projection route will tend to overstate or understate. Reporting cycles are analyzed in a similar fashion. In most cases it is impossible to quantify the results, but the

movement will generally indicate which of the results is likely to be the most accurate. In recent years coordination of benefits and subrogation activities have been intensified. Until the rate of recovery becomes somewhat constant, manual adjustment to estimated ultimate values are made.

External provider activities relative to cost are monitored by evaluating reports of past and current items such as hospital charges, physician charges, dental charges, the various elements of the medical component of the CPI (local and national), and hospital costs issued by the American Hospital Association (AHA).

In conjunction with the development of loss reserves, analyses are performed to determine the adequacy of current rates and to evaluate utilization and cost trends. These trend factors are applied to project ultimate loss costs for past periods to current periods. A comparison of these results to those produced via the routine techniques is made to determine the reasonableness of the results in conjunction with patterns of prior periods.

Where appropriate, pure premiums are calculated by dividing ultimate amounts by exposure for periods for which the values are considered to be stable, and these are projected to current periods of time. By multiplying the projected pure premiums by the exposure, an ultimate claim cost is produced.

V. APPLICATIONS

For Hospital and Physician Benefits ultimate values are calculated by multiplying estimated claim counts times estimated claim costs and by projecting claims paid by incurred period to their estimated ultimate values. As previously mentioned, claim counts and amounts are estimated using two projection techniques.

The first technique uses factors developed by use of twelve month moving data with each accident month within the twelve months being at the same stage of payment. The time span used encompasses 44 months from the oldest to the current accident month. This technique has the advantage of averaging out aberrations which might occur on a monthly or quarterly basis and provides a high degree of stabilization in the factors developed. It is, however, less responsive to current changes in reporting and processing cycles.

The second approach uses unweighted calendar-accident periods to develop projection factors. This technique has the advantage of reflecting recent changes in reporting, processing, or seasonal patterns. This approach is, however, subject

to aberrations due to any non-repetitive occurrence which happened in any of the prior accident periods used to calculate the applicable projection factors. Under this method the estimated number of claims, average claim cost, and total ultimate claim cost are developed for each accident quarter. The average claim cost is used in the moving average calculations described in the previous paragraph.

In addition to calculating claim counts, amounts, etc., pure premiums by incurred period are developed by using the same technique. The estimated ultimate claim amount is calculated by extending the estimated ultimate pure premium by the earned exposure for the accident period.

The ratio method, as described in Section III, is used to develop estimated ultimate amounts as well as estimated ultimate pure premium by incurred period. The pure premiums are extended by the earned exposure for the corresponding incurred period to produce ultimate amounts.

In developing the ultimate loss costs, values are generally calculated using claim counts and claim costs as well as total dollars.

If we examine the graphs portraying the development pattern of each of the lines of insurance and their subdivisions, some insight will be gained as to the timing of the use of the two general techniques.

Except for Extended Benefits for under age 65, all the elements show that after six months of development 90% or more of the ultimate loss cost incurred has been paid. The use of projection or completion factors at this stage of development and beyond proves to produce very accurate and stable results.

At the zero stage of development the percent incurred, reported, and paid for all breaks is less than 50%. The results at this point tend to be quite erratic. For this reason the ratio method is almost universally employed along with judgment.

Between the third and sixth months of development, the ratio and both projection methods are used. Based upon claim notices received, claim dollars paid and claim inventories, a judgment is made as to the validity of the values produced by each of the projection methods. For Extended Benefits under age 65, the ratio and projection methods are employed for 18 months, at which time the projection factor takes over. However, substantial judgment enters into the choice of values depending upon the three elements enumerated earlier in the paragraph.

VI. GENERAL COMMENTS

To aid in the determination of current loss reserve values a series of exhibits containing pertinent data are prepared. The material falls into five general categories:

1. service and claim counts,
2. average claim and service costs,
3. claim receipts and inventories,
4. cycle time for claims submission and processing, and
5. changes in exposure.

These data are depicted in graphical form in Exhibits 3 through 15B.

In analyzing ultimate amounts from current periods, these items of information provide insight as to possible aberrations in the formula results as well as logical relationships from one period of time to the next. For example, a decrease in exposure and claim receipts would indicate that one should expect a decrease in incurred claims. If the cycle time from incurred date to paid date has been shortened, then generally the formula approach will overstate the reserves. The analysis of the runoff of claims paid using claims incurred and paid-to-date for a current period and the runoff for the comparable period a year before provides a benchmark as to the minimum value one might normally expect. By adjusting the prior year's runoff for inflation and exposure and any payment aberrations, a ballpark estimate of the ultimate loss cost can be obtained.

These graphs may be of significant interest to those unfamiliar with health coverages. The patterns indicate that for the most part the elements involved in determining ultimate loss costs develop relatively fast for health coverages with the exception of major medical for under age 65. The development patterns are probably more analogous to property damage lines than to liability coverages with a "long tail."

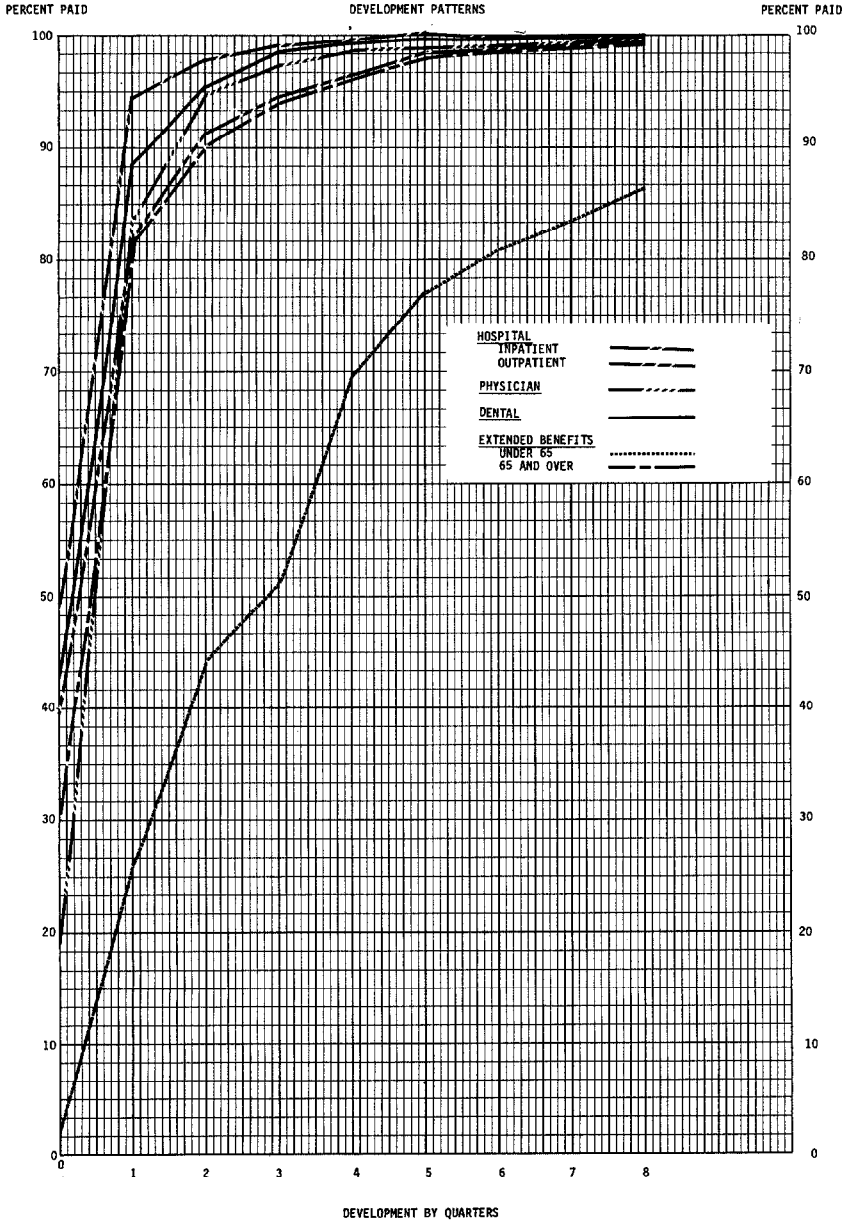
A definite seasonal pattern is shown for all lines. Costs are very sensitive to external economic forces as well as frequency or utilization. The latter is not as discernible as cost but it does display some cyclical tendencies based upon unemployment cycles.

VII. SUMMARY

The presentations portray the various methods currently being employed to determine loss reserves. With the availability of time-sharing computers, modeling techniques can be applied to develop estimated ultimate values from which loss reserves can be produced. The advantages to a computer based model are obvious as it allows one to measure the impact of the change in variables upon the final results within a short span of time.

As was stated in the introduction, this presentation was not intended to be all-inclusive. Alternate techniques are constantly being applied and evaluated as to consistency and accuracy. Data bases are being constructed to allow for automation of the reserve calculation and, in time, to allow for modeling. The approaches presented may appear to be rudimentary and unsophisticated, but over time the results produced have been satisfactory.

EXHIBIT 1



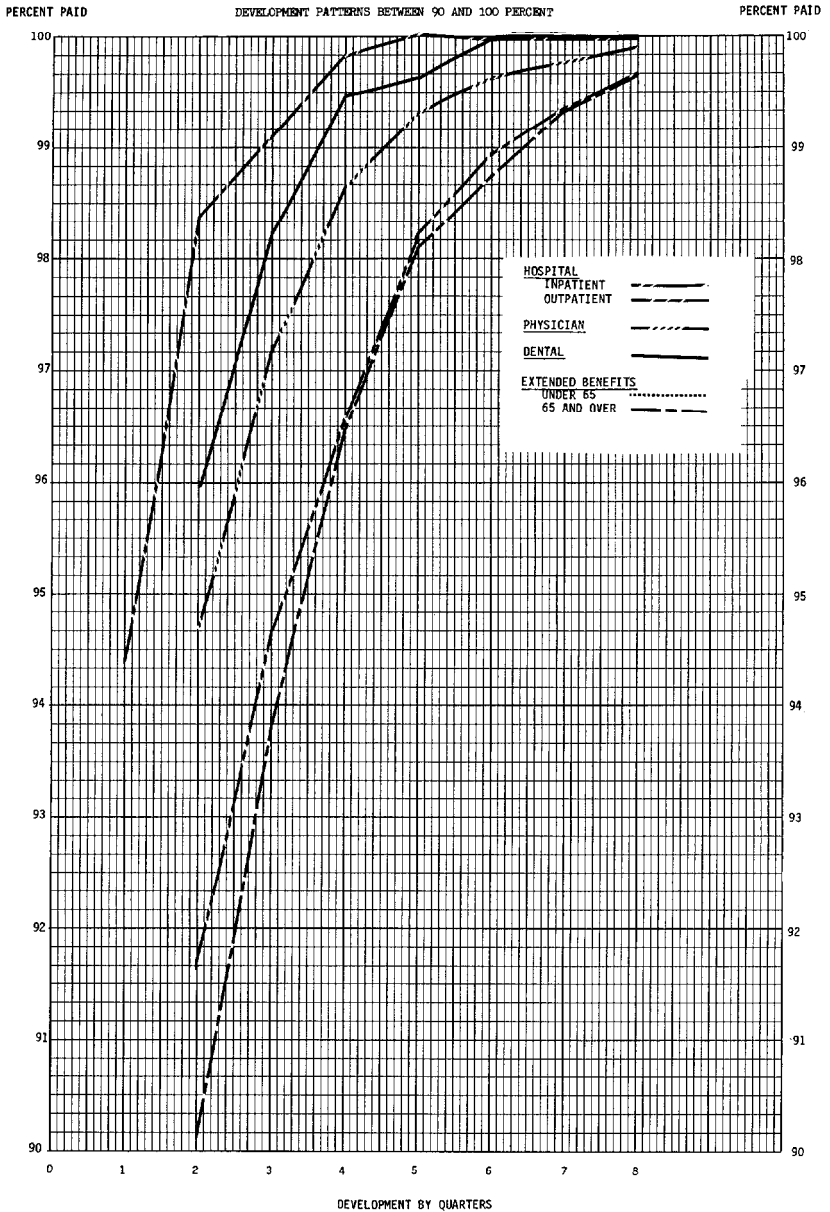
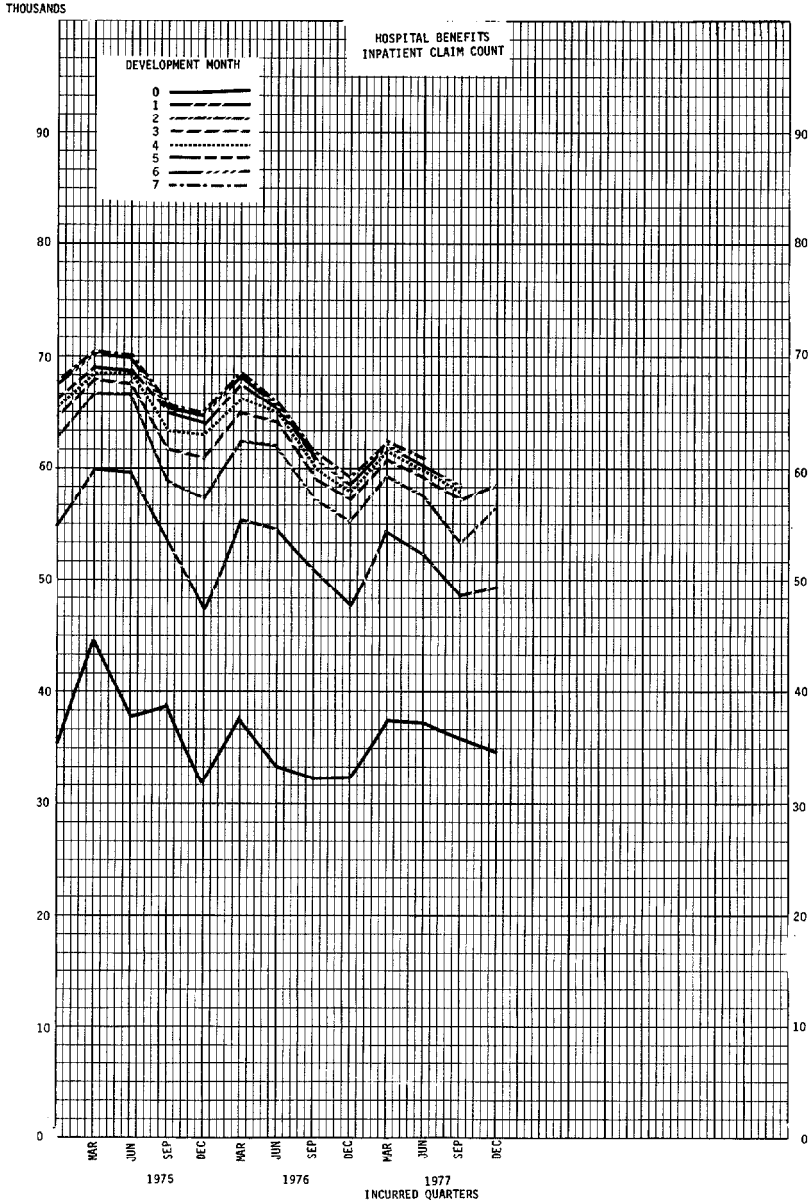


EXHIBIT 3



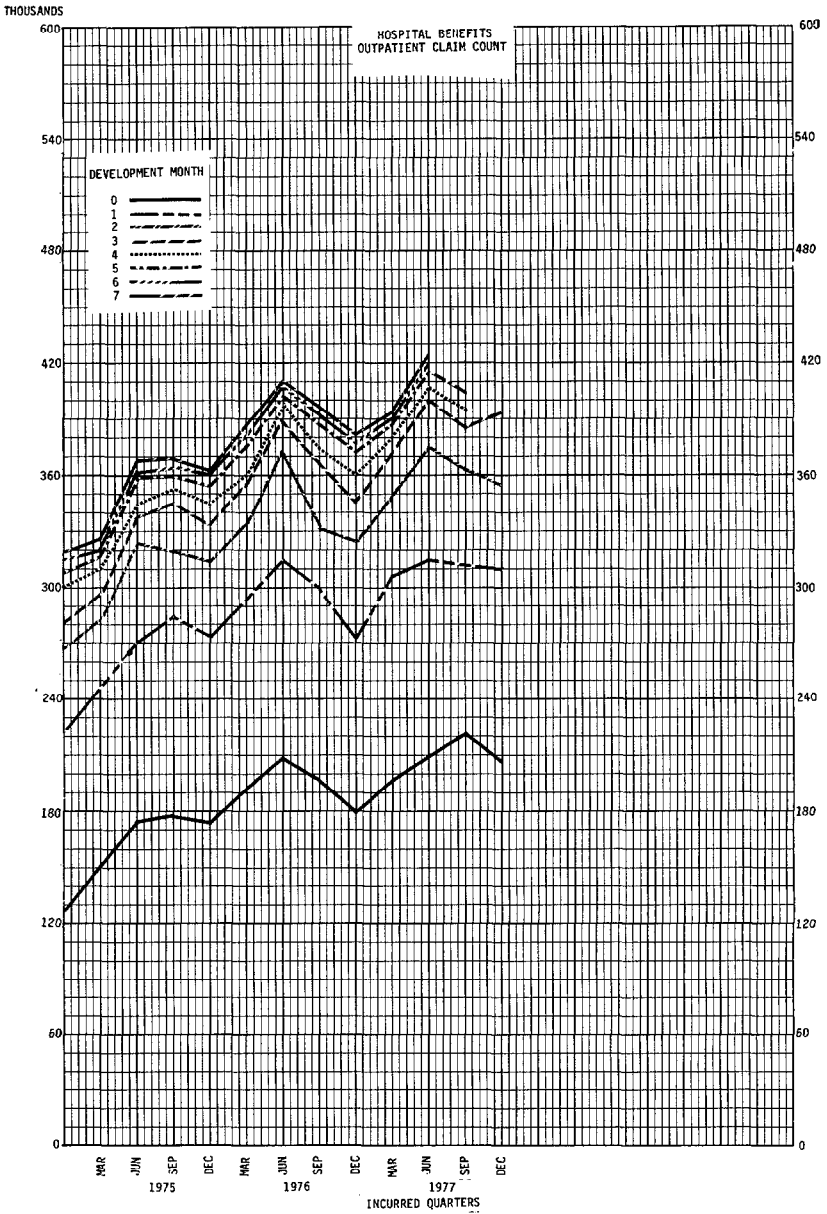
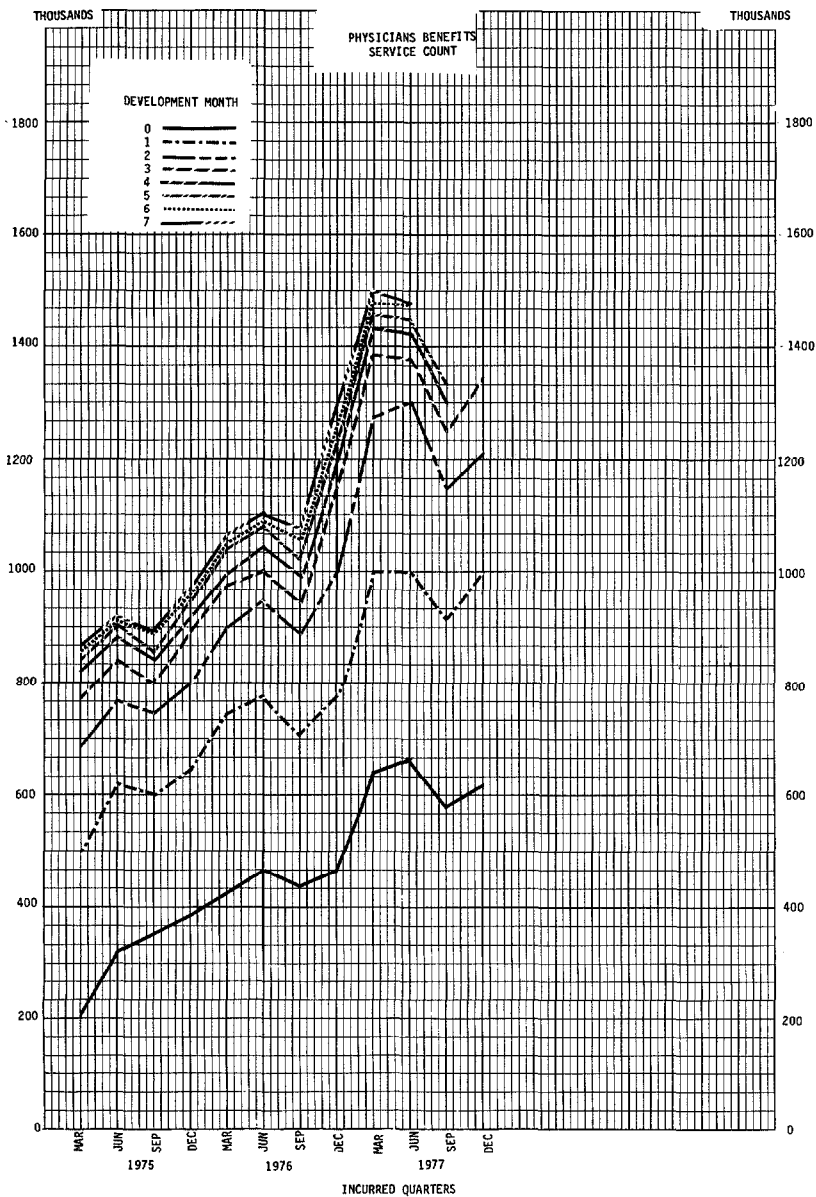


EXHIBIT 5



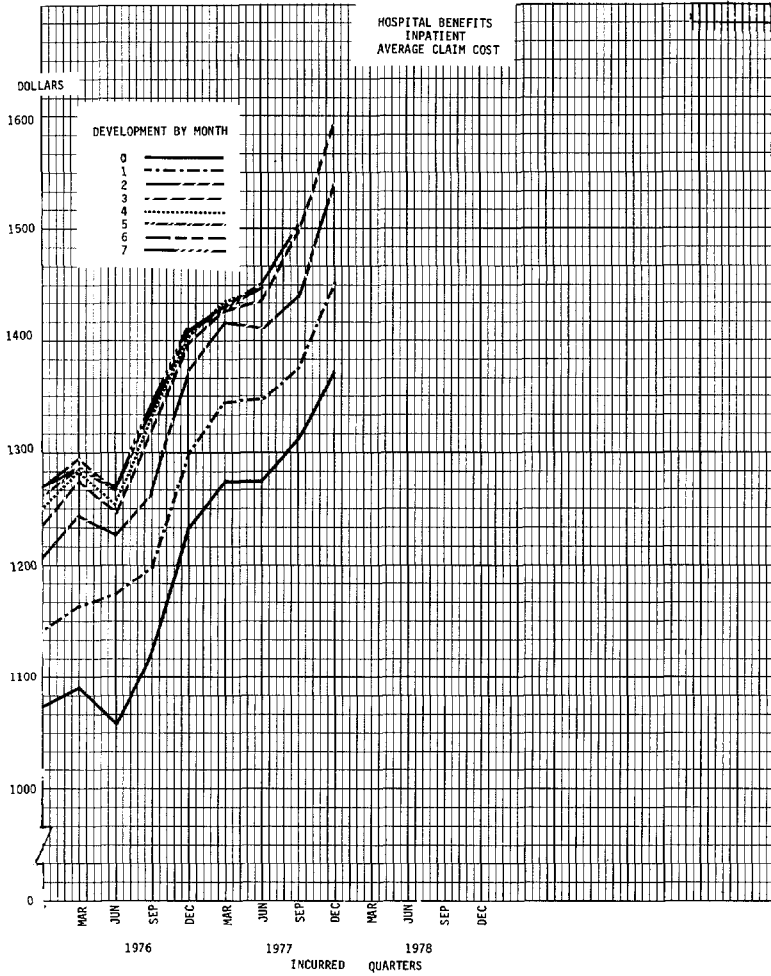
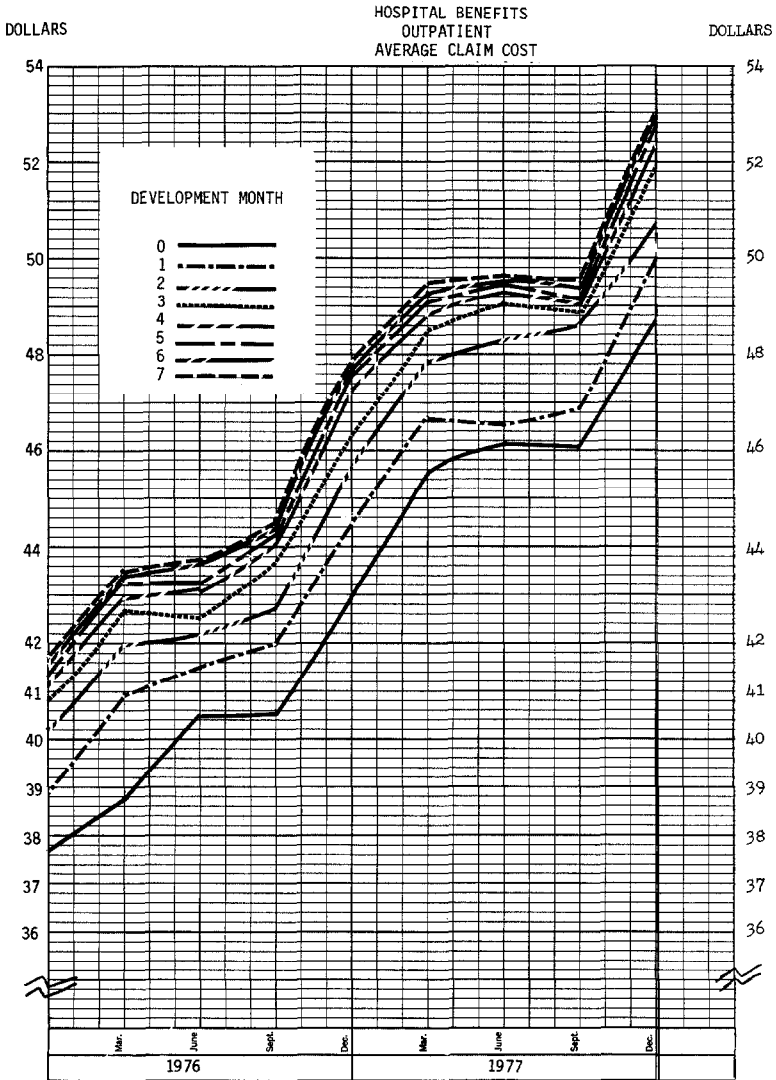
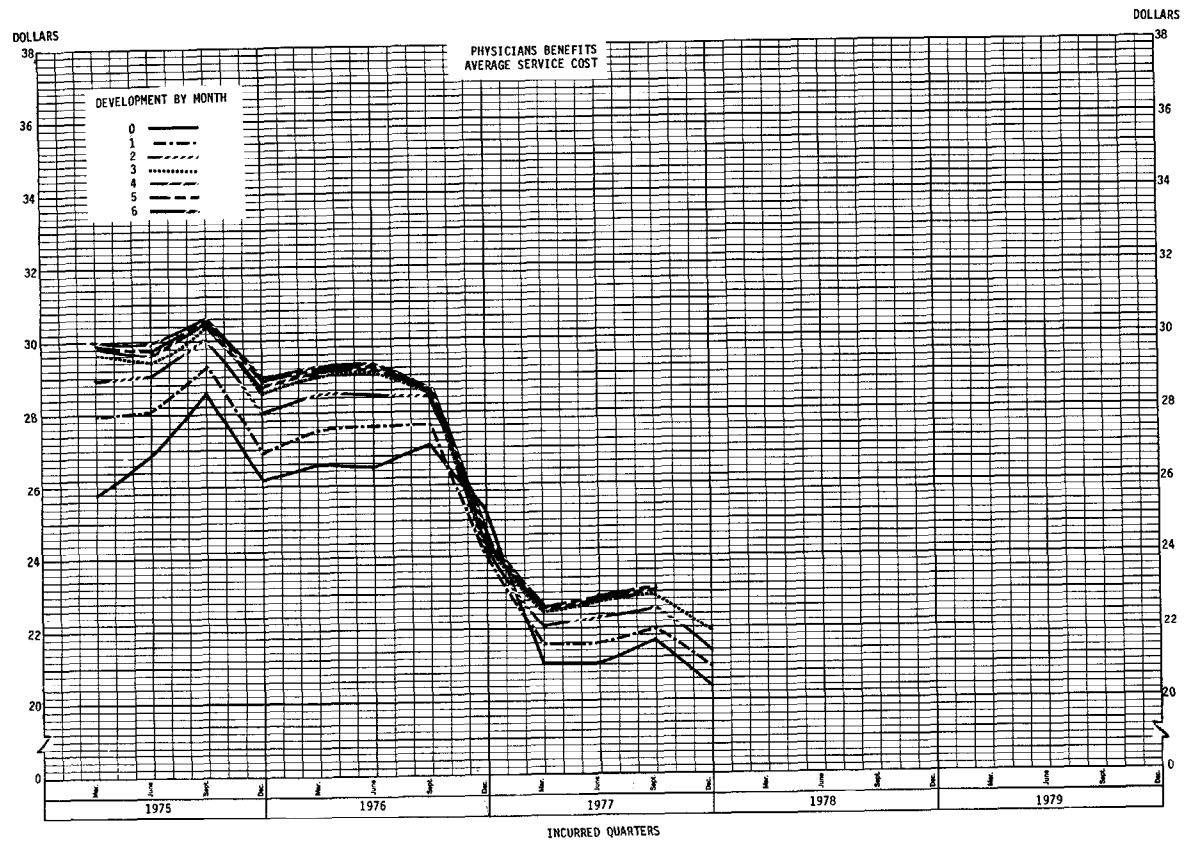
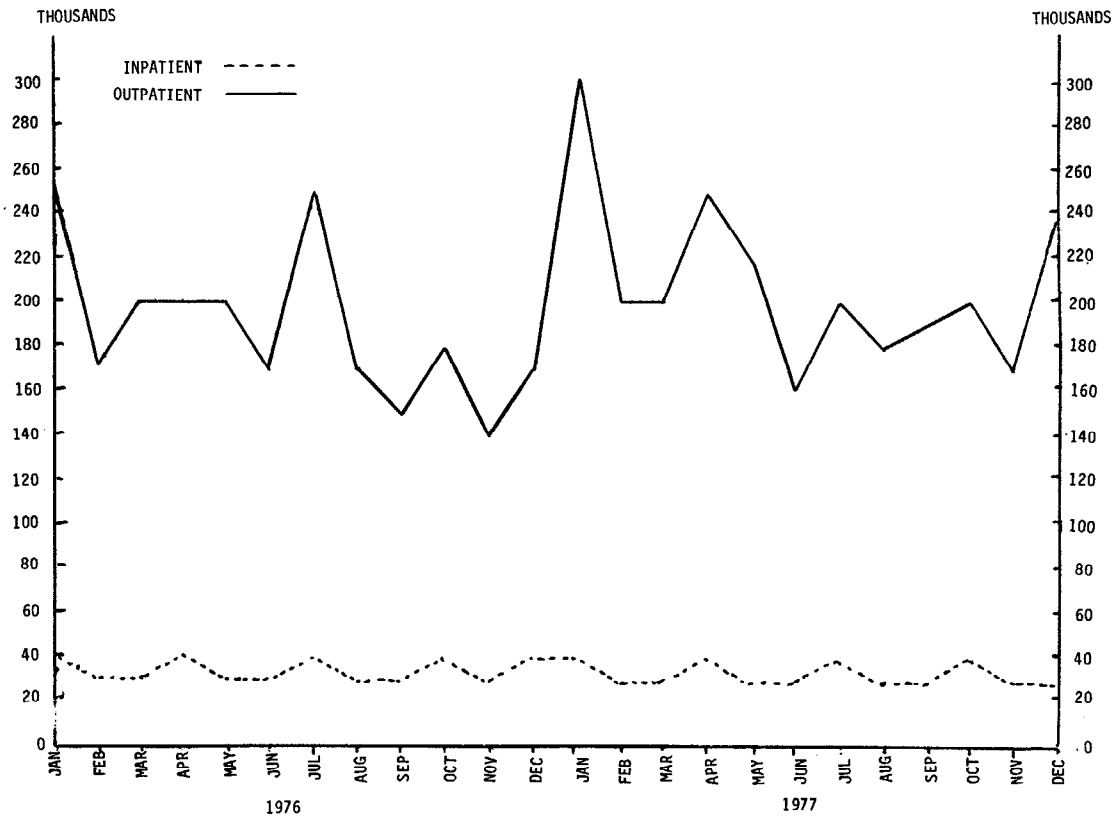


EXHIBIT 7

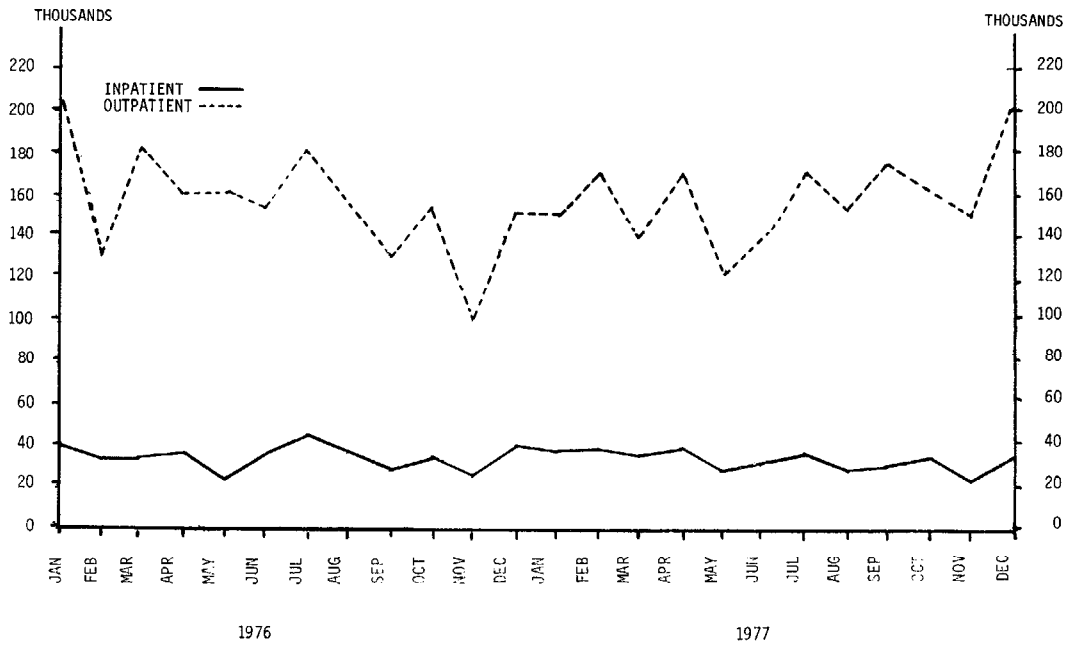




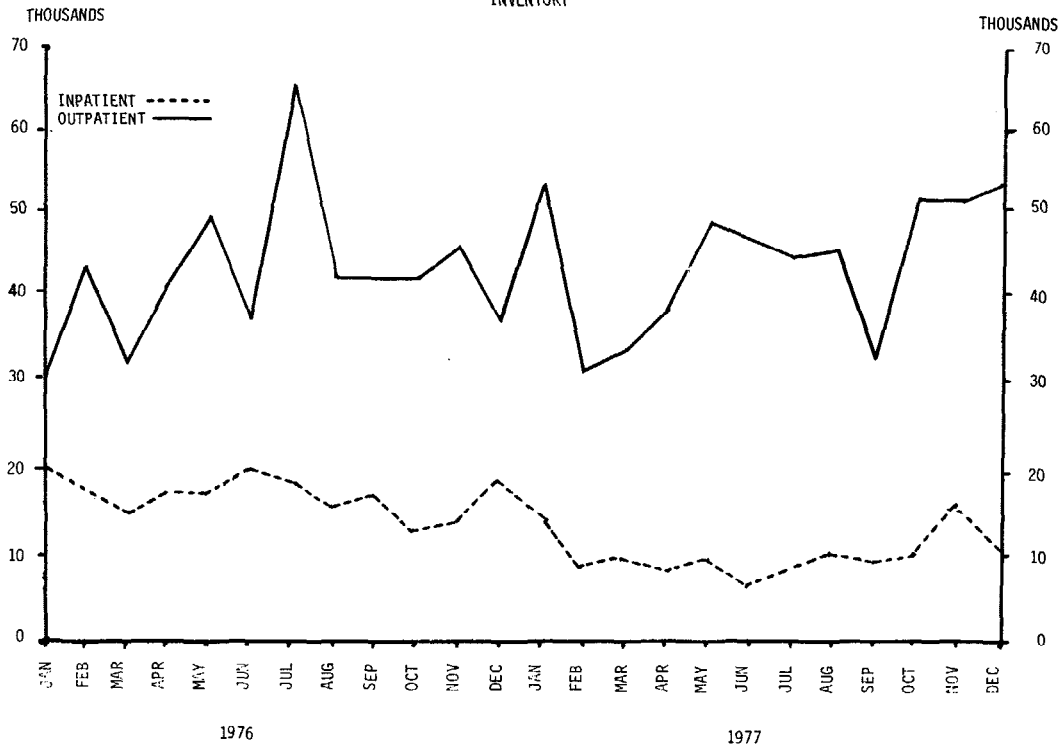
HOSPITAL BENEFITS
CLAIM REPORT-RECEIPTS



HOSPITAL BENEFITS
CLAIM REPORT
PAID CLAIMS



HOSPITAL BENEFITS
CLAIM REPORT
INVENTORY



PHYSICIAN BENEFITS
CLAIM RECEIPTS

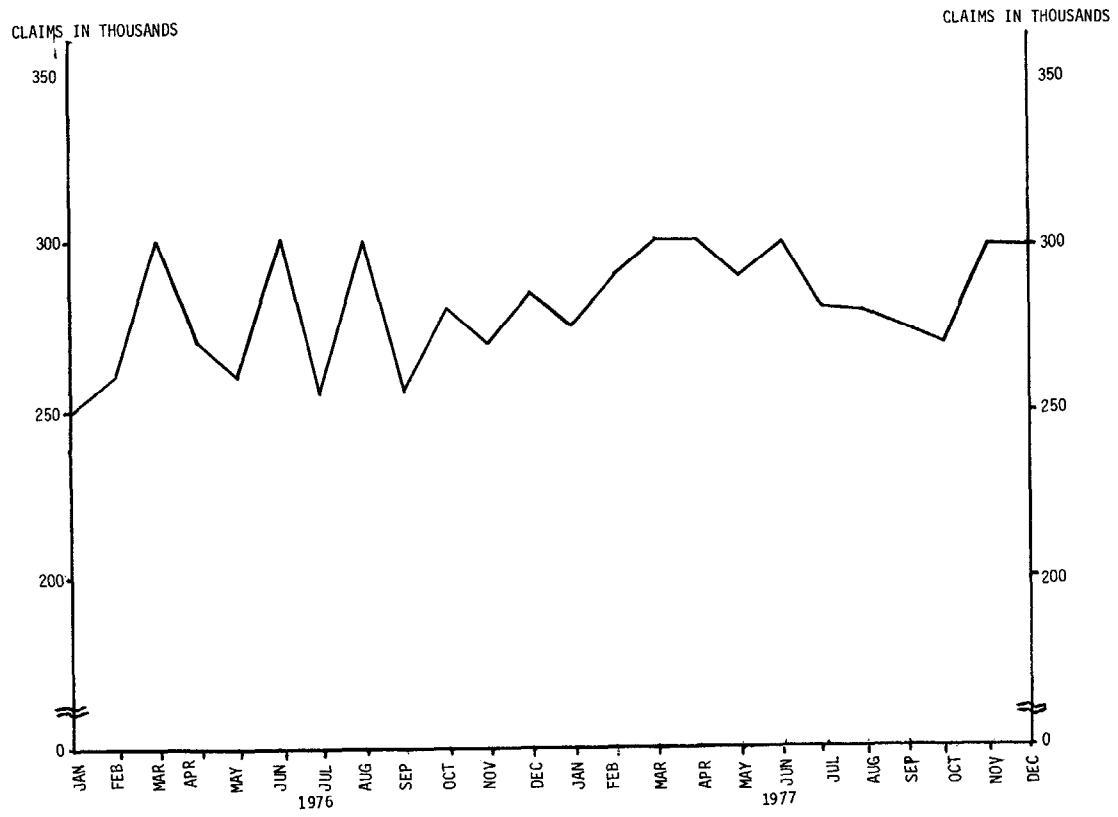
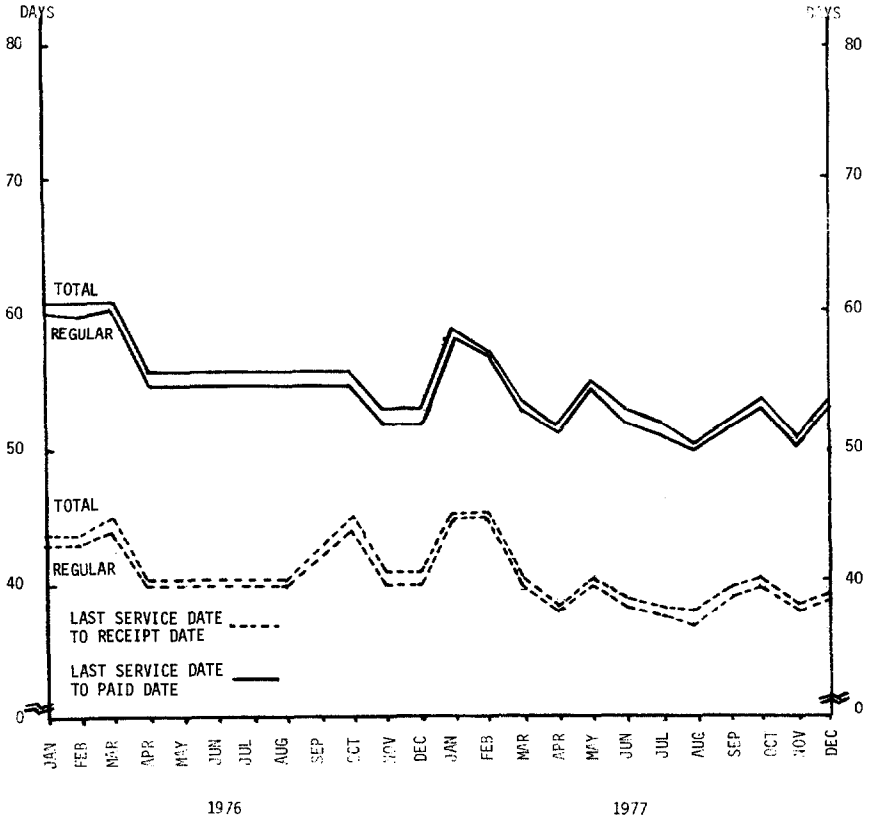
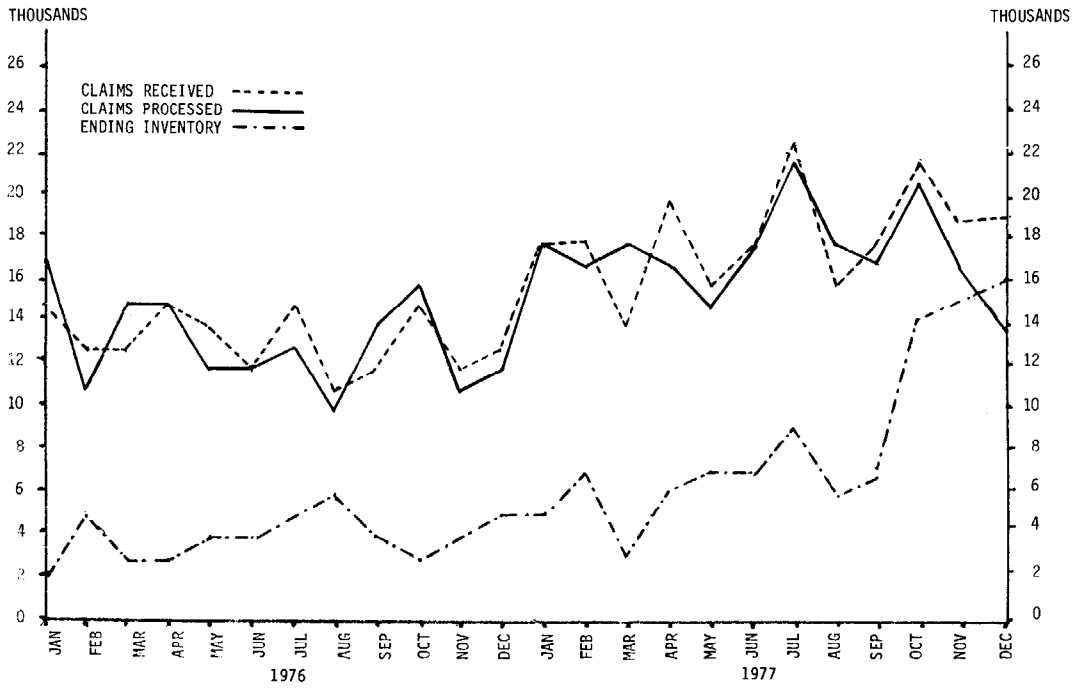


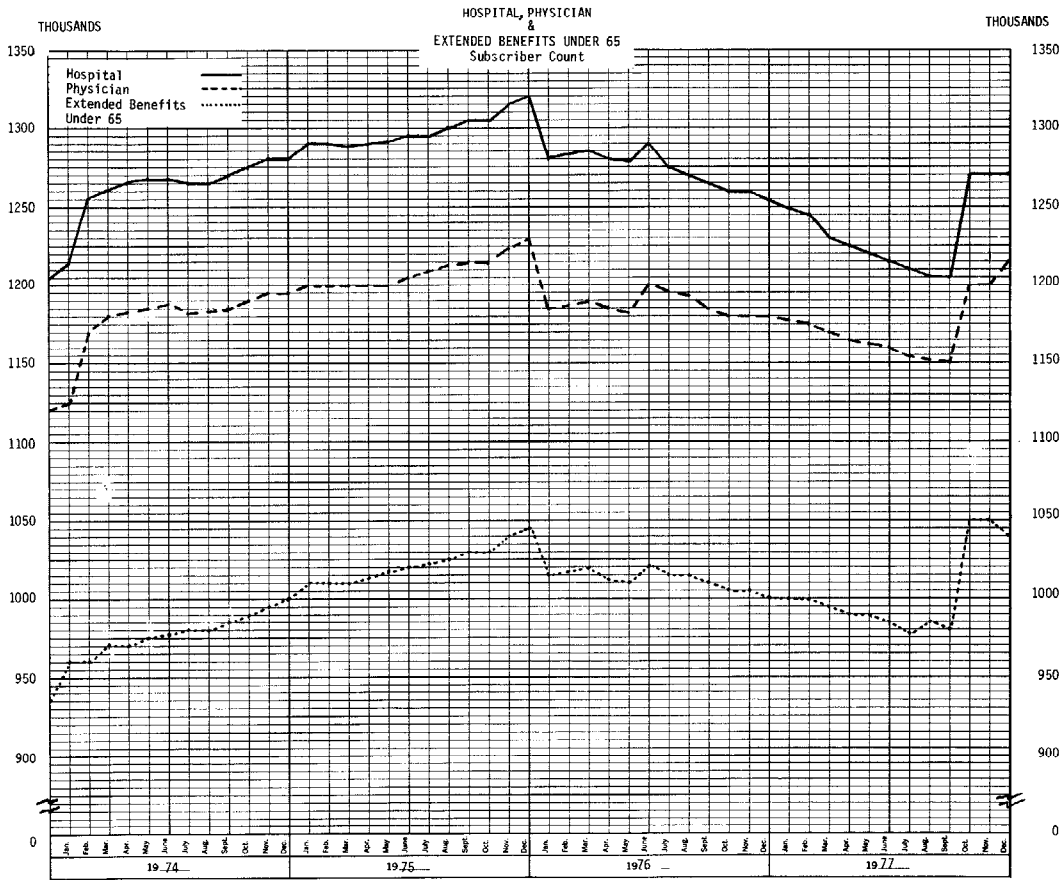
EXHIBIT 13

PHYSICIAN BENEFITS CYCLE TIMES
(PROCESSED CLAIMS)



DENTAL BENEFITS
DENTAL CLAIMS
PRODUCTION REPORT





EXTENDED BENEFITS 65 AND OVER

Subscriber Count

