

A Satisfaction and Return-on-Investment Study of a Nurse Triage Service

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Objective: To assess patient satisfaction and a health plan's return on investment associated with a telephone-based triage service.

Study Design: A pre-post study design, with medical claims data, to assess changes in medical service utilization and health plan expenditures associated with members' use of the triage service.

Patients and Methods: This study is based on data on 60,000 members of a health plan. A telephone survey was conducted to assess member satisfaction and outcomes with the triage service. The plan's medical claims and encounter data were used to calculate medical utilization rates and plan expenditures for those services. The health plan's return-on-investment was evaluated using a pre/post study design to assess changes in medical service utilization between the baseline (December 1995 through November 1996) and program (December 1996 through November 1997) periods.

Results: The average nurse response time to a call was just less than 50 seconds, which indicates the service provided ready access to medical advice 24 hours per day, 7 days per week. More than 90% of users were satisfied, and utilization of hospital emergency department (ED) and physician office services decreased significantly after the service was implemented. The changes in medical service utilization resulted in reductions in health plan expenditures that exceeded the plan's costs of providing the service. The plan's estimated return for every dollar invested in the nurse triage service was approximately \$1.70.

Conclusions: The telephone-based nurse triage service appears to be a cost-effective intervention that improves access to medical advice, thereby encouraging appropriate use of medical services. The service is associated with reductions in utilization of hospital ED and physician office services and with high levels of member satisfaction.

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Health plans, employers, and government financing agencies strive to meet the seemingly conflicting goals of improving access to appropriate medical services while controlling costs. Many efforts to limit health spending have focused on controlling medical service utilization by restricting the supply of medical services and limiting demand for care through such financial disincentives as copayments.

Health programs are being implemented to educate patients in an effort to improve access and quality while limiting costs. Some of these programs, referred to as "demand management programs," basically seek to improve an individual's understanding of his or her own health and medical needs in order to increase appropriate use of medical services. By so doing, the programs expect to reduce demand for unnecessary care.

Although it is difficult to estimate health systems costs associated with the provision of medically unnecessary care, researchers have concluded that many physician office visits are medically unnecessary, and that 40% to 50% of hospital emergency department (ED) visits are for nonurgent conditions.¹⁻⁷

One well-known form of demand management program is the telephone-based nurse information

From Anthem Blue Cross Blue Shield, Denver, CO (JMO), iMcKesson, Broomfield, CO (DAJ), and Coventry Health Care of Kansas City, Inc, Kansas City, MO (JS and DC).

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service. Nurse triage services are a recently developed variation of this type of program. More than 75 million people worldwide currently have access to telephone-based nurse triage services,^{8,9} which are designed so that registered nurses are able to assess callers' acute medical complaints and provide recommendations for appropriate medical care. The type of clinical support tool used by triage nurses to conduct assessments varies. Some services use loosely structured guidelines and protocols, provided on paper or computer disks, and others use interrelational, computerized algorithms.¹⁰⁻¹³

A few recent studies discussed use of nurse triage services, satisfaction with these services and its impact on medical service utilization. High levels of caller satisfaction have been reported in the United States and in the United Kingdom.¹⁴⁻¹⁷ In addition, according to 2 studies, implementation of nurse triage services in the United Kingdom was associated with reductions in medical service use.^{8,14} However, neither study evaluated net cost savings associated with the service.

The purpose of this study is to evaluate member satisfaction and the plan's return-on-investment for the telephone-based nurse triage service referred to as Personal Health Advisor, (PHA). Since 1996, Coventry Health Care of Kansas City (Coventry-KC) (Kansas City, MO) has contracted with iMcKesson (Broomfield, CO) to provide this service to its plan members.

Description of Nurse Triage Service

An analysis of data that Coventry-KC obtained from a member satisfaction survey and from members' complaints indicated that the plan's members wanted to better understand how to handle their medical situations. The members complained that physicians did not return after-hours telephone calls in a timely way, and that long waits for return calls complicated their ability to manage medical situations. Coventry-KC felt that the prompt provision of medical advice could lead to more appropriate utilization of hospital ED, urgent care, and physician office services.

To meet this overall goal, the plan provided the telephone-based nurse triage service to both health maintenance organization (HMO) and non-HMO members. Member and physician communication programs were implemented to provide information about the service. Members were given a toll-free number, which they could use to contact the service 24 hours per day, 7 days per week. They also were informed that they could contact either their

primary care physician or PHA to obtain authorization to use hospital ED or urgent care services. The plan expected that the telephone-based nurse triage service would reduce unnecessary medical service use at the same time it increased member satisfaction.

Members contact the PHA service primarily to have a nurse assess a medical complaint. Those who call for this reason are referred to as "symptomatic callers." The remaining callers contact the service to obtain provider referrals, health-related information, or information about health plan coverage and services. When a plan member with a medical problem contacts PHA, a specially trained registered nurse—the triage nurse—uses a computerized algorithm to conduct the assessment. After conducting the clinical assessment, the nurse immediately gives the caller a recommendation about the most appropriate level of medical care. The nurse may recommend that the caller immediately seek care at a hospital ED, seek urgent care, see his or her provider (ie, schedule a physician [MD] office visit), call the provider, or practice recommended self-care at home while monitoring for changes in health status. The nurse also suggests a time frame for completing the recommended action.

PHA's patented Clinical Decision Architecture includes more than 570 symptom-based computerized algorithms and more than 1200 self-care instructions. The algorithms were developed from treatment protocols, reviews of the medical literature, and suggestions from a physician advisory group.¹³ Program data and medical literature are continuously reviewed to update and modify the algorithms. The algorithms' binary branch chain logic is used to rule out serious conditions, and to determine the level and timing of an intervention. The triage call record includes detailed documentation of the clinical assessment, which can be forwarded to a provider.

After receiving their triage assessments, callers are asked to indicate the level of medical care they would have used had they not contacted the PHA service. Their responses are referred to as their "pre-call intent to obtain care." Because the goal of the triage service is to direct people to the most appropriate level of medical care, the plan assesses the percentage of callers directed to a higher level, the same level, or a lower level of medical care than they would have used in the absence of the service and compares the pre-call intent with the triage nurse's recommendation. The net effect of the triage redirection is expected to be that unne-

essary utilization of hospital ED and outpatient physician services is reduced.

... METHODS ...

We assessed satisfaction by randomly surveying triage callers. We analyzed telephone system records to evaluate the nurses' response times. The plan's return-on-investment was evaluated by measuring changes in medical service utilization rates between the baseline and program periods. The baseline period consisted of the 12 months preceding implementation of the triage service (December 1995 through November 1996), and the program period consisted of the 12 months after implementation (December 1996 through November 1997). The reduction in health plan expenditures associated with these changes was used to estimate the plan's benefit-cost ratio, or return-on-investment (ROI), for the service.

Data Sources and Population

Coventry-KC provides HMO and point-of-service (POS) coverage to approximately 60,000 people in the Kansas City metropolitan area. Although Coventry's plan members in other geographic areas also have access to the service, only data for plan members residing in Kansas City are included in this study. We used PHA triage call records to (1) determine the number of calls per 1000 members during the program period, (2) assess pre-call intent to use medical services and triage recommendations, and (3) identify callers for the satisfaction survey.

During 1997 and 1998, an outside vendor conducted an ongoing caller satisfaction survey of people who used the PHA service, including Coventry plan members. Biweekly, we sent data for a random sample of approximately 8% of all symptomatic callers to the vendor. The vendor made a minimum of 5 attempts to contact each caller; the attempts were made at different times of the day, and on every day of the week except Sunday.

We obtained response times to the triage calls made during the program period from the triage telephone system; the information was used to evaluate access to the triage service. The response rates provide the average interval between the callers' connections with the triage system and the nurses' responses.

Coventry-KC's plan membership data for the baseline and program periods were used to determine the number of members who were enrolled

continuously in the plan during the study's time frame, as well as the number of members enrolled in the plan, by month. Coventry's administrative claims and encounter data were used to determine the number of ED visits and MD office visits during the baseline period and the program period. A small subset of these visits was classified as urgent care visits according to provider codes for the urgent care centers.

We used a pre-post study design to assess changes in medical service utilization associated with implementation of the triage service. Because this design cannot demonstrate that the triage service was solely responsible for these changes, we conducted an informal survey of plan administrators to determine whether the plan implemented changes in benefits, provider networks, plan membership, or programs during the timeframe of the study that could have contributed to changes in medical service utilization. We provided several plan administrators the survey instrument, so that they could document any plan changes, and conducted follow-up phone calls to clarify responses. In addition, we made efforts to assess whether any changes occurred in the geographic area during the study period that could have contributed to reductions in outpatient service utilization. Examples would include hospital ED closures and passage of "a prudent layperson" legislation. If we did not identify any such changes, then we would be able to assume that any observed decreases in ED and MD utilization could be associated with the implementation of the PHA triage service. When making a cost-benefit estimate we changed this assumption and only 80% of the observed reduction was associated with triage implementation.

Given some of the inherent weaknesses of the pre-post study design, we had considered conducting a retrospective case-control study for this evaluation. Using a design of this type would have enabled us to compare the medical service utilization of callers with utilization of a matched sample of non-callers. However, we were not able to identify a method for matching callers and noncallers retrospectively. Since symptomatic callers contact the triage service to discuss a medical complaint and are ill at the time of the call, there is a selection bias that is difficult to overcome.

We did not have an indicator of "being ill" during the program period other than medical service utilization, and many people who are "ill" do not use medical services. Neither medical service utilization during the baseline period nor a health

status indicator created from those data (eg, adjusted clinical group assignment) could be used to control for selection bias.¹⁸ Statistical models used to predict medical spending for relatively healthy populations account for less than 50% of the variation in medical spending, even after controlling for age, sex, and health status.^{19,20} These models would not fully account for health status differences between callers and noncallers; they can account only for some percentage of the differences. Because we could not match callers and noncallers, we concluded that a case-control study design could not be used to assess the impact of the triage service.

Calculation of ED, MD, and Urgent Care Utilization Rates

We used each plan member's unique identification number to match medical claims for ED, MD office, and urgent care clinic visits with the member's records. Utilization rates for each service were calculated for the baseline period and the program period for 2 groups of plan members: (1) members continuously enrolled in the plan during the timeframe of the study, and (2) members enrolled for 1 month or longer during that period. In light of the distribution of the ED and MD utilization data and our use of a pre-post study design, we used the Wilcoxon signed rank test to determine whether changes in medical service utilization were statistically significant.

In order to assess membership changes, we assigned members to 1 of 5 age categories (younger than 5 years, 5 to 17 years, 18 to 44 years, 45 to 65 years, and older than 65 years) and to 1 of 2 plan types (POS and HMO). During the study time frame, the distribution of plan members, by age and plan type, changed between the baseline and program periods. The percentage of young children and elderly increased, as did the percentage of POS members. Because these membership changes could lead to increased utilization, we adjusted utilization rates for plan members enrolled in the plan for 1 month or longer for plan membership changes, by age and plan type. To make these adjustments, we used a direct standardization approach that allows for a multivariate adjustment. It was not necessary to make these adjustments to rates for continuously enrolled members.

We used an interrupted time series approach to further examine changes in medical service utilization. Under this approach, we calculated utilization rates for each quarter of the baseline and program periods. We then examined the time series data to

determine whether a structural break in the data (ie, a change in the intercept) was evident at the point of implementation of the service and assessed the statistical significance of the change.

Return on Investment

The nurse triage service would be expected to influence medical expenditures in various ways, as patients might be advised to use a higher, the same, or a lower level of medical care than they otherwise would have sought. We measured net changes in utilization of hospital ED, MD office, and urgent care services and in related plan expenditures to determine plan savings associated with the triage service, for use in the ROI analysis.

We did not attempt to quantify other plan savings and costs associated with triage service use. One goal of the triage service is to improve appropriate use of medical care; health plans may realize savings when members are directed to higher levels of care than they would have used in the absence of the service. For example, treatment costs might be lower if people with pneumonia or abdominal pain are directed to seek care sooner. However, an assessment of these plan savings would involve a clinical assessment of symptoms and utilization data that is beyond the scope of this study. It is also difficult to quantify the value of the provision of medical information to callers who were given recommendations to use the same level of medical care. For example, the information may have helped the members to better care for their condition at home or assisted callers in speaking with their provider about their medical complaint after the triage call.

In addition to excluding some plan savings from the ROI analysis, we also excluded some plan triage costs. If a triage caller was redirected inappropriately to a higher or lower level of care, the plan might have incurred additional treatment costs. For example, if the caller was given an inappropriate recommendation to use a lower level of care, the condition may have worsened and the resulting medical expenditures might have been greater than they otherwise would have been.

It is difficult to quantify the overall influence of excluding these plan savings and costs from the ROI analysis. Indicators of quality, presented in the Discussion section, suggest that the plan did not incur large costs because recommendations inappropriately led to a lower use of medical care. An analysis of algorithms associated with upward redirection indicated that the redirection can lead to

reductions in hospital admissions or lengths of stay for some conditions, because some serious conditions are treated promptly. The upward direction of more than 20% of callers could be associated with significant plan savings. We concluded that excluding these savings and costs from the ROI analysis would result in an underestimate of plan savings and a conservative ROI estimate for the service.

Finally, the ROI model does not account for the value to the plan of nonsymptomatic PHA calls. Although only 77% of all PHA callers were medically triaged, we accounted for 100% of the telephone-based nurse triage service costs in the ROI estimate. The ROI would have been substantially higher if we had included only the percentage of PHA costs associated with the triage service.

Description of the ROI Model

We followed a 4-step procedure to calculate health plan savings associated with the net changes in medical service. We made the calculations twice: once using the utilization rates for continuously enrolled plan members and once using the rates for members enrolled 1 month or longer. We derived the estimates of health plan savings used to calculate the ROI (benefit-cost) ratio for the PHA service. The 4-step process can be summarized as follows:

- Step 1: Estimate the number of visits avoided (incurred) during the program period. For each service, calculate the difference between the baseline and program period utilization rates. To estimate the number of visits avoided (incurred) during the program period, multiply the difference by the average number of plan members enrolled during the program period.
- Step 2: Estimate the average plan costs of an ED, MD office, and urgent care visit. Coventry-KC reported that plan expenditures for an ED visit averaged \$412 during 1997. We assumed plan expenditures for an ED visit avoided as a result of triage service use to be lower than the cost of the average ED visit because the medical acuity of the avoided visits is lower. The average cost of an avoided ED visit was estimated to be 75% of \$412, or \$309. Although Coventry-KC's providers are capitated, the plan incurs costs for MD office visits. The average cost of an avoided MD office visit, including the costs of ancillary services, was estimated to be \$80. The estimated cost of an urgent care visit was \$95.
- Step 3: Estimate total plan savings resulting from changes in utilization for each service by multi-

plying the number of avoided (incurred) visits by the estimated average cost of a visit.

- Step 4: Calculate the ROI ratio by dividing the total health plan savings by the estimated program costs for the service. Program costs include the actual implementation and set-up costs associated with initiation of the service, actual marketing and communication costs associated with program promotion, actual program (per member per month) fees paid to the vendor, and the estimated plan costs associated with ongoing program management.

... RESULTS ...

Approximately 60,000 HMO and POS members were enrolled in the Kansas City plan during each month of the baseline and program periods. Of these plan members, 25,426 were enrolled continuously during the entire time frame of the study.

Nurse Triage Utilization

During the program period, plan members placed more than 10,000 calls to the triage service, resulting in an annual call rate of 174 calls per 1000 members. Of these, 77% contacted the service because they had medical complaints and were medically triaged by the nurses. The annual symptomatic call volume was 133 calls per 1000 members during the program period.

Table 1 presents information on triage recommendations for callers, stratified by pre-call intent. For each call, pre-call intent was compared with the triage recommendation to determine the percentage of callers who were redirected to higher, the same, or lower levels of medical service by the triage nurses. Approximately 23% of callers were directed to a higher level of care, and 42% were directed to a lower level of care. The remaining callers were provided a triage recommendation that matched the level of care they had intended to use.

Response Rates

During 1996, the nurses took an average of 49.7 seconds to respond to the triage calls, even though 78% of the calls were made after normal working hours or on weekends.

Callers' Satisfaction with the Program

Satisfaction data were available for 787 PHA callers telephone interview time averaged 4.5 minutes; the survey achieved a response rate of 64%. In general, callers reported high levels of satisfaction with the nurse triage service. When asked to rate

their satisfaction levels on a scale from 1 to 5, where 1 represented “very dissatisfied” and 5 represented “very satisfied,” 93% of callers reported that they were either satisfied or very satisfied. When asked how likely they were to use the service again, 93% responded positively, and 84% reported that the plan’s provision of the triage service increased their positive feelings about their health coverage.

A similar scale was used to assess levels of satisfaction with specific aspects of the service. More than 90% of callers were satisfied (ie, they used responses of “4” or “5” only) with regard to the nurses’ understanding their medical complaints and the nurse’s medical knowledge. They also were satisfied with their comfort level in speaking with the nurses by telephone.

In general, the level of satisfaction did not vary by age, sex, education, or nurse’s recommendation. Pre-call intent data were available only for the 1998 survey data. After being directed to higher, the same, or lower levels of medical care than they would have used, 95%, 89%, and 87% of callers, respectively, were satisfied with the program. In addition, more than 85% of callers directed to lower

levels of care were either satisfied or very satisfied with the triage service.

As part of the satisfaction survey, callers were asked whether their medical conditions resolved after they followed the triage recommendation. Those whose conditions did not resolve were asked what they did to resolve their condition. No respondents whose triage nurses recommended making an appointment to see their physician later used emergency services, and only 10% given the recommendation to provide self-care subsequently used hospital ED services or MD services (1.2% and 8.8%, respectively); none of these callers reported any adverse outcomes. Furthermore, 91.1% of these callers were satisfied with the triage service and 93.5% felt the triage recommendation was appropriate even though they obtained additional medical services at a later date.

Utilization of Medical Services

We were able to match nearly all ED and MD office visits with a member record. Of 24,876 ED visits identified in the data, only 108 (0.43%) were not matched with a member record. For MD office and urgent care

Table 1. Nurse Triage Recommendation, by Pre-Call Intent to Use Medical Services*

Pre-Call Intent	Use Hospital Emergency Services		Use Urgent Services		See Provider		Call Provider		Use Self-Care Recommendations		Total	
	n	%†	n	%†	n	%†	n	%†	n	%†	n	%†
Use hospital emergency services	183	16	288	26	89	8	330	30	222	20	1112	18
Use urgent care services	18	5	81	12	46	12	137	35	106	27	388	6
See provider	12	2	57	10	151	25	136	23	237	40	593	10
Call provider	76	3	171	7	335	14	863	36	979	40	2424	39
Use self-care recommendations	51	3	100	6	196	12	429	26	885	53	1661	27
Total	340	6	697	11	817	13	1895	31	2429	39	6178	100

*Pre-call intent data were not available for approximately 20% of calls.

†These percentages are row percents. The sum of the percentages may not equal to 100% due to rounding.

visits, only 1,567 (0.52%) MD and 7 (0.23%) urgent care visits were not matched with a member record.

Continuously enrolled members had significantly lower utilization rates for ED and MD office services during the program period than during the baseline period (Table 2). After implementation of the nurse triage service, these members' ED utilization rates decreased by 4.3%, from 207 visits per 1000 members to 198 visits per 1000 members ($P < .02$). Utilization of outpatient physician services decreased by 5.4% (from 2665 to 2521 visits per 1000 members; $P < .01$). In contrast, utilization rates for urgent care services increased, most likely as a result of triage redirection of some plan members from ED care to urgent care.

We adjusted the utilization rates for plan members enrolled for 1 month or longer to account for membership changes in age and plan type using a direct standardization method. The results indicated decreases in medical service utilization for plan members enrolled 1 month or longer were somewhat lower than those for continuously enrolled plan members (Table 2). This finding could be due to differences between the 2 populations in patterns of medical service utilization.

We used an interrupted time series approach to further examine changes in medical service utilization. As shown by the graphic presentation of utilization rates for ED and MD services for each quarter during the baseline and program periods, a structural break in the data for both services occurred after implementation of the triage service (Figures 1 and 2). In both cases, the differences were statistically signifi-

cant ($P < .05$ and $P < .01$ for ED and MD utilization, respectively).

Survey of Health Plan Administrators

We surveyed plan administrators to determine whether the plan had enacted any changes other than implementation of the nurse triage service during the study period that could explain the alterations in the patterns of medical service use. A survey instrument was used to record information on changes in benefits, provider networks, plan membership, and programs.

The survey findings revealed that the plan did not make other changes during the study time frame that would have influenced utilization of ED and MD services. As a result of changes in plan membership during that period, the distribution of plan members' ages and plan type changed. These changes may have led to higher utilization rates, and that would have biased the analysis against positive findings. As noted, we accounted for these changes by using a direct standardization approach to calculate utilization rates for people who had not been enrolled continuously in the plan. In addition, we were not able to identify any changes in the geographic area that would have led to decreases in utilization of outpatient services. These findings, although inconclusive, suggest that implementation of the nurse triage service was associated with the reductions in ED and MD utilization that we observed.

Return on Investment

The changes in medical service utilization represent savings to the health plan resulting from reduc-

Table 2. Utilization of Hospital ED, Outpatient Physician, and Urgent Care Services

	Plan Members (No)	ED Utilization Rate*			MD Utilization Rate*			Urgent Care Utilization Rate*		
		Baseline Period	Program Period	% Change	Baseline Period	Program Period	% Change	Baseline Period	Program Period	% Change
All members	57,673	216	210	-2.8	2640	2534	-4.0	20	31	55
Continuously enrolled members	25,426	207	198	-4.3	2665	2521	-5.4	18	28	53

ED = hospital emergency department; MD = outpatient physician visit.

*Annual number of visits per 1000 members.

Table 3. Nurse Triage Return-on-Investment Results

Estimated Plan Savings and Expenditures for Continuously Enrolled Members	
Estimated Plan Savings	
Hospital ED services	
Step 1. Determine no. visits avoided (207-198)/1000 × 58,112	523
Step 2. Determine avoided visit average cost (75% of average ED charge \$412)	\$309
Step 3. Estimate avoided plan expenditures (no. visits avoided × average cost)	-\$161,609
Physician office services	
Step 1. Determine no. visits avoided (2665 - 2521)/1000 × 58,112	8368
Step 2. Determine avoided visit average cost (\$80 for visit + ancillary costs)	\$80
Step 3. Estimate avoided plan expenditures (no. visits avoided × average cost)	-\$669,450
Urgent care	
Step 1. Determine no. visits incurred (18-28)/1000 × 58,112	581
Step 2. Determine average cost (\$95 for visit + ancillary costs)	\$95
Step 3. Estimate additional plan expenditures (no. visits avoided × average cost)	\$55,206
Total plan savings	\$775,853
Estimated Plan Expenditures for Nurse Triage Service	
Implementation fees	
Fees (\$25,000) split evenly between Kansas City and Louisiana, \$12,500 prorated over 3-year period. For 1 year, cost = \$4167.	\$4167
Member communication	
From December 1996–December 1997, member costs = \$85,008 (13 mo). Use 92.3% of these costs for 12 mo.	\$78,469
Triage costs	
12 mo of triage billed at \$20,000/mo = \$240,000	\$240,000
Plan personnel costs	
Plan personnel costs (annual estimates) for contracting and managing vendor, marketing staff time, data management = \$60,000 (est).	\$60,000
Total plan costs	\$382,636
Estimated ROI	
Results for continuously enrolled plan members (plan savings/plan expenditures)	2.03
Results for plan members who were not continuously enrolled	1.33

ED = emergency department; ROI = return on investment.
*Using utilization rates for the continuously enrolled population.

tions in reimbursement for the services. Estimates of the average health plan expenditure for ED visits, MD office visits, and urgent care services were used to assess the amount of plan savings associated with the utilization changes. We calculated the savings twice: once while using the utilization rates for continuously enrolled plan members, and once using the rates for members enrolled for 1 month or longer. The ROI estimates for both calculations are shown in **Table 3**.

On the basis of the 2 sets of calculations, we estimated that the changes in ED and MD utilization produced gross savings for the plan in the range of \$510,804 to \$775,853, and an ROI in the range of \$1.33 to \$2.03. After averaging the figures, we estimated that the plan saved approximately 1.7 dollars for each dollar invested in the nurse triage service.

... DISCUSSION ...

Health plans and employers implement telephone-based nurse triage services to provide easy access to medical information; improve the appropriateness of medical service utilization, health outcomes, and member satisfaction; and reduce spending. In this study, we evaluated members' access to the triage service, their level of satisfaction with the service, and the service's ROI.

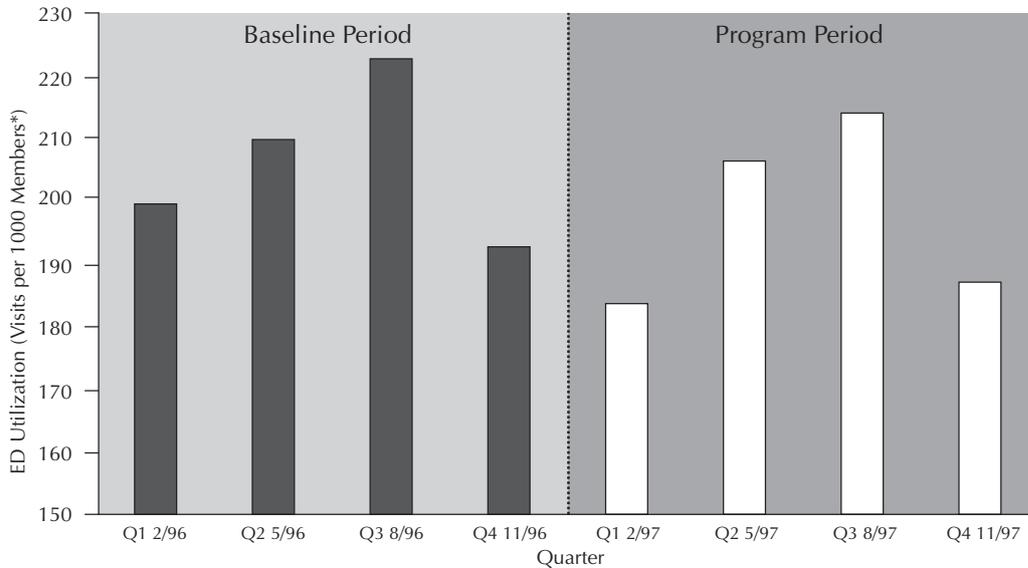
With an average call response time of 49.7 seconds, even though nearly 80% of calls were received after normal working hours and on weekends, the triage service gave members ready access to medical information and advice at no cost. The findings of the satisfaction survey demonstrate that members remained satisfied with this service even when directed to less intensive medical services than they otherwise would have used. Finally, the claims-based analysis indicates that implementation of the telephone-based nurse triage service was associated with overall reductions in hospital ED and MD office utilization. When the reduction in

the plan's expenditures for these services was compared with the plan's costs of providing the PHA service, the ROI was estimated to be \$1.70. These findings indicate, the PHA triage service is a cost-effective program that offers plan members quick access

to medical advice while providing high levels of user satisfaction.

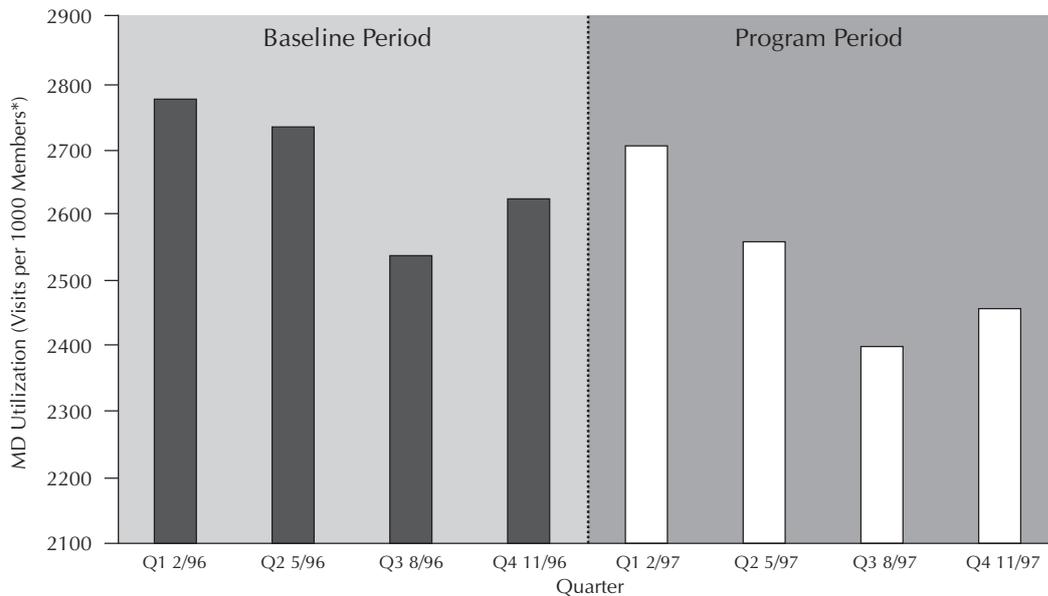
One of the limitations of this study was the use of the pre-post study design to assess the program's impact on medical service utilization. It is possible

Figure 1. Utilization of ED Services During the Baseline and Program Periods



ED = emergency department.
*Annualized rate.

Figure 2. Utilization of MD Office Services During Baseline and Program Periods



MD = physician.
*Annualized rate.

that other changes in the plan or in the provision of medical care in the plan's geographic area during the timeframe of the study could have contributed to the observed changes in medical service utilization. We addressed this issue to some extent by surveying plan administrators about plan changes that would have affected the services examined in this study. Other than minor changes in the members' age and plan type, no such changes were identified. Although we could have strengthened the pre-post design by including additional years of baseline data or data from a comparable plan operating in the geographic area, we were unable to obtain these data for this study. To determine the influence of a lower triage impact on medical service use, we estimated an ROI assuming only 80% of the observed reductions in medical service utilization were associated with the triage service. Even with this assumption, the ROI was estimated to be \$1.34.

The ROI analysis accounted for savings associated with the net effect of the triage redirection, which was expected to reduce unnecessary hospital ED and outpatient MD services utilization. We did not attempt to quantify other types of plan savings and costs associated with redirection of callers to a higher level of medical care than they would have otherwise sought or with clinically inappropriate recommendations. Our assessment of these other savings and costs suggested that the ROI, as calculated, is a conservative estimate. This finding is due in part to indicators of the clinical quality of the nurse triage assessments. One final limitation of the ROI analysis was that we did not calculate directly the average plan costs of avoided ED and MD office visits. We chose conservative estimates of these costs so as not to bias the results in the direction of a positive ROI.

Although we did not attempt to assess the clinical quality of the triage recommendations in this paper, the telephone-based survey findings for nearly 800 callers indicate that only a small percentage of those whose conditions did not resolve after following the triage recommendations sought additional medical care. In addition, these callers reported no adverse outcomes and 91.1% were satisfied with the triage service. In some cases, the additional medical service utilization was associated with a worsening or persistence of the condition that then merited a more intensive use of services.

The firm providing the triage service appraises clinical quality through a number of activities, including monitoring of calls, analysis of triage data, documentation and review of complaints, and ongoing clinical review of the algorithms. Triage nurses

are required to have a minimum of 5 years of medical experience, and the nurse quality monitoring process includes in-person monitoring and use of algorithm data to assess nurse interrater reliability. In addition, the firm provides on-site training to improve the nurses' understanding of the algorithms and performance. A team of physicians provides oversight for these activities.

The results of another study indicate a high level of physician concordance with this vendor's nurses' triage recommendations (J.M.O., unpublished data, 1998). Additional research should be conducted to assess the clinical appropriateness of the triage recommendations for callers of all ages. In particular, the research should evaluate the health and financial outcomes of inappropriate triage recommendations, as well as the value of directing callers to obtain the appropriate level of medical care sooner than they otherwise would have done.

Through implementation of the telephone-based nurse triage service, the plan was able to improve access to medical advice, particularly during evenings and weekends. The study findings indicate triage users are satisfied with the service and that it offers a favorable return on investment.

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