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Utilization and Financial Outcomes of an Asthma Disease Management Program Delivered to Medicaid Members

Results of a Three-Group Comparison Study

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Abstract

Background: Although various studies have reported the financial outcomes of disease management programs for commercial populations, few have addressed the outcomes for Medicaid recipients. McKesson Heath Solutions (MHS) disease management programs support clients whose members have serious chronic illnesses including asthma, diabetes, congestive heart failure, coronary artery disease, chronic obstructive pulmonary disease, and mental health conditions. This study describes financial outcomes of the MHS asthma disease management program by evaluating changes in health services utilization measures for Medicaid members who participated in the asthma disease management program.

Objective: To analyze and describe medical care utilization for asthma patients enrolled in a Medicaid managed care organization located in the eastern US.

Methods: Medicaid participants were identified and referred to the asthma program by the healthcare plan. Two comparison groups were used in the study to more reliably assess program impact. The first comparison group included members who were referred to the program, but who chose not to participate. The second group included members who were identified through medical claims data, but who were not contacted or referred to the program by the plan. All eligible participants with at least 30 days of program participation, and all non-participants with at least 30 days of effective plan enrollment in the pre- and post-program periods were included in the study.

The utilization rates for the three groups were compared in the pre- and post-program periods. The effect of group membership on inpatient admissions (IP), emergency department (ED) visits, and hospital outpatient department/physician office (MD) visits was analyzed using Poisson regressions. The regression analyses controlled for baseline levels of utilization, demographics, and relative risk scores generated by $D_xCG^{®}$ software (manufactured by $D_xCG^{®}$ in Boston, Massachusetts, USA).

Results: While the MHS asthma disease management program has created positive financial outcomes for commercial populations, this study extends that scope to include a Medicaid population as well. 313 Medicaid participants experienced significant decreases in IP admissions and ED visits following program implementation. Participants also experienced decreased MD visits between the pre-program and program periods; however, their post-program MD visits were not reliably predicted by group membership after controlling for demographic differences and relative risk scores.

Conclusions: The experience of the MHS asthma disease management program demonstrates its efficacy and relevance to Medicaid populations. This study strongly suggests that a structured asthma program may create positive financial outcomes while promoting enhanced self-management through continued support, education, and patient involvement.

Background

In October of 1998, McKesson Health Solutions (MHS; formerly The Access Health Group) provided a disease management program to Medicaid members enrolled in a major health plan located in the eastern US. The purpose of the program was to improve self-management practices of patients with asthma through patient monitoring, education and counseling.

The effective management of asthma remains a critical challenge in Medicaid populations. For example, during the last two decades, the increases in asthma prevalence, morbidity, and mortality have been disproportionately high for members of low-income, inner-city, and minority groups.[1] Recent studies also document higher rates of medical service utilization for children enrolled in Medicaid compared with other populations or those insured by non-Medicaid programs.[2-4] Other studies of Medicaid programs, which serve many minority children, have also reported that beneficiaries may not be receiving appropriate preventive medications for asthma.[5,6] Additionally, while the underlying causes remain unknown, minority children in the US tend to experience more severe asthma, and are at higher risk of hospitalization and emergency department (ED) visits compared with other populations.[7] Given this background and the paucity of outcomes research that focuses on asthma disease management for Medicaid managed care plans, our study perspective was to determine whether an asthma care support management tool had an impact on the healthcare utilization and costs of Medicaid beneficiaries with asthma.

Overview of the Asthma Disease Management Program

During the past 20 years, the prevalence and costs of asthma have increased dramatically. The Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, USA, have estimated that in the year 2000, more than 20 million persons in the US had asthma.[8] One recent report has suggested that as many as 31.3 million Americans have had an asthma diagnosis at some point in their lives.[8] The direct economic costs of this disease are estimated at $US8.1 billion a year, with another $US4.6 billion being spent on indirect costs (2000 values), which include factors such as lost work days, lost school days and a diminished quality of life.[9] Moreover, recent data collected by the CDC indicate that asthma prevalence rates have been rising steadily since the early 1980s.[10]

Hospitalizations and mortality rates have also shown a marked increase during the 20-year period between 1979 and 1998. In 1998, there were approximately 423 000 Americans hospitalized with asthma, a 25% increase over 1979 levels. In addition, while the age-adjusted mortality rate for asthma increased by approximately 56% between 1979 and 1988, deaths attributed to all causes decreased by approximately 18%. Both inappropriate pharmaceutical therapy and under-treatment have contributed to increased morbidity and mortality rates for this disease.[11-13]

Scientific evidence indicates that proper management of asthma can reduce the costs associated with acute exacerbations of the disease. The high prevalence and costs of asthma have induced many health plans to implement programs to assist persons in managing this condition. The medical and social costs for persons with Medicaid coverage are of particular concern.

MHS developed this asthma disease management program to address directly some of the most serious challenges facing healthcare providers, health plans, and employers seeking to improve asthma management. Through an individualized approach to patient monitoring, education and counseling, the program seeks to:

- Improve patients' self-management practices and communication with their providers
- Improve clinical outcomes and quality of life
- Reduce treatment costs associated with asthma.

MHS began enrolling the plan members in its asthma disease management program during late October of 1998.

Methods

Program Participants and Comparison Groups

All program participants and comparison groups were selected from administrative data provided by a health maintenance organization located in the state of Pennsylvania. Medical services provided to group members occurred principally within Pennsylvania.

Members referred to MHS for the program enrolment included only those identified by the plan. The health plan referred a total of 724 members to the asthma program. The referred members were contacted by health counselors from MHS to determine whether the member would be interested in participating in the program. The members who were not able to be contacted, or who were contacted but chose not to participate, or who were no longer eligible for the plan were excluded from the program participant group.

A retrospective cohort study design was used to evaluate the asthma program impact by comparing changes in utilization for program participants with that of two non-participant groups. The medical service utilization of hospital inpatient (IP), hospital ED and hospital outpatient department/physician office (MD) services was evaluated during the program period from November 1998 through April 1999 and compared with an equivalent time period

for each person in the baseline (pre-program period) from November 1997 to April 1998. Membership and medical claims data provided by the health plan were used to estimate utilization rates before and after the program's implementation.

Patients were eligible for this study if they were shown as enrolled in the plan membership file during the pre-program (baseline) and program periods. In addition, a minimum of 30 continuous days in the program was used to select study subjects. If subjects had incomplete or missing encrypted identification numbers they were not included in the study, since matching of eligibility and claims data would have been difficult, if not impossible. No age restrictions were placed on the selection of members for this study. Program participants had an age range from 1–68 years; that for referred non-participants was from 1–62 years; non-referred claimants had an age range from 1–82 years. Selection of the final groups was based on an equivalent time period and valid plan enrollment for each member in the pre-program and program periods.

Of the 724 referred members, 202 did not meet the study criteria because of: missing or incomplete encrypted identification numbers (n = 7); the beneficiary's plan membership data did not cover the same time period as the beneficiary's program enrollment (n = 98); or, based on the membership eligibility file, there was not an equivalent time-period match between the person's baseline and program period (n = 97). Of the 522 remaining members, 313 enrolled in the program, and 209 did not enroll. Applying the same exclusion criteria, we found a total of 592 non-referred beneficiaries through examination of the medical claims records provided by the plan.

In this study, we selected a multiple group comparison design because of accessibility to the medical claims data for the entire membership and the historical problems associated with single group pre- and post-intervention designs. Because the historical pre-post design offers no basis for comparison, the internal validity of these studies is brought into question. The use of two comparison groups, rather than one, also provides an additional control in the analysis. Using this methodology affords a more comprehensive check of the internal, external, and inferential validity of the study.

Also, in the current study, the use of multiple regression models provides a rigorous methodology in which statistical adjustments, rather than one-to-one matching, are made to account for group differences.

Two groups of non-participating members were identified in the comparison groups; their medical utilization was then compared with that of the program participants. The first group included members with asthma who were referred to the program but who didn't participate during the study period. The second group of non-participants was selected from approximately 2.5 million medical claims provided by the plan from May 1996 to April 1999. This data set included members who were not referred to the program but who had a primary diagnosis of asthma during this time period. The participating and non-participating members included in the study were covered by a Medicaid managed care plan located in Pennsylvania.

Calculation of Inpatient, Emergency Department and Hospital Outpatient Department/Physician Office Utilization Rates

IP, ED and MD claims were identified by the claim's place of service code and CPT (Physicians' Current Procedural Terminology) code. IP admissions were selected based on a place of service code designated 'hospital inpatient'. ED visits were based on a place of service code designated as 'emergency department', or having an 'outpatient' designation with emergency department services codes of 99281–99285 inclusive. MD visits were selected based on having a 'physician office' place of service coding with an evaluation and management CPT code within the ranges: 90640–90646, 99201–99205, 99211–99215, or 99241–99245. Because disease management programs are designed to treat the patient and related non-catastrophic conditions, all costs were included for hospital IP admissions and ED or MD visits. For one member, an IP admission included all claims on which the dates were consecutive. Only one ED or MD visit was counted if more than one ED or MD claim was found on the same day.

The baseline period was chosen to have the same season and length as the program period. In that manner, the seasonal effect on medical service utilization of patients with asthma was avoided. Since the program participants had different intake dates, the actual starting date of the program period for a particular participant was his or her intake date.

Participants could exit the program at any time. If a member chose to disenroll from the program but stayed in the plan, the member's post-program medical services were included as a part of utilization in the post-program period because the program impact would likely still exist even if the member was not participating in the program.

Utilization rates were calculated for the post-program period and the baseline period by dividing the number of IP admissions, ED, or MD visits, by the average membership for the 12 months in the study. Costs reported in the study reflect approved claim payments from November 1997 through April 1998 and November 1998 through April 1999. The majority of claims and their associated costs occurred in calendar year 1998.

Table I. Demographic and utilization characteristics of patients referred to the McKesson Health Solutions asthma disease management program

	Participants referred to program	Non-participants referred to program	Asthma claimants not referred to program	p-value
No. of patients	313	209	592	
Mean age in years (SD)	20.2 (19.2)	15.4 (16.8)	27.1 (20.1)	<0.0001[a]
Female (%)	58.5	59.3	68.9	0.0021[b]
IP admissions (pre-program period)	80	55	143	0.8059[c]
IP admissions (post-program period)	40	58	179	<0.0001[c]
ED visits (pre-program period)	290	193	586	0.7896[c]
ED visits (post-program period)	208	176	645	<0.0001[c]
MD visits (pre-program period)	776	515	1711	0.0829[c]
MD visits (post-program period)	728	462	1668	0.0019[c]

a F-Test based on one-way analysis of variance.

b Chi-square test.

c Kruskal-Wallis test.

ED = emergency department; **IP** = inpatient; **MD** = hospital outpatient department/physician office.

Return-On-Investment (ROI) Estimates

The following six steps were used to estimate the plan's financial return on investment in the program.

1. Estimate the number of admissions or visits avoided in the program period.
2. Estimate the average cost of an IP admission, ED visit, and MD visit.
3. Estimate avoided plan expenditures by multiplying the number of visits avoided by the average cost of the visit.
4. Estimate total savings by adding IP, ED and MD savings.
5. Determine the expenditures for the participants in the program.
6. Calculate the return on investment (ROI) by dividing the estimated savings by the plan expenditures.

Statistical Analysis and Multivariate Regressions

Table I lists the demographic and utilization characteristics of the three study groups. A one-way analysis of variance (ANOVA) was used to test for differences in mean age across the three groups. The analysis revealed a significant effect for group membership, $F(2,1111) = 32.52$; $p < 0.0001$. The p-value indicates that the null hypothesis – that there is no significant difference for mean age across the three groups – may be rejected.

Table I also indicates that the proportion of females by group was statistically different for the three groups. To check for this difference, a chi-square test was performed. The chi-square value obtained was 12.3664. The associated p-value of 0.0021 indicated that there was one chance in 2100 of obtaining a chi-square value this size (or larger) if the variables were independent. The null hypothesis being tested was that gender and group membership were unrelated. This hypothesis was rejected, and we concluded that gender was related to group membership. In sum, it appears that the three groups differed based on their gender compositions.

The three groups were also compared in terms of the number of IP admissions, ED visits, and MD visits. To perform this comparison, a nonparametric Kruskal-Wallis test was used. The test is especially useful when comparing non-normal distributions, and is based on a rank ordering of the counts or visits. The ranks are then used in a similar manner to continuous data used in a one-way ANOVA model. The null hypothesis to be tested was that the distribution of the response variable was the same for three or more groups. p-Values less than 0.05 would indicate that there were statistically significant differences across the groups, while p-values above 0.05 would suggest no group differences on the response variable being measured. As table I shows, there was no statistical difference in visits and hospital admissions across the three groups in the baseline or pre-program period. There were statistical differences in visits and admissions across the three groups during the program period.

Regression analyses were performed to account for possible confounders and the demographic differences across groups. Possible confounders included age, gender, levels of utilization in the pre-program period, and a person's relative risk score as measured by DxCG® Software. DxCG Inc., whose headquarters are in Boston, Massachusetts, USA, uses a proprietary clinical classification system to risk stratify patients based on clinical similarities derived from administrative claims data. Patients are assigned to diagnostic cost groups based on similar medical problems. Diagnoses rather than procedures are used to describe the level of morbidity and illness burden. A relative risk score is estimated for

each person in the study based on expected resource use. Since age, gender, and all co-morbidities in the claims data are used to generate a person's risk score, the score is based on a range of distinct medical problems and is more comprehensive than just a single measure of disease-specific severity.[14]

Overall, the significant results from the regression analysis included the variable 'group', which indicates that, after controlling for the co-variates of visits or hospital admissions, age, gender, and relative risk score, the designated group membership reliably predicted IP admissions, ED and MD visits during the program period. The one exception to this finding was for the prediction of MD visits when comparing non-participants referred to the program and program participants. Given this exception, all associated probabilities for the variable group were statistically significant ($p < 0.05$). This finding suggests that the program outcomes of reduced IP hospitalizations and ED visits were reliably predicted by program participation versus non-program participation. A more detailed analysis of the regression methodology follows.

Six regression models were estimated. The first three models examined the levels of utilization in the program period for IP admissions, ED visits, and MD visits. These three models estimated the effect of group membership (participants versus non-participants who were referred to the program) on utilization in the program period. The last three models used the same predictive and regressor variables, but compared the effect of group membership based on participants and non-participants who were identified through medical claims data.

The dependent variable was the number of visits (or admissions) that occurred in the program period. Since the dependent variable is a discrete count variable and not continuous, ordinary least squares is not appropriate.[15,16] Given the count nature of the dependent variables, Poisson models were used to estimate the effect of group membership. Poisson models also account for possible confounders. For each study participant, we calculated the actual number of visits in the pre-program period and the equivalent time period during the program period. Explanatory variables included age, gender, utilization in the pre-program period, relative risk score, and a categorical variable (0,1) for group membership, where 0 was used to designate participants and 1 to designate non-participants.

Results

A total of 313 participating members met the plan membership and program inclusion criteria. 255 (81.5%) participants were enrolled in the program for more than 3 months and 58 (18.5%) participants were enrolled for less than 3 months. Based on 12 months total in the pre-program and program periods, the average monthly membership for this group was 298. For the 209 referred members who did not participate in the program, the average monthly membership for the 12 months was 192. Lastly, 592 non-participants who were not referred to the program were identified by claims; their average monthly membership was 555.

Pre-Post Results

Table I documents the basic demographic and utilization characteristics for the three groups. While the groups differed both in age and gender composition, their utilization of medical services in the pre-program period was not statistically different ($p > 0.10$) for IP admissions and ED visits. However, as table I illustrates, a statistically significant difference ($p < 0.05$) in utilization existed for the three groups in the program period. Figure 1, figure 2 and figure 3 also provide a graphic illustration of these utilization differences in the pre-program and program periods. A sizeable reduction in IP admissions and ED visit rates, in particular, was noted for the participant group, while the non-participants generally exhibited increased rates during the program period. The statistical entries in table I, however, do not account for group demographic differences or other risk factors in the pre-program period. To account for these differences, and to test for intervention effect, a series of Poisson regressions was performed, which included pre-period utilization, demographic factors, and scores as co-variates in the predictive models.

Figures 1–3 show the baseline and post-program period IP admission rates, ED visit rates, and MD visit rates. Figure 2 shows that the IP service utilization rates clustered in the pre-program period, which suggests similar utilization rates across the groups before program implementation. During the program period, however, the between-group rates exhibited a much greater dispersion, with the participant group's rates dropping 50% and the non-

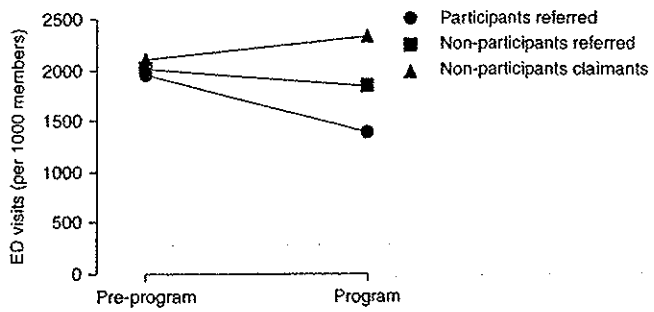

Fig. 1. Annualized emergency department (ED) visit rates for McKesson Health Solutions asthma disease management program participants, non-participants referred, and non-participant claimants in pre-program and program periods.

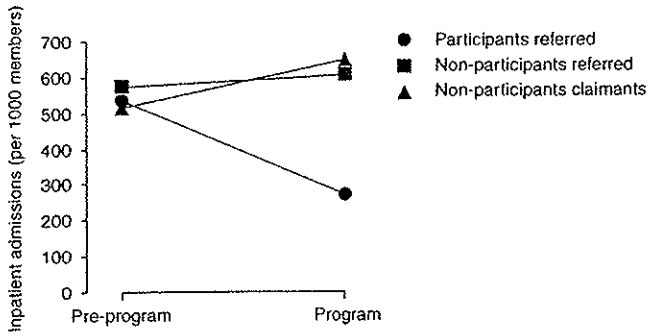

Fig. 2. Annualized inpatient admission rates for McKesson Health Solutions asthma disease management program participants, non-participants referred, and non-participant claimants in pre-program and program periods.

participant groups rising as much as 25% for those non-referred members identified through the medical claims data.

The same general clustering of ED visit rates in the pre-program period is evident in figure 1. During the program period, however, the participant group experienced a 28% decrease, while non-referred members showed a slight decrease of 8.8% and the non-participants identified from claims exhibited an increase of 10.1%.

Figure 3 depicts the MD visit rates. This service area also shows that the participant group rates decreased by 6.2%. At the same time, all three groups showed little change in MD utilization rates between the pre-program and program periods. This suggests that the primary goal of reduced inpatient hospitalizations and ED visits was met, but not at the expense of MD consultations and visits, which showed only slight reductions over time.

Multiple Regression Results

The statistical output from the Poisson regression models is presented in table II and table III. Table II shows the statistics from regression models that compare the participant group with the referred non-participants. Table III shows the output of regression models that compare the participant group with the non-referred, non-participants identified by medical claims data.

Since the unit of analysis in tables II and III is the individual, the coefficients indicate the unit change in the dependent variable while controlling for the other regressors in the equation. For example, the coefficient of 0.0854 for the group in the first equation in table II indicates that, for one person, the number of IP admissions increases by that amount, holding all other variables at the same level. Alternatively, this can be expressed as a *decrease* of 85.4 hospitalizations per 1000 ($p < 0.05$) for the participant members relative to the non-participants, controlling for the other regressors in the equation. Table II points to a decrease of 137.4 ED visits per 1000 ($p < 0.05$) for the participant members relative to the non-participants referred to the program. The third equation in table II indicates an increase for the participants of 5.3 MD visits per 1000 relative to the non-participant group. This last coefficient, however, is not statistically significant at a p-value of < 0.10.

Table III compares participants with non-participants who were not referred to the program. The statistics for these equations support the data presented in table II, including the visit rates presented in figures 1–3. In terms of IP admissions, we would expect a reduction of 81.2 per 1000 persons for participants relative to the non-participants. ED visits would also be expected to decrease 313.3 visits per 1000 members for the participants. Finally, MD visits for the participants relative to the non-referred, non-participants, will drop 304.2 visits per 1000 members ($p < 0.05$) in the program period.

Excepting the results of the third regression model, the data in tables II and III indicate that, after controlling for initial demographic and risk differences, the coefficient of the group variable has an expected sign and is statistically significant for all models at $p < 0.05$. This indicates that utilization in the post-program period is reliably predicted by group membership after controlling for demographic and risk variables. Substantively, the effect of the asthma program on participants' IP and ED utilization was very favorable compared with that of either of the non-participant groups.

Additionally, the coefficients for nearly all models have the anticipated sign and level of significance ($p < 0.05$), indicating that a higher relative risk score in the pre-program period reliably predicts higher levels of utilization in the program period. Table IV summarizes the relative changes in utilization of the participant group relative to both the non-participant groups.

For ROI calculations, the utilization of IP, ED and MD services from the participating members is summarized in table V. For participants in the program, utilization of hospital IP services

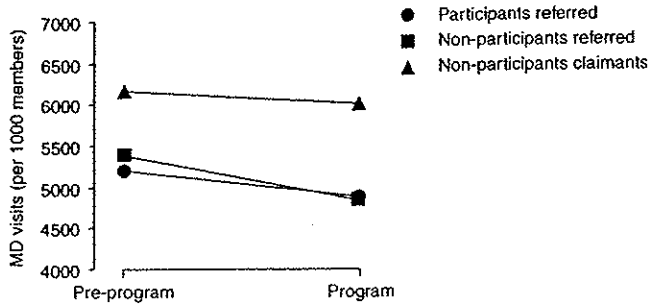

Fig. 3. Annualized hospital outpatient department/physician office (MD) visit rates for McKesson Health Solutions asthma disease management program participants, non-participants referred, and non-participant claimants in pre-program and program periods.

Table II. Output from Poisson regression models – analysis of parameter estimates. Comparison of participants with non-participants referred to the McKesson Health Solutions asthma disease management program

Parameter	Estimate	p-value
Regression model 1 (dependent variable: IP hospital admissions in program period)		
Intercept	0.0241	0.1694
IP admissions	0.1831	0.0026[a]
Age	0.0024	0.0100[b]
Gender	−0.0173	0.3985
Group	0.0854	0.0145[b]
Relative risk score	0.0166	0.0218[b]
Regression model 2 (dependent variable: ED visits in program period)		
Intercept	0.3242	< 0.0001[a]
ED visits	0.2436	< 0.0001[a]
Age	−0.0014	0.4566
Gender	0.0296	0.6791
Group	0.1374	0.0455[b]
Relative risk score	0.0474	< 0.0001[a]
Regression model 3 (dependent variable: MD visits in program period)		
Intercept	0.5962	< 0.0001[a]
MD visits	0.5149	< 0.0001[a]
Age	0.0042	0.2555
Gender	0.2620	0.0249[b]
Group	−0.0053	0.9627
Relative risk score	0.0616	< 0.0001[a]

a $p < 0.01$.

b $p < 0.05$.

ED = emergency department; **IP** = inpatient; **MD** = hospital outpatient department/physician office.

decreased by 50%, utilization of hospital ED services decreased by 28%, and utilization of outpatient MD services decreased by 6%. Table VI outlines the steps and results of the ROI analysis. These results show that for each dollar invested in the program, the health plan generated a return of 131%.

Discussion

The current study focused on the changes in medical care utilization for three groups of identified Medicaid members with asthma: (i) those members who participated in the asthma program (n = 313); (ii) members referred to the program who could not be contacted, or who elected not to participate (209); and (iii) non-participating, non-referred members who were identified through the medical claims data provided by the healthcare plan (592).

The three identified groups differed significantly over time across the three medical service areas of inpatient admissions, ED visits, and MD visits. These differences are most notable in the magnitude of reduced inpatient hospitalizations and ED visits for the asthma program participant group. At the same time, the two comparison groups experienced increased hospitalizations and, based on both comparison groups combined, increased ED visits. The differences of IP and ED utilization between the participants and non-participants in the program period were reliably predicted by group membership after controlling for pre-program differences in demographics and relative risk scores.

As the data in table V and figures 1–3 reveal, the program participants experienced a 28% reduction in ED visit rates, a 50%

Table III. Output from Poisson regression models – analysis of parameter estimates. Comparison of participants in the McKesson Health Solutions asthma disease management program with non-participants identified through medical claims

Parameter	Estimate	p-Value
Regression model 4 (dependent variable: IP hospital admissions in program period)		
Intercept	0.0294	0.1325
IP admissions	0.1343	0.0009[a]
Age	0.0040	< 0.0001[a]
Gender	−0.0258	0.2057
Group	0.0812	0.0022[a]
Relative risk score	0.0123	0.0065[a]
Regression model 5 (dependent variable: ED visits in program period)		
Intercept	0.2633	< 0.0001[a]
ED visits	0.3469	< 0.0001[a]
Age	0.0001	0.9588
Gender	0.1351	0.0272[b]
Group	0.3133	< 0.0001[a]
Relative risk score	0.0134	0.0327[b]
Regression model 6 (dependent variable: MD visits in program period)		
Intercept	0.7301	< 0.0001[a]
MD visits	0.5489	< 0.0001[a]
Age	0.0039	0.1592
Gender	0.1213	0.2455
Group	0.3042	0.0015[a]
Relative risk score	0.0096	0.1629

a $p < 0.01$.

b $p < 0.05$.

ED = emergency department; **IP** = inpatient; **MD** = hospital outpatient department/physician office.

Table IV. Relative changes in utilization during program period for participants versus non-participants[a] in the McKesson Health Solutions asthma disease management program

Comparison group	Relative change of participant group to comparison group for program period		
	IP admissions	ED visits	MD visits
Members with asthma who were referred but who did not participate in the program	−85.4	−137.4	+5.3
Members who did not participate in the program identified by asthma claims	−81.2	−313.3	−304.2

a Based on output from Poisson Regression Models. Rates based on admissions or visits per 1000 members.

ED = emergency department; IP = inpatient; MD = hospital outpatient department/physician office.

reduction in inpatient hospitalization rates, and a 6.2% reduction in MD visit rates. The non-participants identified through the medical claims data, however, experienced an increase of 10.1% in ED visit rates, an increase of 25.5% in inpatient hospitalizations, and a slight (2.5%) reduction in MD visit rates. During the same time, the non-participating group referred to the program experienced a decrease of 8.8% in ED visit rates, an increase of 5.6% in inpatient admission rates, and a 10.3% reduction of MD visits.

These data also suggest that a central program objective of reduced inappropriate IP admissions and ED visits has been met. Since these two service areas are likely to account for the largest volume of avoidable healthcare expenditures, reduction of overall utilization in both areas contributes to reduced costs and effective use of healthcare resources.

Changes in medical service utilization represent savings to the health plan as a result of reductions in reimbursement for these services. Estimates of average plan expenditures for the services were used to assess the amount of plan savings associated with the utilization changes. We estimated that the changes in medical service utilization resulted in $US116 340 savings and an ROI of 131%.

The MHS asthma disease management program provides comprehensive information and counseling on asthma self-management practices through a number of integrated program components. This study has suggested that implementation of an asthma program is associated with reductions in utilization of hospital IP, hospital ED and MD office services. The substantial reduction in hospital IP and ED utilization for participants demonstrates that the asthma program may be highly effective for Medicaid members, in addition to non-Medicaid populations discussed in the literature[17-20] in recent years.

Table V. Utilization of hospital inpatient services in the McKesson Health Solutions asthma disease management program (annual number of admissions per 1000 members)

	Average no. of members during the program period[a]	Baseline utilization rate[a]	Program utilization rate[a]	% change
IP utilization				
Participants	298	537	270	−50.0
Non-participants referred to program	192	574	606	+5.6
Non-participants identified through medical claims	555	515	645	+25.2
ED utilization				
Participants	298	1947	1397	−28.2
Non-participants referred to program	192	2016	1838	−8.8
Non-participants identified through medical claims	555	2112	2325	+10.1
MD utilization				
Participants	298	5211	4889	−6.2
Non-participants referred to program	192	5379	4825	−10.3
Non-participants identified through medical claims	555	6167	6012	−2.5

a Figures have been rounded to the nearest digit.

ED = emergency department; IP = inpatient; MD = hospital outpatient department/physician office.

The implications of this study may have relevance to both payors and providers for Medicaid beneficiaries. Because the annual growth rate in total Medicaid spending in the US has been increasing since 1995 and, most recently in 2002, was more than four times the growth rate reported for the period 1995–1997,[21] states have come under increasing pressure to curtail the growth of expenditures. Indeed, given the anticipated state budget deficits projected for 2004, millions of recipients face the risk of losing existing Medicaid coverage.[22]

At the same time, physicians have been struggling in recent times with progressively declining reimbursements combined with the increased costs of doing business. The proportion of physicians serving Medicaid patients in 1997 was 87.1%. This percentage had dropped to 85.4% in 2001.[23] Low reimbursements coupled with increasing costs have resulted in a number of physician practice closures in the US during the last four years.[24]

The findings of the current study suggest that asthma disease management programs may provide a cost-effective approach to managing Medicaid recipients with asthma and related chronic conditions. And, while the estimated ROI of 131% is not high, this figure may reflect the complexity and challenges of managing poor populations, including the reimbursement policies of state agencies, federal agencies, and health maintenance organizations that manage Medicaid recipients. Finally, rather than limiting access by making it more difficult to qualify for Medicaid, or cutting reimbursements to physicians, states have begun to address escalating costs and quality of healthcare delivery by hiring outside contractors who specialize in the management of populations with chronic conditions.

While this retrospective comparison has pointed to the positive outcomes of the MHS asthma program, there exists in this study the likelihood of a multiple-group threat to internal validity based in part on selection bias. Unfortunately, given the current retrospective approach, which relies principally on medical claims data, there is no assured way of controlling for selection bias. At the same time, for reasons described below, we believe that selection-regression artifacts have had a very insignificant effect on the study results.

In an attempt to reduce these threats, we used two comparison groups to help rule out the single group threats to internal validity. In terms of regression artifacts, the results of the IP utilization analysis strongly suggest that the utilization outcomes result from program impact as opposed to regression toward the mean. Regression might explain, for example, why the mean of the participant group moves toward the mean of the control groups in the post-program period, but not why the 'crossover' effect exists. The crossover pattern evident in figure 2 suggests the minimum influence of regression artifacts and represents a very strong argument

Table VI. Return-on-investment (ROI) estimates for the McKesson Health Solutions asthma disease management program

Savings from IP services		
Step 1	Number of hospital admissions avoided	40
Step 2	Determine the average cost of an admission	$US2500
Step 3	Estimate avoided plan expenditures (number of admissions avoided × average cost)	$US100 000
Savings from ED services		
Step 1	Number of ED visits avoided	82
Step 2	Determine the average cost of an avoided visit	$US170
Step 3	Estimate avoided plan expenditures	$US13 940
Savings from MD services		
Step 1	Number of visits avoided	48
Step 2	Determine the average cost of an avoided visit	$US50
Step 3	Estimate avoided plan expenditures	$US2400
Calculating ROI		
Step 4	Total plan savings	$US116 340
Step 5	Estimated plan expenditures for the program	$US88 717
Step 6	Estimated ROI	131%

for a program effect. The divergence of ED utilization rates in the program period also attests to the likelihood that mean regression has had a minimal influence on study results. Although the MD rates for the entire population decreased 4.8% between the two time periods, those of the participant group decreased even more (6.2%), which indicates a relative movement away from the population mean for participants during the program period. That regression artifacts are likely to have a minimal influence in this study is further reinforced by the use of multiple regressions, which shows that the participant group has experienced decreased rates of utilization *relative to* the comparison groups in five of the six models.

Overall, the program period differences in utilization are reflected not only in the participant group's reduced utilization rates, but also in the comparison groups' tendency toward *increased* rates of IP hospitalizations and ED visits. We noted that there was no statistically significant difference in $D_xCG^{®}$ relative risk scores across the three groups in the pre-program period. Because these scores are based on medical claim expenditures, and would likely capture important group differences in the pre-program period, we have increased confidence that the groups were comparable in terms of costs and disease severity in the pre-program period.

Based on the similar utilization rates in the pre-program period, there is also reason to believe that the three groups were generally comparable prior to the program intervention. Finally, statistical adjustments have been made by regression equations that control for other demographic differences.

This study is based on a limited time framework; as such, it may result in not fully capturing the outcomes associated with the program intervention. There is the possibility that the program effects would naturally diminish over time. However, the current asthma program, in common with other disease management programs offered by MHS, is designed to monitor and educate on a continuing basis. In this respect, the 'intervention' is ongoing, and we would expect to see additional cumulative beneficial effects of this program over time.

An additional limitation is that recipients have been selected from one region of the US and may therefore represent the idiosyncratic nature of health services administration in that region. Although each state has been given latitude in how its programs are administered, there remain an increasing number of policies and procedures at both the state and federal level that would tend to limit the variation in how this insurance plan is administered. In this regard, the findings from one region may not differ substantially from others across the nation.

Because the client data did not include information at the physician and clinic level, it is not possible to measure the effects of clustering of services around physicians or clinical sites. The degree to which variability exists across physicians and sites would not be captured by the regression models, and, therefore, the inferences made regarding program outcomes would require that this limitation be recognized. Additionally, the regression models themselves rely on observable measures. To the extent that unobservable measures affected the reported outcomes, the conclusions drawn from this study must be considered with caution.

The program evaluation and financial outcomes reported in this study indicate that the estimated ROI for the program period was 131%, notwithstanding the relatively small numbers under investigation and the short time period for the evaluation. At the same time, we believe the ROI to be a conservative estimate since the full program effect would also reflect changes in outpatient services that were not included in this study.

We believe the study has filled a gap in the literature concerning the administration of disease management programs to Medicaid populations, most notably for those recipients enrolled in a Medicaid managed care health plan. While various articles have documented disease management programs and outcomes with commercial populations, few have analyzed the outcomes associated with Medicaid populations. Given projected budget constraints for most states, and the fact that the percentage of Medicaid managed care enrollment is near 60% in the US,[25] the need for future research on disease management programs for Medicaid populations remains quite compelling.

Conclusion

This study suggests that an effectively designed asthma disease management program may be expected to create very positive economic and behavioral outcomes for Medicaid health plan members. Future studies that focus on disease management outcomes with Medicaid members should provide an important resource base from which health plans and agencies can evaluate economic, clinical, and behavioral outcomes.

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References

1. Gillespie JL. The value of disease management – part 3: balancing cost and quality in the treatment of asthma. Dis Manag 2002; 5: 225-32
2. National Pharmaceutical Council. Pharmaceutical benefits under state medical assistance programs. 1998 Dec
3. Finklestein JA, Barton MB, Donahue JG, et al. Comparing asthma care for Medicaid and non-Medicaid children in a health maintenance organization. Arch Pediatr Adolesc Med 2000; 154: 563-8
4. Center for Health Care Policy and Evaluation. Research findings 1998 [online]. Available from URL: http://www.centerhcpe.com/researchfindings/rfnov1998.html [Accessed 2003 Jun 16]
5. Lieu TA, Lozano P, Finkelstein JA, et al. Racial/ethnic variation in asthma status and management practices among children in managed Medicaid. Pediatrics 2002; 109: 857-65
6. Finkelstein JA, Lozano P, Farber HJ, et al. Underuse of controller medications among Medicaid-insured children with asthma. Arch Pediatr Adolesc Med 2002; 156: 562-7
7. Ortega AN, Calderon JG. Pediatric asthma among minority populations. Curr Opin Pediatr 2000; 12: 579-83
8. Centers for Disease Control and Prevention – National Center for Health Statistics. Asthma prevalence, health care use and mortality, 2000-2001 [online]. Available from URL: http://www.cdc.gov/nchs/products/pubs/hestats/asthma/asthma.htm.
9. ALA Data and Statistics – Trends in Asthma Morbidity and Mortality. 2001 [online]. Available from URL: http://www.lungusa.org/data/asthma/asthmach_chm.html [Accessed 2003 Jun 30]
10. Mannino DM, Homa DM, Pertowski CA, et al. Surveillance for asthma---United States, 1980-1999. CDC Surveillance Summaries, March 29, 2002. MMWR 2002; 51 (SS01): 1-13
11. Pappas G, Hadden WC, Kozak LJ, et al. Potentially avoidable hospitalizations: inequalities in rates between US socioeconomic groups. Am J Public Health 1997; 97: 811-6
12. Friday Jr GA, Khine H, Lin MS, et al. Profile of children requiring emergency treatment for asthma. Ann Allergy Asthma Immunol 1997; 78: 221-4
13. Hartert TV, Windom HH, Peebles Jr RS, et al. Inadequate outpatient medical therapy for patients with asthma admitted to two urban hospitals. Am J Med 1996; 100: 386-94
14. Zhao Y, Ash A, Ellis R, et al. Disease burden profiles: an emerging tool for managing managed care. Health Care Manag Sci 2002; 5: 211-9
15. Greene W. Econometric analysis. 4th ed. New Jersey: Prentice Hall. 2000

16. Rothman KJ. Greenland S. Modern epidemiology. 2nd ed. Philadelphia (PA): Lippincott Williams & Wilkins, 1998
17. de Oliveira MA, Bruno VF, Ballini LS, et al. Evaluation of an educational program for asthma control in adults. J Asthma 1997; 34: 395-403
18. Sondergaard B, Davidsen F, Kirkeby B, et al. The economics of an intensive education program for asthmatic patients: a prospective controlled trial. Pharmacoeconomics 1992; 1: 207-12
19. Bolton MB, Tilley BC, Kuder J, et al. The cost and effectiveness of an education program for adults who have asthma. J Gen Intern Med 1991; 6: 401-7
20. Clark NM, Feldman CH, Evans D, et al. The impact of health education on frequency and cost of health care use by low income children with asthma. J Allergy Clin Immunol 1986; 78: 108-15
21. Smith VK. Medicaid and state budgets in a changing health care marketplace [online]. Available from URL: http://www.michiganmedicaid.org/docs/Handouts2.pdf [Accessed 2003 Jun 16]
22. Doherty RB. New college report shows access problems are growing [online]. Available from URL: http://www.acponline.org/journals/news/feb03/access.htm [Accessed 2003 Jun 16]
23. Cunningham P. Mounting pressures: physicians serving Medicaid patients and the uninsured: 1997-2001. Track Rep 2002 Dec; 6: 1-4
24. Massachusetts Medical Society Online. Critical conditions executive summary: physician practices and the future of Massachusetts health care [online]. Available from URL: http://www2.mms.org/pages/cc_summary.asp [Accessed 2003 Jun 16]
25. Centers for Medicare and Medicaid Services. 2001 Medicaid managed care enrollment report [online]. Available from URL: http://www.cms.gov/medicaid/managedcare/mmcss01.asp [Accessed 2003 Jun 16]

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