

Disease Management Program Improves Asthma Outcomes

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Abstract

Objective: To show that a disease management program that empowers patients with asthma to participate in the management of their condition can improve quality of life and reduce the use of medical services.

Study Design: Utilization and quality-of-life data were tracked to identify outcome changes in patients with moderate to severe asthma. Baseline measures were used as a control and were compared with measures taken at 6 and 12 months after enrollment.

Patients and Methods: Study participants were from a single Medicaid managed care plan in western Pennsylvania. Patients' quality of life during their participation in the program was tracked through an outside pharmacoepidemiologic research firm. Utilization data were updated with every interaction between a patient and case management nurse.

Results: Both quality-of-life and utilization data show statistically significant improvements at 6 months. Further, 12-month data show improvement that is statistically significant in all measures with the exception of the adult quality-of-life measure, where a small sample size limited the statistical results.

Conclusions: A collaborative, proactive approach to asthma management improves patients' quality of life and reduces use of costly medical services.

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In the last generation, noninfectious diseases rapidly surpassed infectious diseases as the dominant adversary in healthcare.^{1,2} This shift challenges us to evaluate the traditional infectious-disease approach to care.^{3,4} Chronic diseases—asthma, in particular—require new management strategies that go beyond acute care. Asthma is estimated to affect more than 15 million Americans. In 1995 alone, asthma caused more than 1.8 million visits to the emergency room (ER).⁵ It is the most common pediatric chronic disease⁶ and accounts for approximately 13 million doctor visits and 200,000 hospitalizations annually among those under 18 years of age.⁷

The classic acute-care approach to chronic disease often does not address the day-to-day self-management needs of the patient. It has been suggested that between 90% and 95% of healthcare decisions about chronic conditions like asthma are made by the patients themselves.⁴ These decisions vary in importance, from when to take a medication to when to visit an ER.

The effects of asthma (ie, morbidity and mortality) have greater impact on inner-city and economically disadvantaged populations. Research has shown that patients and guardians in these populations often lack the knowledge needed to make appropriate daily decisions about their disease.⁸ One investigation of inner-city populations showed that most parents of asthmatic children became aware of asthmatic episodes only after their children began to suffer from late-stage symptoms, such as wheezing and shortness of breath.⁸ Furthermore, only half of the parents studied were able to identify the appropriate use of albuterol, and less than a quarter could identify the appropriate use of steroids.⁸ One often-cited reason for this lacking decision-making capability is an absence of continuity of care within these communities. Clearly, a system of care that provides edu-

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cation and reinforcement from trained professionals would positively influence patients' and guardians' daily health decisions.⁹

The *National Jewish Medical and Research Center Disease Management Program: Asthma (DMP: Asthma)* addresses continuity of care by integrating traditional treatment methods with a disease management program that focuses on creating a partnership between the patient and the healthcare team. The program incorporates practice guidelines outlined in recent reports by The National Heart, Lung, and Blood Institute (NHLBI) at the National Institutes of Health.¹⁰ The goal of the program is to empower patients with the tools and resources they need to comply with their treatment protocol. For people with moderate to severe asthma, *DMP: Asthma* accomplishes this goal through its Disease Specific Care Management (DSCM) program. This program:

- Identifies and addresses patient's educational needs;
- Reinforces an Asthma Action Plan created for the patient by the primary care physician;
- Provides support services, such as asthma education materials paired with peak flow meters, to guide the patient into long-term monitoring;
- Helps teach patients, via home health visits, environmental control measures to reduce exposure to known triggers;
- Provides open communication between patients, physicians, and nurses through telecommunication.

DMP: Asthma provides patients with the knowledge, skills, and resources necessary to control symptoms or seek help during more extreme disease exacerbations. This paper describes the results of a 1-year intervention through *DMP: Asthma*, purchased by a managed care plan in Pennsylvania for a specific high-risk Medicaid population that were high utilizers of healthcare services.

Table 1. DSCM Program Stratification Model

<p>Moderate Asthma</p> <ul style="list-style-type: none"> ■ Recurrent nighttime awakening with respiratory symptoms occurring 1 to 3 times/week ■ Best prebronchodilator FEV₁ or peak flow within 60%-80% of baseline (Varies 20%-30% when symptomatic) ■ Overuse of inhaled β-agonist ■ One to 2 ER/urgent care visits in past year ■ One asthma-related hospitalization in the past year <p>Severe Asthma</p> <ul style="list-style-type: none"> ■ Recurrent nighttime awakening with respiratory symptoms occurring >3 times/week ■ Best prebronchodilator FEV₁ or peak flow range is < 60% of baseline (Highly variable: 20%-30% changes with routine medication) ■ Use of β-agonist more frequently than every 4 to 6 hours with minimal relief ■ Asthma-related hospitalizations ≥2 times in the past year ■ Asthma exacerbations occurring >2 times/week despite aggressive therapy ■ High dose of inhaled corticosteroid >2 months ■ Short bursts of corticosteroids >4 times in the past year ■ Daily or alternate-day oral corticosteroid therapy ■ Severe corticosteroid side effects ■ Previous ICU admissions for asthma ■ Previous intubation related to asthma ■ Cost of medical care >\$15,000/year for asthma ■ ER/urgent care visits >2 times/year

DSCM = Disease Specific Care Management; FEV₁ = forced expiratory volume in 1 second; ER = emergency room; ICU = intensive care unit.

... METHODS ...

Patient Member Identification

Asthma patients considered for participation in this program were members of a single Medicaid managed care plan in western Pennsylvania. The total population of the plan grew from approximately 25,000 to 55,000 members during the year in which the program was implemented. Potential participants were identified from a pool of all plan members with any *International Classification of Disease (ICD)-9* code for asthma. All patients under the age of 12 years with a code for chronic airway obstruction, dyspnea and respiratory abnormalities, or chronic bronchitis were flagged. All patients with any asthma-related hospitalization or ER visit during the preceding 12 months were invited to participate in the program. Patients who were not initially identified but who were later either hospitalized for asthma or counseled on the plan's triage telephone line were immediately

referred for enrollment into *DMP: Asthma*. Additional participants came from self-referrals or physician referrals.

Patient data for the 12 months prior to the start of the program for all participants were gathered from the managed care plan. Patients were also contacted directly to ascertain previous utilization, work- or school-related absenteeism, symptom severity (including frequency of nocturnal awakenings, wheezing, coughing, etc), and self-management skills. Pennsylvania Medicaid data were used to verify patient self-reports whenever possible.

After the patient was enrolled in *DMP: Asthma*, all patient-specific hospitalization and ER claims data were reported to National Jewish Medical and Research Center (or "National Jewish") within 30 days. These data were incorporated into the post-intervention utilization and absenteeism data pool, and the data pool was updated with every nurse / patient interaction. (DSCM targeted guardians of patients less than 15 years of age.) Table 1 outlines the criteria for classifying asthma severity.

Intervention through *DMP: Asthma*

DMP: Asthma has 4 major components: education, care management, home healthcare, and data management. These components are governed by 2 basic philosophies. First, the physician is at the center of all treatment strategies for the patient. Second, a written and frequently updated Asthma Action Plan (AAP) guides all treatment irrespective of the clinical state.

Physician Education. Educational programs were provided for physicians and allied health professionals. The main tenets of these programs are:

1. Asthma is a chronic inflammatory disease.
2. Environmental factors are related to the variant pattern of asthma and can be addressed.
3. Asthma therapy must correlate to the level of inflammation and the clinical state of the patient.
4. Prophylactic anti-inflammatory therapy is mandatory for all patients with persistent asthma.
5. A written AAP is the guide for patients in both the stable and unstable states.
6. Patients must be informed to make rational and logical decisions regarding asthma care.

A 3-hour educational session, providing 3 continuing medical education hours, was offered for primary care physicians and specialists. Physician office staff and allied health professionals involved in patient education were also encouraged to

attend. These meetings were conducted by the *DMP: Asthma's* medical director and a respiratory nurse specialist and provided an overview of the disease management program, a review of the physiology of asthma, and a review of NHLBI guidelines. Discussion of the AAP, the role of steroids in the chronic and acute management of asthma, and the use of home monitoring devices took place in smaller breakout groups. Further support for the physicians was provided through a telephone consultation service. This 800 number (or Internet access) provided the physician with access to National Jewish pulmonologists or allergists for consultation on complex cases.

A select group of participating pediatricians, allergists, pulmonologists, and primary care physicians who were well regarded in the medical community were recommended by the Pennsylvania plan for participation in *DMP: Asthma's* Physician Champion program. Those that accepted the invitation spoke in support of *DMP: Asthma* during the physicians' educational seminar and at other forums within the medical community.

Patient Education. Patients received published educational materials written in either low (4th grade) or moderate (10th grade) literacy levels. Topics covered in these publications included:

- Understanding asthma;
- Identifying triggers of asthma;
- Recognizing asthma signs;
- Peak flow monitoring;
- Managing medication and supplies; and
- Allergic reactions to animals, dust mites, mold, and pollen.

Care Management. Disease-specific care management, implemented through a team of highly specialized respiratory nurses, was provided for patients with moderate and severe persistent asthma. Care management began at the time of enrollment with an entry questionnaire. This instrument was designed to help the nurse ascertain the patient's current health management strategies, health status, and educational needs by gathering information on the patient's asthma history, symptoms, medical history, current prescriptions, use of asthma management tools such as a spacer or peak flow meter, understanding of asthma, and family support system. Through this assessment, care managers determined when patients needed moderate or more aggressive intervention.

Patients received between 4 (moderate asthma) and 6 (severe asthma) proactive calls annually from care management nurses. These proactive calls offered opportunities for asthma education while providing the care managers time to assess the patients' health status. During these calls, care managers reviewed the patient's AAP and verified that the patient had the resources needed to prevent and treat an attack at home. Patients were encouraged to contact nurses when they were symptomatic. Such reactive calls triggered reinforcement of early intervention and allowed the nurses to assist patients in implementing their AAP. Patients who called when experiencing a change in their condition received follow-up telephone calls from their care manager to ensure that appropriate care was being pursued.

In a timely manner, physicians received reports from the care managers summarizing patients' status and providing healthcare utilization and productivity data as reported by the patient. This occurred after every contact between patient and care manager.

Home Healthcare. National Jewish worked closely with local home healthcare companies to provide 2 home health visits for each patient enrolled in the program. The information and education provided to all agencies was standardized. These visits were used to evaluate patients' health status, assess patients' ability to manage their asthma, and provide each patient with in-home education.

The first home health visit occurred within 4 weeks of enrollment. During this visit, home health nurses reviewed the asthma process (including a discussion of inflammation as a primary disease component), identified early warning signs, discussed the patient's medication, and reviewed the AAP. Further, during this visit, home health providers helped patients assess their home environment for asthma triggers, taught patients environmental control measures, and demonstrated the correct use of a peak flow meter and metered-dose inhaler.

During the second home visit, the nurse again reviewed asthma symptoms, the AAP, peak flow monitoring, metered dose inhaler technique, and environmental triggers. Nurses identified any need for further education during this visit and determined whether additional home health visits were required. All information obtained during the home health visits was shared with the care managers.

Data Management. The effectiveness of the program was continuously monitored through data analyses. Direct utilization of resources, including hospitalization, intensive care unit (ICU) admissions, ER visits, and urgent doctor visits were

tracked. School absenteeism was monitored, along with days missed from work for both adult patients and caretakers of pediatric patients. Further, quality of life was tracked to identify the impact of DSCM's interventions on the patients' day-to-day emotional and functional well-being.

Baseline utilization, absenteeism, and quality-of-life data were collected by care managers during the initial telephone encounter with the patient or guardian. To mitigate data bias from nursing intervention, care was taken to ensure that data were gathered prior to any educational discussion. Care managers gathered utilization and absentee data for the 6-month period preceding enrollment. Care managers instructed patients to recall incidents that occurred "during the past 6 months."

The baseline data pool served as the control, and data gathered between enrollment and 6 months and between months 6 and 12 served as the experimental data sets. The 6- and 12-month experimental data were collected at each encounter with a patient. Thereafter, patients were asked to recall occurrences "since the last time I spoke with you." Per the protocol, all follow-up data for the pediatric population were gathered through the same guardian that provided baseline information.

Follow-up quality-of-life and patient satisfaction data, also collected by telephone, were gathered by an outside research center at 6-month intervals after enrollment. Quality of life was measured for adult patients through the Asthma Quality of Life Questionnaire (AQLQ),¹¹ and for guardians of pediatric patients through the Pediatric Asthma Caregiver's Quality of Life Questionnaire (PAC-QLQ).¹² Both surveys have been demonstrated to be sensitive to quality-of-life changes in an individual when followed over time.^{11,12} The AQLQ uses a 5-point, 0-to-4 scale for 20 questions. Patients are asked to respond to questions based on how asthma impacted their life over the preceding month; 0 represented "not at all" and 4 represented "very severely." Subsets of questions measured total score, breathlessness and physical restrictions, mood disturbance, social disruption, and concerns for health. Subscale scores were determined by averaging the mean of questions in the scale and then rescaling them to a possible 0 to 10. PAC-QLQ is a 13-question survey designed to measure overall quality of life, emotional function, and activity limitation of guardians of asthma patients. Responses to all questions fall within a 7-point scale where 1 means "all of the time" and 7 means "none of the time." Questions examined

how children with asthma impacted parents' physical and emotional well-being. Within each subscale, questions were weighted equally so means could be averaged to calculate scores.

All data were evaluated at 6 and 12 months to assess the effectiveness of the intervention. Since the median response for many of the utilization and productivity components were zeros at baseline and 6 and 12 months, a signed rank test was used to determine the statistical significance of the changes. Baseline utilization and productivity data (6 months prior to enrollment through the date of enrollment) were compared with 6-month data (enrollment through 6 months after enrollment) and then again to 12-month data (6 months after enrollment through 12 months after enrollment). Quality-of-life data were analyzed for significance using a paired *t*-test since each difference in the sample was independent, and the differences were normally distributed.

Utilization costs were derived from a survey of hospitals and allergists' offices in the Denver area. Billing quotes from each source were averaged and then multiplied by 0.75 to determine an estimated managed care reimbursement. Bureau of Labor wage statistics were used to generate a daily cost for adult and caretaker days missed from work.¹³

... RESULTS ...

Utilization and Performance

Six-month utilization and productivity data were based on responses from 317 patients who completed at least 6 months in the program. The data set was 61% female, 39% male, 47% adult (≥15 years of age), and 53% pediatric.

Figure 1 summarizes aggregated 6-month utilization and productivity data. All indices showed substantial reductions from baseline, and adult days missed from work dropped by over 85%. The financial benefits of these reductions, both direct and indirect, total more than \$400,000. After an average adjusted case rate of approximately \$303 per 6 months, benefits remained far ahead of costs (Table 2).

Sixty-two patients from the group completed 12 months in DSCM. Figure 2 presents their aggregated results. Both adult and caretaker days missed dropped by over 90%.

Quality of Life

- Ninety-five adult and 96 pediatric DSCM participants provided 6-month quality-of-life data. The remaining members were not included because they either refused to participate in outcomes

Figure 1. Baseline and 6-Month Utilization Data (n=317)

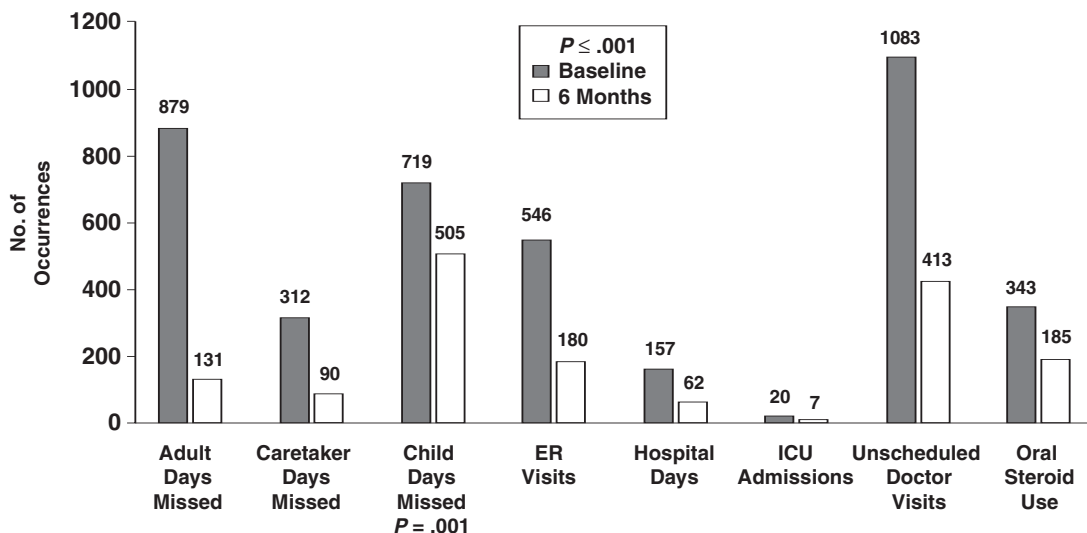


Table 2. 6-Month Cost Benefits (n=317)*

		Difference Between Baseline and Followup	
Direct Cost Savings			
ER Visits	@ \$ 450 each [†]	366	\$ 164,700
Hospital Days	@ \$ 825 each [†]	95	\$ 78,375
ICU Admissions	@ \$2250 each [†]	13	\$ 29,250
Unscheduled Doctor Visits	@ \$ 130 each [†]	670	\$ 87,100
Subtotal			\$ 359,425
Indirect Cost Savings			
Adult Days Missed	@ \$ 89.08 each [†]	748	\$ 66,632
Caretaker Days Missed	@ \$ 89.08 each [†]	222	\$ 19,776
Child Days Missed From School	(214 days saved)	214	
Subtotal			\$ 86,408
Total Direct and Indirect Savings			\$445,833
Service Fees			
Average Adjusted Case Rate	@ \$303 ea. for 6 months		\$ 96,051
Subtotal			\$96,051
Net Savings	Total Savings – Program Costs		\$349,782

*Utilization costs were derived from a survey of hospitals and allergists' offices. Billing quotes from each source were averaged and then multiplied by 0.75 to acquire an estimated managed care reimbursement amount.

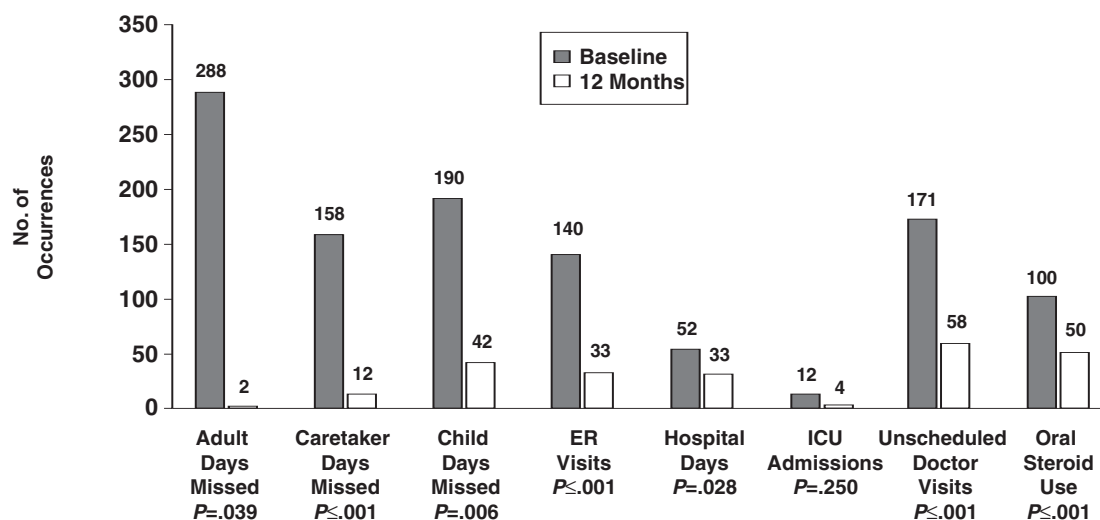
[†]Salary calculated from Bureau of Labor Statistics, Feb 1999.

tracking or were unavailable for follow-up after at least 5 contact attempts.

Six-month adult quality-of-life results (Table 3) showed improvements that were statistically significant in all subscales. We observed the most significant improvement in the mood score, which declined by 1.07 on a scale of 0 to 10. Twelve-month AQLQ results continued to show improvement from baseline in all subscales, but these results are not reported due to an insufficient sample size.

Results from the PACQLQ (Table 4) all indicate improved quality of life. Changes were all statistically significant, with the activity limitation subscale showing the greatest improvement. As with the 12-month AQLQ results, there was a limited response to the PACQLQ at 12 months. Despite the small sample size, the results were statistically significant (Table 5).

Figure 2. Baseline and 12-Month Utilization Data (n=62)



... DISCUSSION ...

In the last decade, disease management programs have been developed to facilitate the transition to preventive medicine in the healthcare industry. The programs have employed a variety of techniques, from patient education classes and materials to intensive care management. At National Jewish, we combined a variety of established techniques with our overall expertise in understanding and treating respiratory disease to create the *DMP: Asthma* program. At all times, we adhered to the principles that the *physician must be at the management center* and that a *written action plan clearly understood by the patient must exist*. We recognized that patients make decisions about their disease every day, and we wanted these to be informed decisions. Our goal was to give the patients the necessary tools to achieve this goal.

We hypothesized that patients frequently approach an exacerbation of asthma with a lack of sufficient information to make cognitive, educated decisions, and that, when faced with these decisions, patients have limited resources to obtain immediate assistance. It was our intent to remedy both of these situations. The physician, with his/her local expertise and patient awareness, was best suited to create the AAP for both daily and emergent treatment and thereby help address the first issue. National Jewish developed a program centered around the physician/patient relationship. This relationship was central to the creation of the program, and we ensured that the physician received information about any changes in the patient's clinical state. To approach the second issue (ie, a lack of resources to obtain immediate assistance), our DSCM program was created.

Relationships between the care managers and the patients/families were established through proactive calls to the home. In addition, the patient/family had opportunities to call with concerns and problems at any time. This established trust and provided the opportunity to change lifelong patterns such as visiting the ER upon changes in the clinical state.

Table 3. Asthma Quality of Life Questionnaire (AQLQ) Results at 6 Months (n=95)

Subscale	Baseline Mean	6-Month Mean	Change*	Significance
AQLQ Total	5.44	4.53	- 0.91	<i>P</i> ≤.001
Breathlessness	5.80	4.89	- 0.91	<i>P</i> =.001
Concern	5.28	4.34	- 0.94	<i>P</i> ≤.001
Mood Disturbance	5.32	4.25	- 1.07	<i>P</i> ≤.001
Social Disruption	5.12	4.34	- 0.30	<i>P</i> ≤.001

*Decline in score indicates improvement.

Table 4. Pediatric Asthma Caregiver's Quality of Life Questionnaire (PACQLQ) Results at 6 Months (n=96)

Subscale	Baseline Mean	6-Month Mean	Change*	Significance
PACQLQ Total	4.69	5.49	.80	<i>P</i> <.001
Activity Limitation	4.82	5.83	1.01	<i>P</i> <.001
Emotional Function	4.64	5.34	.70	<i>P</i> <.001

*Increase in score indicates improvement.

Table 5. Pediatric Asthma Caregiver's Quality of Life Questionnaire (PACQLQ) Results at 12 Months (n=19)

Subscale	Baseline Mean	6-Month Mean	Change*	Significance
PACQLQ Total	4.82	6.09	1.28	<i>P</i> =.001
Activity Limitation	5.08	6.18	1.11	<i>P</i> =.019
Emotional Function	4.70	6.06	1.35	<i>P</i> <.001

*Increase in score indicates improvement.

The comparison of 6- and 12-month results with the baseline data demonstrates persuasively that the program was successful. Baseline data served as a control against 6- and 12-month results, guaranteeing the comparability of all data sets. A number of limitations in this data collection process need to be recognized, however. Utilization and absenteeism information are self-reported. Additionally, nurses collected baseline information by asking patients to recall the preceding 6 months, while 6- and 12-month data were gathered by simply asking the patient to recall incidents since "the last time we spoke."

The changes in sample size within each surveying topic (ie, utilization, quality of life) can be attributed to patient dropout and loss to follow-up. As we were not continually enrolling new patients into our population, we expected some attrition. This is particularly true with Medicaid patients, whom we have observed to move more frequently than the general population.

The changes in sample size *between* surveying topics can be attributed to the different data collection pathways. While nurses gathered objective utilization and absenteeism data, an outside research company collected the more subjective quality-of-life information. We found that the research company had a more difficult time obtaining complete surveys than did the nurses. We hypothesize that the nurses had more success because they were able to build relationships with the patients. Further, we suspect that the prevalence of caller identification added an obstacle to telephone data collection by any organization without the National Jewish name.

Despite these limitations, the 6- and 12-month data showed that patients had dramatically reduced their utilization of costly services and absences from work and school. Further, patients' quality of life improved significantly. In fact, according to studies performed by creators of the PACQLQ, the amount of change we saw at 6 months in all of the survey's quality-of-life subscales were greater than cutoff scores found in other studies to indicate a "minimal important difference."¹²

Asthma is a disease that, for many patients, fluctuates substantially in severity. These fluctuations can sometimes be attributed to exposure, seasonal allergies, age, and other factors. It is possible, therefore, that the improvement seen in this study might reflect a period of improvement of a severe asthmatic population. A recent independent study, however, found that a hospitalization in a single year is actually predictive of hospitalization during the preceding year.¹⁴ Consequently, we believe that the

decreases seen in hospitalization, ER, and ICU rates are the result of the program.

The importance of our findings lies in the concurrent reductions of costly services, increases in productivity, and an overall improvement in quality of life. All outcome variables tracked showed notable improvements at 6 months. Achieving this combination of results is the essence of disease management.

In conclusion, the results of our approach to disease management demonstrate that this program has achieved a tremendous amount of success. As we move forward, we are challenged to quantify the impact of each individual component of *DMP: Asthma*.

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