



Evaluation Report

“ICC – Asthma Network” Project

Integrated Care Collaboration and Seton Family of Hospitals
July 2008

By Anjum Khurshid, PhD

Contributors: Steve Conti, Cindy Batcher, Sandy Coe Simmons, & Ann Kitchen

Integrated Care Collaboration 2101 IH-35 South, Suite 500 Austin TX 78741

Evaluation of ICC-Asthma Network

Executive Summary

The “ICC-Asthma Network” was funded through a grant to the Integrated Care Collaboration (ICC) to provide better disease management for asthma in uninsured or underinsured patients in the Williamson County. The ICC-Asthma Network program uses I-Care database to identify asthma patients who are likely to benefit from asthma education in the management of their disease. Asthma patients selected for enrollment in the program fulfilled one of the following criteria:

- Had at least 1 Emergency Department (ED) visit for asthma in the last 12 months
- Had at least 1 in-patient (IP) visit or hospitalization for asthma in the last 12 months
- Had more than 4 outpatient visits for asthma in the last 12 months

The intervention consisted of several components: Quality of Life Surveys, asthma education program, Asthma Action Plan, case management and care coordination services and ICC’s Medicaider[®] program. The clinical information of the enrolled patients were entered into a disease management software system and uploaded into I-Care database. Patient satisfaction surveys, quality of life surveys and personal interviews with key program personnel were also used in evaluating the program.

The evaluation design uses pre-/post-test evaluation as well as retrospective cohort comparison. Process and Outcomes Evaluations provide an insight into the operational aspects of the program and highlight the effect on patients’ disease status. Of the 172 patients enrolled in the program between June 1, 2007 and May 31, 2008, 52% were Hispanic, 18.7% African American, and 17.5% Caucasian. 70% of the enrolled patients had some form of persistent asthma according to NHLBI/NAEPP guidelines. Almost all enrolled patients received Asthma Action Plan, education about triggers and training on inhaler techniques.

The key outcomes showed significant improvement in the enrolled patients. Patients who were enrolled in the program for more than 6-months had a 40% decrease in ED visits and about 95% decrease in IP visits after the intervention. The length of stay for inpatient

visits in these patients was reduced by 96%. We used I-Care database to create a control group by randomly selecting patients who fulfilled the eligibility criteria for enrollment. The control group (without any intervention) showed a significant increase in utilization in the one year duration; their ED visits increased by 89% and inpatient visits increased by 100%. By using proxy pricing methodology, the return on investment of the program for asthma patients comes out to \$539,090. This means that for every dollar spent on the program, about \$5.5 are saved in avoided medical services.

The results of the ICC-Asthma Network program clearly show the benefits of such an intervention. There is a measurable difference in outcomes both in terms of utilization of services and quality of life measures. The economic benefits of such a program are also demonstrated by using the data and applying proxy pricing methodology. The value and role of I-Care database in identifying patients, tracking their utilization and in conducting meaningful evaluation of the program are unique aspects of this intervention.

Evaluation of ICC-Asthma Network

Introduction

The “ICC-Asthma Network” was funded through a grant to the Integrated Care Collaboration (ICC) to provide better disease management for asthma in uninsured or underinsured patients in the Williamson County. The program is based on a previously running asthma management program of one of the ICC member organizations, the Seton Family of Hospitals. Seton has run a successful outreach asthma program in Austin demonstrating positive outcomes and favorable return on investment. Seton’s asthma program is based on using a respiratory care professional (RCP) as an educator and a case manager. The RCP works with asthma patients at an individual level and provides asthma-related services to them to achieve better management of their condition.

The ICC partnered with Seton to add a certified asthma educator and a full-time outreach clerk for the operations of ICC-Asthma program in Williamson County. The asthma program in Williamson County was conducted through the clinics of Lone Star Circle of Care. The funding for the program started in April 2007 and the first patients were enrolled in June 2007. This evaluation report will, therefore, cover one-year time period from 1st June 2007 to 31st May 2008.

Background

Asthma is a chronic respiratory disease caused by inflammation and narrowing of respiratory passages. Symptoms may include shortness of breath, coughing, wheezing, chest pain and restricted physical activity. More than 16 million Americans (7.3%) have asthma, of which 6.8 million are children (9.4%).¹ The number of people with asthma has been increasing at a rate that almost doubled between 1980 and 1995 nationally. Asthma is responsible for about half a million hospitalizations (17 per 100,000 people), about 5,000 deaths (1.4 deaths per 100,000 in adults and 0.3 per 100,000 deaths in children) and 134 million days of restricted activity in a year. Asthma is one of the most common

¹ Summary Health Statistics for U.S. Adults: National Health Interview Survey 2006. Tables 3&4 Appendix III, Table V and Table 1, Appendix III, Table IV

principal diagnoses in emergency department and outpatient visits. In 2005, asthma patients made over 12 million physician-office visits, 1.3 million hospital outpatient department visits and 1.8 million hospital emergency visits.

Direct medical expenditures for asthma are significant economic burden, estimated at \$3.64 billion annually with indirect economic losses in excess of \$2.5 billion. The total cost of asthma is estimated to be in excess of \$12.7 billion annually, that includes both direct and indirect expenditure.² Among people who report at least one asthma attack in the previous year, children missed 12.8 million school days and currently-employed adults missed over 10 million work days.³ Significant disparities also exist in the prevalence of asthma in the United States. Death from asthma is 2-6 times more likely in African Americans and Hispanics than among whites. Rates of hospitalization for asthma in African Americans are also triple those for whites. Hospitalization for asthma has also increased dramatically in children under age 5 years. Socioeconomic status, particularly poverty, appears to be an important contributing factor to asthma illness and disability. (Healthy People 2010)

In Texas, 7.3% children and 6.8% adults have asthma.⁴ There were about 25,000 hospitalizations for asthma in Texas in 2005 and nearly 1,300 deaths in 2001-2005.⁵ According to Department of State Health Services draft report there were 135 actual admissions for adult asthma in Williamson County in 2005 (for a population of 230,561), at an average charge of \$11,049 per patient.⁶ In 2004, 12% of adult population in Williamson County reported being told by a health professional that they had asthma. In the same survey, 12% respondents said that at least once during the previous year they could not see a doctor when needed because they could not afford the cost of the visit. These numbers show that asthma is a prevalent chronic condition in Williamson County

² Weiss KB, Sullivan SD. The health economics of asthma and rhinitis. I. Assessing the economic impact. *J Allergy Clin Immunol.* 2001;107:3-8.

³ National Health Interview Survey 2002-2003, NCHS

⁴ 2005 Texas Behavioral Risk Factor Surveillance System, Statewide BRFSS Survey

⁵ Texas Department of State Health Services, Center for Health Statistics

⁶ Williamson County, Preventable Hospitalizations Profile. Texas Department of State Health Services. <http://www.dshs.state.tx.us/ph/docs/phwilliam0416.doc>

and establish a need for interventions that work with patients in this community who are unable to afford routine care because of their socioeconomic conditions.

Program Description

The ICC-Asthma Network program uses I-Care database to identify asthma patients who are likely to benefit from asthma education in the management of their disease. Asthma patients selected for enrollment into the program fulfilled one of the following criteria:

- Had at least 1 Emergency Department (ED) visit for asthma in the last 12 months
- Had at least 1 in-patient (IP) visit or hospitalization for asthma in the last 12 months
- Had more than 4 outpatient visits for asthma in the last 12 months

Williamson County patients with physician-referral from ICC-member network were also accepted into the program. Once identified, the ICC-Asthma Network staff attempted to contact these patients by first sending them a postcard and then calling to invite them to enroll in the program. At least three attempts were to be made to contact each individual patient. Once a patient agreed to participate, the next steps involved scheduling an appointment with the RCP for asthma education and better disease management of the patient.

The asthma education and management program consisted of the following key components:

- Quality of Life Survey (QoLS):
All patients were to complete a QoL Survey indicating how well their asthma was managed at the time of enrollment, during the program and at the end of the program
- Asthma education program
Asthma education program and skills training were to be provided to all patients on how to use and care for inhaler device and a peak flow meter. Patients were also to be educated about how to use prescribed medications, adopt self-management and monitoring techniques, and maintain a daily patient diary.
- Asthma Action Plan

To reinforce self-management and provide decision-support for parents and caregivers each patient was to be given an asthma action plan that described for the patient how to manage their asthma and prevent attacks. Besides giving a copy to the patient or the caregiver, the action plan was also placed in the patient's medical record and, in the case of a school-aged children, one copy is faxed to the child's school nurse.

- Case management and care coordination services

The patient's primary care physician was to be kept informed of the intervention with the patient through this program to ensure coordinated care. For patients who do not have a primary care physician, the program staff tries to find one and also assists the patient in understanding and following the medication regime prescribed by their health provider for controlling asthma.

- ICC's *Medicaider*® program

For patients who have no source of health coverage or lose their coverage during the program, ICC-Asthma Network staff use ICC's *Medicaider*® program to identify funding eligibility and try to establish insurance coverage and a medical provider for the patient.

All enrolled-patient data were entered into a clinical information system (CIS) software program called Patient Electronic Care System (PECSYS). The ICC maintains a database, called I-Care, which captures uninsured or underinsured patient data from member organizations. PECSYS data were then uploaded into I-Care database to link enrolled- patient records with the longitudinal data in I-Care. I-Care database has encounter data back to 2002 and has over 4 million patient encounters.

Evaluation Goals

The CDC defines program evaluation as “the systematic collection of information about the activities, characteristics, and outcomes of programs to make judgments about the program, improve program effectiveness, and/or inform decisions about future program

development.”⁷ The purpose of the ICC-Asthma Network evaluation is to document progress on program goals and the effectiveness of these strategies, and to demonstrate accountability to the stakeholders. The evaluation of the ICC-Asthma Network derives its basis from conceptual frameworks used to plan and implement health education and health promotion programs, manage chronic disease in the community and evaluate public health interventions. We consult the Precede/Proceed Model developed by Green and Kreuter (1999)⁸ that the New York City Department of Health and Mental Hygiene used to evaluate an asthma program. We also take into account Wagner’s Chronic Care Model that forms the basis of the PECSYS CIS system.⁹ Finally, we also include the steps identified by the Centers for Disease Control and Prevention for systematic evaluation of public health programs.^{10,11}

Evaluation Methodology

The evaluation will assess procedural or operational aspects of the program and will attempt to measure how well the program was implemented. This is termed as Process Evaluation. However, the main function of the program is to improve the health of patients who are enrolled in the program. The other part of evaluation, called Outcome Evaluation, focuses on measurable outcomes that assess the improvements in health status and quality of life of the enrolled patients. The outcome evaluation helps assess the effectiveness of the program strategy in a systematic manner and informs decisions about the future replication or expansion of such a program. We conducted in-person interviews with program staff. For program description we rely on their knowledge and some interim operational reports submitted to ICC Board. The list of some of the quantitative measures that we use for evaluating the ICC-Asthma Network is shown in Table 1:

⁷ US Department of Health and Human Services, Centers for Disease Control and Prevention. Office of the Director, Office of Strategy and Innovation. Introduction to program evaluation for public health programs: A self-study guide. Atlanta, GA: Centers for Disease Control and Prevention, 2005

⁸ Green L & Kreuter M. Health Program Planning: An Educational and Environmental Approach. 3rd edition. Mountain View, CA: Mayfield Publishing Co.

⁹ Wagner EH. Chronic disease management: What will it take to improve care for chronic illness? *Effective Clinical Practice*. 1998;1(1):2-4

¹⁰ Centers for Disease Control and Prevention. Framework for program evaluation in public health. *MMWR* 1999;48(RR-11)

¹¹ Milstein B, Wetterhall S. A framework featuring steps and standards for program evaluation. *Health Promotion Practice*. July 2000;1(3):221-228

Table 1: Process and Outcome Evaluation measures

Evaluation Measures	Evaluation Objective	Data Source
Process Measures		
1. Number of patients categorized according to NHLBI/NAEPP Guidelines by severity of asthma	Measure efficiency in stratifying patients	PECSYS
2. Number of completed Quality of Life (QoL) surveys	Measure efficiency in getting QoL information	QoL Surveys
3. Number of patients with persistent asthma given a written asthma action plan	Measure output of the program in providing tools for self-management to patients	PECSYS
4. Number of patients who complete follow-up surveys	Report follow through by the program staff to capture outcomes	QoL Surveys
5. Number of school-aged children who have action plan at school	Measure efficiency in providing coordinated care to children with asthma	PECSYS
6. Number of patients receiving training on using Peak Exploratory Flow Rate (PEFR) meters	Measure asthma education provided to help in self-management of disease by patients	PECSYS
7. Number of patients with persistent asthma with self-management goals	Measure adherence to program design and promotion of self-management of disease in patients	PECSYS
8. Number of patients receiving education on use and care of inhaler	Measure achievement of patient education goals regarding self-care and management of disease	PECSYS
9. Number of patients receiving education about asthma triggers	Measure efficiency in patient education about how to prevent exacerbations caused by environment	PECSYS
10. Patient satisfaction with program	Measure patient satisfaction with services and education provided	Patient Satisfaction Surveys
Outcomes Measures		
11. Average number of Emergency Department (ED) visits per patient	Measure effect of intervention on utilization of ED services by asthma patients	I-Care
12. Number of In-Patient (IP) visits per patient	Measure the improvement in control of asthma in patients	I-Care
13. Average length of stay per patient	Measure effect of intervention on severity of asthma and care coordination	I-Care
14. Number of patients with symptom-free days	Measure effect on control of asthma	QoL Survey

15.	Number of patients with symptom free nights	Measure effect on control of asthma	QoL Survey
16.	Number of patients with physically active days	Measure effect on management of asthma	QoL Survey

The Evaluation design uses both pre-/post-test evaluation as well as a control-treatment evaluation. In the pre-/post-test evaluation design enrolled patients' utilization, health outcomes and quality of life measures following the intervention are compared with the same before the intervention. We use data collected through PECSYS and I-Care databases to calculate these measures. I-Care database helps in getting the information on utilization of services across the network by asthma patients. It identifies the date, time, type, and location of encounters by asthma patients. It also traces their utilization longitudinally to help in the pre-/post-intervention comparison. Other details of the services provided through the ICC-Asthma Network are recorded in PECSYS and include a record of all medications, interventions conducted, referrals made, education provided, and assessments done. Additional information is obtained from the QoL surveys that were completed routinely as part of the program.

In order to control for any external factors affecting outcomes seen in the enrolled patients, we also create a control group using I-Care database. A random group of patients who fulfill the enrollment criteria for the program are selected using random function of a spreadsheet. We use this group as a control because this group should, in concept, have comparable characteristics to the enrolled patient group except that the patients in the control group were not enrolled in the program. The utilization and available information of the control group are then compared to the results of the enrolled group.

Data Sources

Several data sources were used to evaluate the ICC-Asthma Network program. I-Care database is one of the main sources of information for outcome evaluation. Residing on an SQL server, the database includes patient data from members of ICC. The information collected for most patients in I-Care database includes: name, date of birth, sex, social security number, patient address, race/ethnicity, marital status, funding program,

encounter type, location of encounter, attending doctor, admission date and time, discharge date and time, diagnosis code (ICD-9) and procedure codes (CPT-4). Data on prescriptions dispensed is also available from a few ICC Members. Patients are asked to sign an authorization for sharing data across ICC membership. This authorization is valid for two years and is updated whenever a new authorization is provided.

I-Care database is populated via data uploads through an interface engine using secure servers. It contains data on the uninsured and underinsured only, with patient selection or de-selection criteria set by ICC member. ICC uses a master patient Index to manage duplicates among ICC Members. Users of I-Care database access the database using Internet Explorer web browser. The database currently holds data for about 700,000 patients, involving more than 4 million encounters in ICC network of Members.

Since I-Care database mainly provides encounter data with some medications, laboratory and payer information, the ICC-Asthma Network used information from PECSYS for additional disease-related data on patients enrolled in the program. PECSYS is a clinical information software that was adopted by all Federally Qualified Health Clinics (FQHCs) as a disease management software system. The purpose was to collect disease-related data in a consistent manner. Information on asthma severity assessment, medications, and asthma education activities were entered into PECSYS system for ICC-Asthma Network program. These patients were then identified in I-Care database as part of ICC-Asthma Network program.

The program design included pre-intervention and post-intervention quality of life surveys to be filled in by the patients. The QoL surveys were developed using instruments already tested by the Institutes for Healthcare Improvement and adopted at the state level in Texas. The QoL surveys gather information about symptoms and medications from the patients. The surveys were to be repeated during the year following the intervention at regular intervals. Patient satisfaction surveys were also conducted to seek feedback from patients about the administration of the program from their

perspective. This information was maintained in a Microsoft Access database by the Program Coordinator.

Results

The total number of patients identified from I-Care database as eligible for the ICC-Asthma Network program during the course of the program was 2,991. The number of patients enrolled in the program was 172. Hence, the enrollment ratio was about 6 percent (172/2,991) Figure 1.

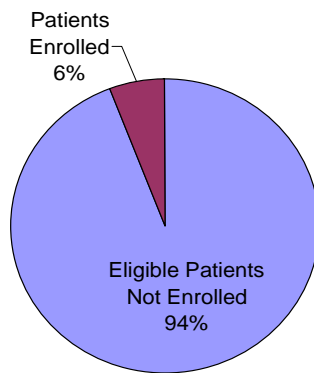


Figure 1: Percentage of patients enrolled

The demographic breakdown of patients in the program shows that the average age for the enrolled patient group on June 1, 2007 was 21.4 years. The age criteria for enrollment used date at the time of enrollment but in order to maintain consistency we used the program beginning date. Breakdown of age in the enrolled patients is shown in Figure 17. There were slightly more females (52%) in the group than males (Figure 2).

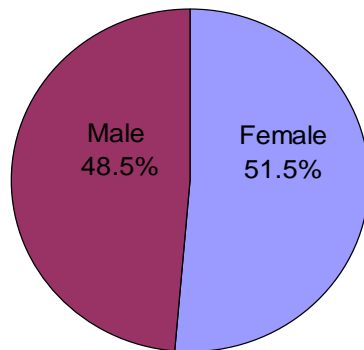


Figure 2: Gender distribution of enrolled patients

As shown in Figure 3, a majority of the enrolled patients were Hispanic (52%). There were slightly more African Americans (18.7%) than Caucasians (17.5%) in the group.

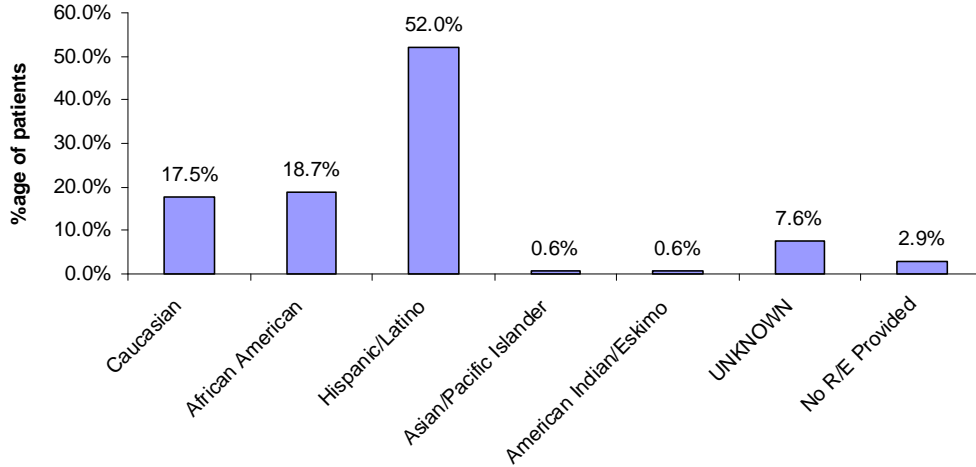


Figure 3: Race/ethnicity of enrolled patients

Insurance data were collected for 91% of patients after Medicaider[®] screening (Figure 4). Most of the patients in the group were identified as Medicaid patients (53%) while there were some with CHIP (9.6%) and private insurance (14%).

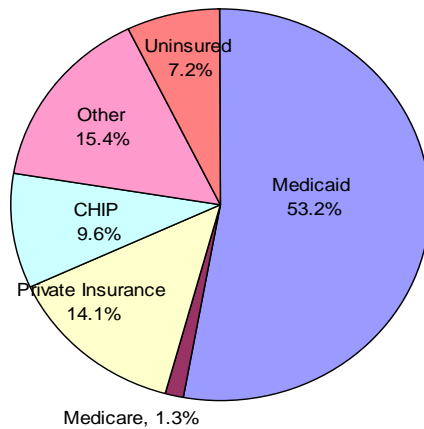


Figure 4: Health coverage of patients at enrollment

Process Evaluation

We looked at process evaluation measures to see how well the program adhered to the original design of the intervention. This included looking at how many patients were categorized by severity of asthma, received asthma education, had an asthma action plan delivered and had set self-management goals for themselves.

The data show that 96% of enrolled patients had an underlying assessment conducted during the program. This assessment evaluates the severity of asthma according to the NHLBI/NAEPP guidelines that range from mild intermittent asthma to severe persistent asthma.¹² The breakdown of patients by severity in Figure 5 shows that almost 70% of patients had some form of persistent asthma. 27% had mild intermittent asthma, which means that the symptoms appear only occasionally such as during exercise (exercise-induced asthma) or following an upper respiratory infection. Of the patients with persistent asthma, a little over a tenth (11.4%) had severe persistent asthma.

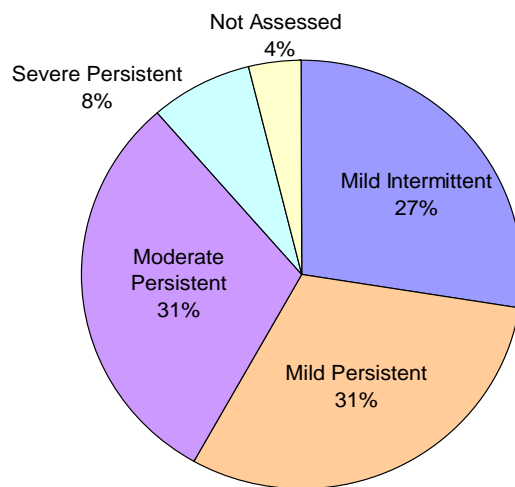


Figure 5: Underlying asthma severity categorization at enrollment

The key process measures for the program include those related to patient education and training. According to the design of the program each patient was to be given an asthma action plan that they can follow to better manage their disease. Similarly, training on how to use peak expiratory flow rate (PEFR) meters at home and to use and take care of an inhaler for medications were important parts of the intervention. The data in Figure 6 show that all patients received asthma action plan and almost all (99%) received education about various triggers for an asthma exacerbation as reported by the staff. Less than two-thirds received PEFR education (62%) but most (96%) were trained on inhaler

¹² U.S. Department of Health & Human Services. Guidelines for the diagnosis and management of asthma. National Asthma Education & Prevention Program. Expert Panel Report 3. NIH Publication Number 08-5846. October 2007.

techniques. The PEFR percentage is low because this component of the program is not given to patients under the age of 5 years (based on telephonic communication from Program Director).

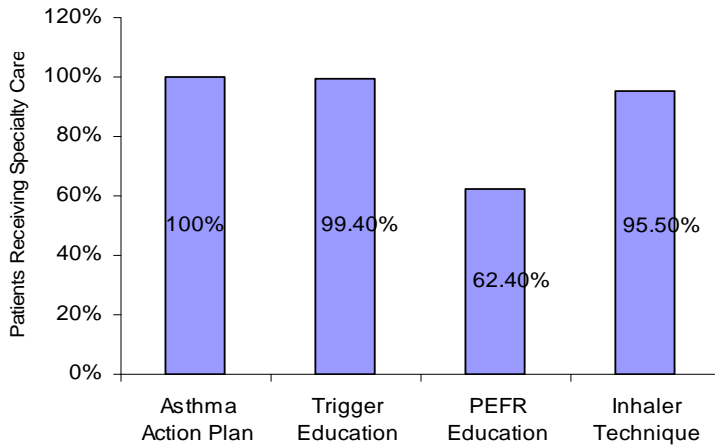


Figure 6: Delivery of specialty care services

As part of the program the patients were also asked to fill out quality of life (QoL) surveys that include questions about symptoms of the disease. Figure 7 reports how many patients filled out quality of life surveys: 154/171 at the start of the intervention and 136/136 at the follow-up.

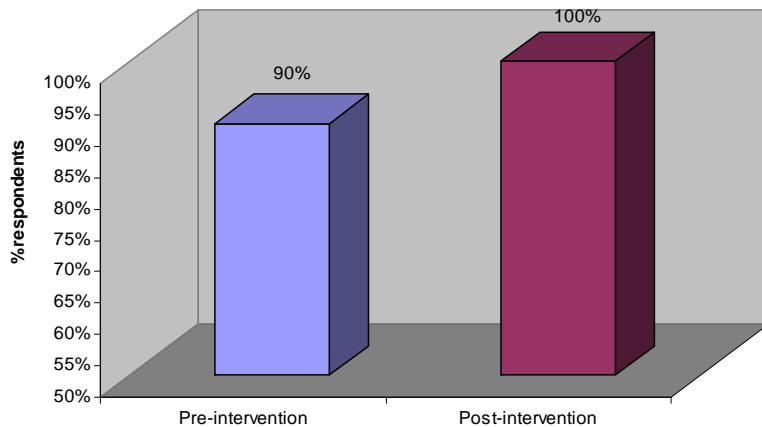


Figure 7: Percentage of enrolled patients completing Quality of Life Survey

The ICC-Asthma Network developed an asthma action plan that was given to all the enrolled patients and in case of school-age children also faxed to the relevant school

nurse. As shown in Figure 8, before being enrolled in the program only 11% of patients had an asthma action plan. But after the intervention 95% reported having an asthma action plan (this is in contrast to the 100% reported by the staff). Similarly, only 12% of school-aged children had an asthma action plan with their school nurse before enrollment but after enrollment in the program 95% reported having an asthma action plan with the school nurse.

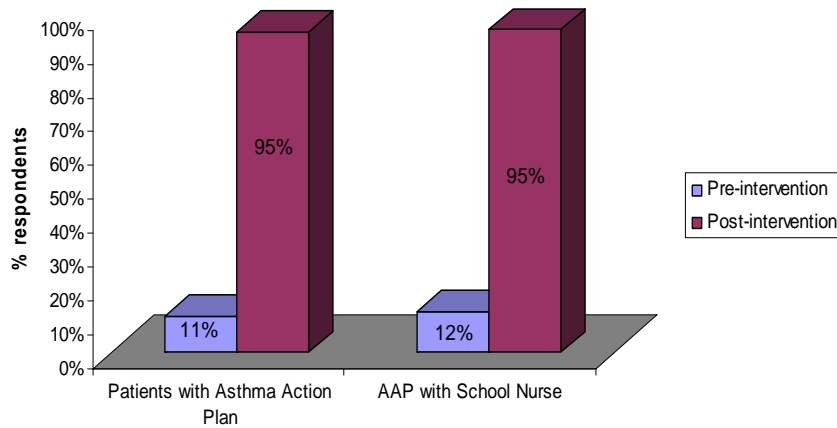


Figure 8: Percentage of enrolled patients with Asthma Action Plan

Finally, the ICC-Asthma Network program also collected feedback from the patients about their satisfaction with the program. Getting the perspective of the patients on how an educational program has served the patients’ needs and fulfilled their expectations is an important measure of how efficiently the program was run. As Table 2 shows, the level of satisfaction with the program and expectation of its effectiveness were very high among the patients. A scale of 1 to 5 was used with 5 being an excellent rating.

Table 2: Patient Satisfaction Surveys

Survey Question	Respondents	Average Response (1-5)
The methods used to support learning were helpful to me	107	5
The pace of the offering was appropriate for me	107	4.98
The facilities were appropriate to learning	107	4.99
The informational materials provided	106	5

were clear and understandable

The instructor had the subject matter expertise to provide instruction	106	5
The instructor created an environment that supported learning	107	5
The information provided will help me control my asthma	105	4.99
Overall satisfaction score	107	99.36%

Outcome Evaluation

According to the Disease Management Association of America (DMAA), disease management is defined as a system of coordinated health care interventions and communications for populations with conditions in which patient self-care efforts are significant.¹³ The disease management goals for asthma patients determine the outcomes of interest for the purpose of outcome evaluation of the program. The outcome measures are also linked to the evidence-based strategies identified by the NHLBI/NAEPP Guidelines for asthma. These include symptom and exacerbation prevention, maintenance of pulmonary functions, optimized activity levels, meeting expectations of satisfaction with asthma care and the provision of optimal pharmacotherapy.

The outcome measures we use for evaluating the ICC-Asthma Network program are of two types: emergency department (ED) and hospital utilization measures and self-reported quality of life measures. The former include number of ED visits, number of hospital in-patient (IP) visits, and total length of stay (LOS) in days of asthma patients in hospitals. In order to see the program effect we search I-Care database for utilization by enrolled patients in the 12 months prior to the patient's enrollment in the program and compare it to that after the intervention. The quality of life measures we use are symptom-free days in the last 14 days, missed school or work days in past 30 days, and number of days of physical activity in the last 14 days. We report the data at the time of enrollment with that derived from follow-up surveys that are conducted at 3-, 6- and 9-

¹³ Disease Management Association of America. DMAA Definition of Disease Management. Available at www.dmaa.org/dm_defintiion.asp. Accessed June 30, 2008.

month intervals after the intervention. In case of more than one follow-up surveys, we report the average of the responses for each patient.

I-Care data show that patients who were enrolled in the program had 99 ED visits in total in the 12 months before the intervention and only 36 after the intervention. Similarly, their number of in-patient visits was 33 before and only 2 after the intervention. The total days that asthma patients in the program stayed in a hospital, using number of hours of stay, were 62.9 days before the program and only 3.5 after the program. Table 3 summarizes the results.

Table 3: Utilization of medical services by enrolled patients

<i>n=172</i>	Pre-intervention	Post-intervention
ED visits	99	36
IP visits	33	2
Encounters	132	38
Total LOS (days)	62.9	3.5

Figure 9 shows the average pre- and post-intervention utilization of the enrolled patients.

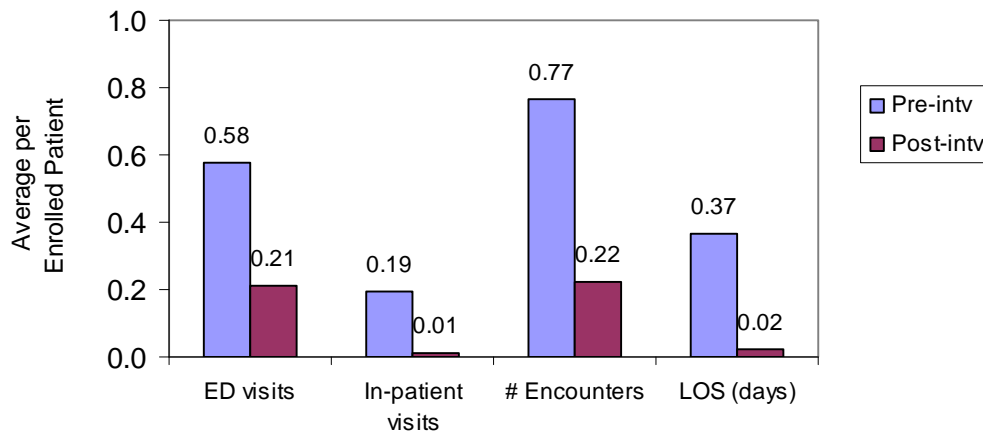


Figure 9: Average utilization of medical services by enrolled patients

Figure 10 uses average utilization before and after the program and shows the percentage decrease in each category as a result of the program. There is 63.6% reduction in ED visits after the program. Inpatient visits decrease by 83.9%, and total encounters by 71.2%. Length of stay also shows a decrease of 94.4%.

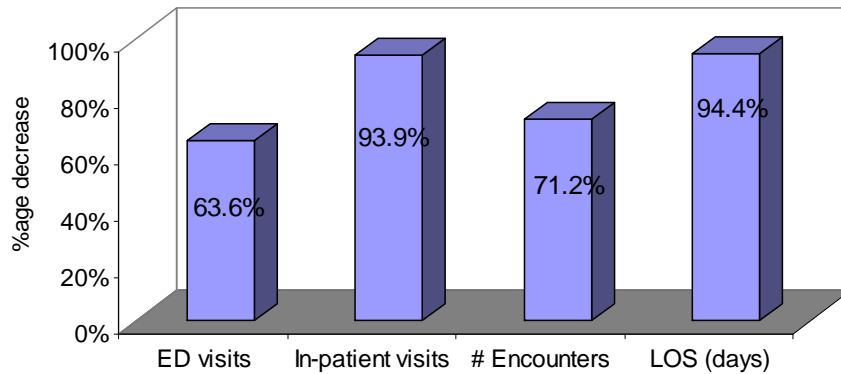


Figure 10: Percentage decrease in average utilization of enrolled patients

The limitation of this analysis is that the post-intervention period is not equal to the pre-intervention period in most cases. Overall, the average duration of patients in the program for this group is 175 days. This is calculated by using the first encounter date after June 1, 2007 and subtracting it from the end of the program date, May 31, 2008. Ideally, we should be looking at utilization during identical period of times before and after the intervention, but in this case the program has recently ended so we can not have enough post-intervention time to match the pre-intervention time period. In the absence of such data we refine our analysis by looking at only those patients who have been in the program for at least 6 months. We do this by counting only patients that were enrolled in the program during first two quarters of the year-long program. This gives a better comparison for the utilization after the intervention. The results are reported in Table 4.

Table 4: Utilization by >6 months enrolled patients

<i>n</i> =88	Pre-intervention	Post-intervention
ED visits	59	25
IP visits	26	1
Encounters	85	41
Total LOS (days)	47	1.4

The average duration of this group of patients in the program is about 254 days. The table shows that ED visits in this group are reduced from 59 to 25, IP visits are reduced from 26 to only 1 and total length of stay has gone down from 47 to 1.4 days.

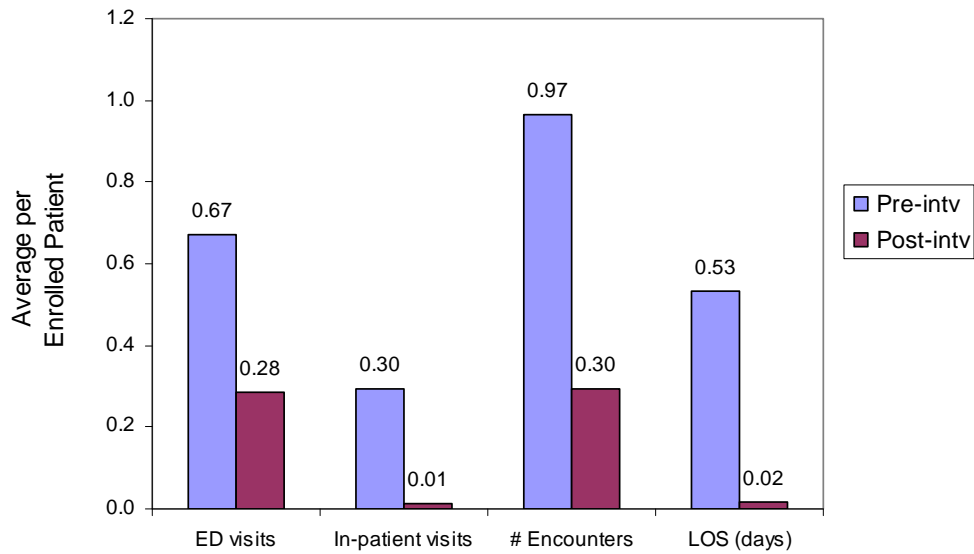


Figure 11: Average utilization by >6 months enrolled patients

We then calculate the percentage decrease in utilization in the >6 month enrolled group as shown in Figure 12.

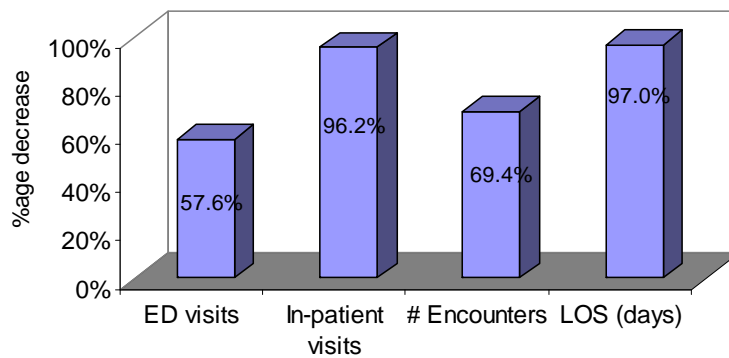


Figure 12: Percentage decrease in utilization by >6 months enrolled patients

The trend appears to be the same as seen for all the enrolled patients. There is relatively even greater improvement in the inpatient encounters (96.2% decrease) and the length of stay (97% decrease). The average length of stay is calculated by dividing total days of hospitalization with the number of patients who were hospitalized.

We can further address the difference in pre- and post-intervention time period by extrapolating the mean utilization in the more than 6-month enrolled patients to average utilization in 12 months time period. The extrapolated utilization numbers appear as shown in Table 5. The pre-intervention figures will remain the same.

Table 5: Extrapolated mean utilization by >6 months enrolled patients

<i>n</i> =88	Pre-intervention	Post-intervention
ED visits	59	35.7
IP visits	26	1.4
Encounters	85	37.1
Total LOS (days)	47	2.0

The average utilization pre- and post-intervention is shown in Figure 13, still showing significant decrease in post-intervention utilization.

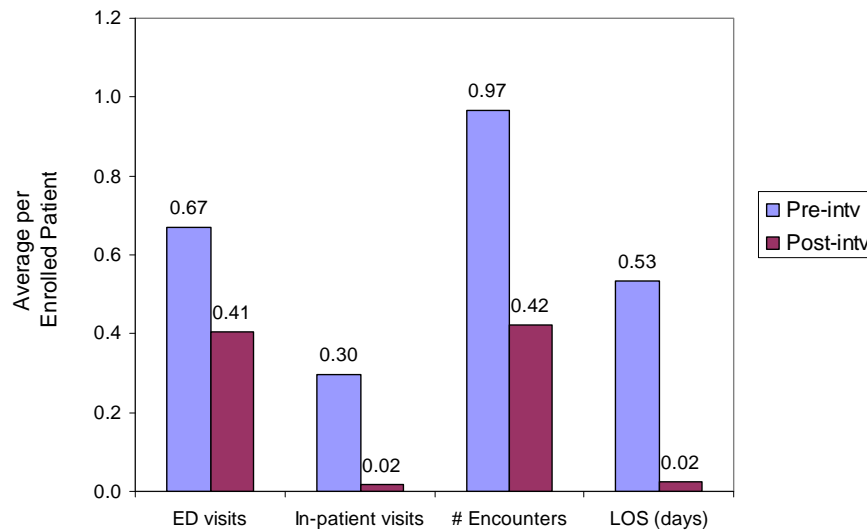


Figure 13: Percentage decrease in extrapolated average utilization by enrolled patients

Figure 14 also shows the overall decrease as a percentage. There is a 40% decrease in ED visits and about 95% decrease in IP visits in 12 months after the intervention in those patients who have been in the program for at least 6 months.

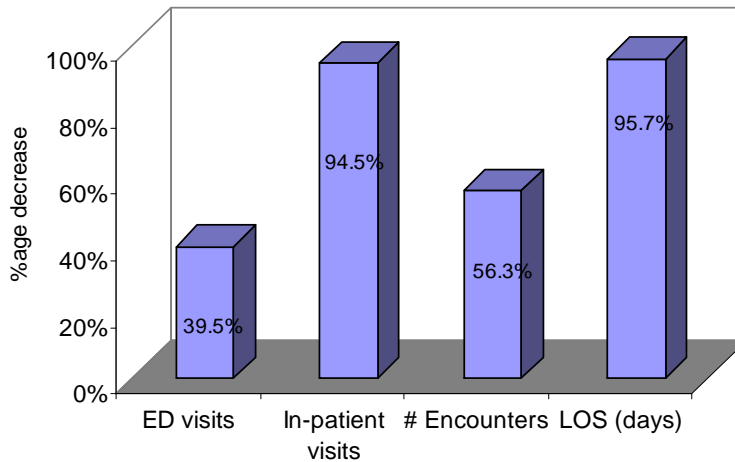


Figure 14: Percentage decrease in extrapolated utilization by enrolled patients

Since the pre-/post-test design does not rule out influence from external factors as an explanation for changes before and after an intervention, we examine these outcome changes using the control-treatment design. We use I-Care database to apply a retrospective cohort study design by creating a control group that matches the treatment group of enrolled patients. We use the original list of patients in I-Care database who were identified for inclusion in the program and who did not enroll in the program. We randomly pick about 222 of these eligible patients and use them as a control. We examine their utilization in the year before June 1, 2007, when the ICC-Asthma Network program began, and compare it to their utilization in the year after the program. The results will show to us if the trend in this indigent population of asthma patients is any different from the pre-/post-utilization we observe in the enrolled patients.

Table 6: Utilization of patients in control group

<i>n</i> =222	Pre-intervention	Post-intervention
ED visits	55	104
IP visits	19	38
Encounters	74	142
LOS	58.1	100.3

Table 6 shows that patients in the control group had 55 visits in the year before and 104 in the year after June 1, 2007. Similarly, IP visits increased (from 19 to 38), encounters increased (74 to 142) and total length of stay increased (58.1 to 100.3 days). To control for differences in the sample size, we use average utilization in Figure 15 to compare with average utilization by enrolled patients.

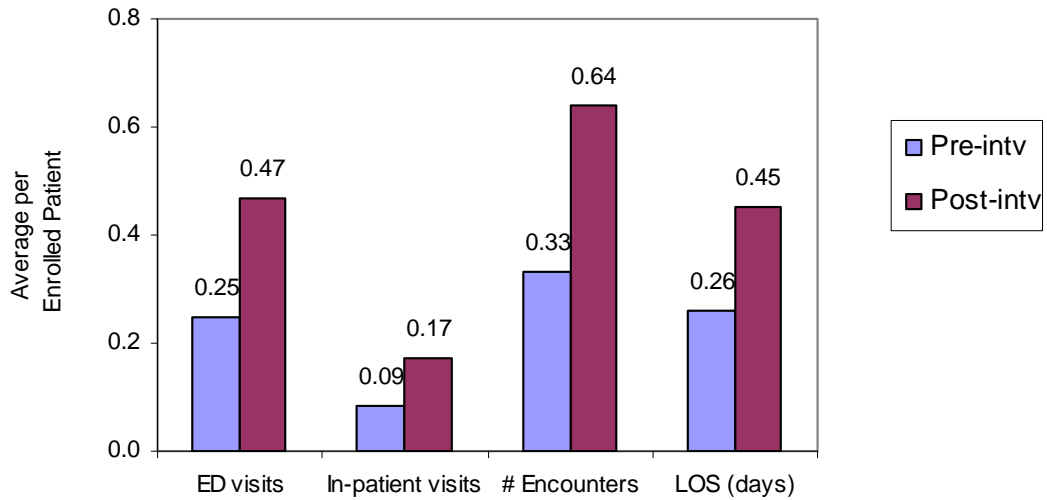


Figure 15: Average utilization by control group

Figure 16 show that the change in utilization of services, such as ED and IP visits, are in opposite direction to the changes observed in pre-post-intervention in the enrolled group (Figure 10 & 14).

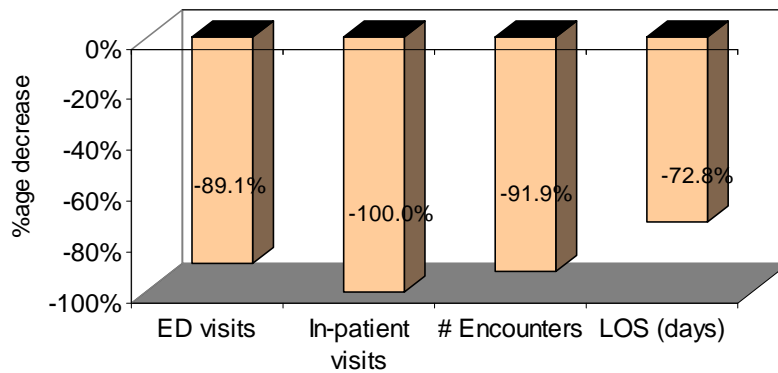


Figure 16: Percentage decrease in average utilization by control group

Although we look at the utilization of these patients in the 12 months after the start of the program, at first glance their post-intervention time period is more than the post-intervention period for the enrolled patients. However, the enrolled patients' time in the program is counted from the date of their first encounter after June 1, 2007 while the control group's months are counted from the date of the start of program. If we use the same criterion to count the time period for the control patients as we did for the enrolled patients, the average duration from the date of encounter to the end of the May 2008 for control patients is 174 days, which is very close to the average duration of all enrolled patients (175 days) and less than the average duration of the more than 6-month enrolled patients (254 days). It appears that we do not need to correct for change in post-intervention duration when comparing aggregate utilization figures.

The control group and the enrollment group are also compared for demographic differences. Figure 17 and Figure 18 show a comparison of age and ethnicity between the two groups. The treatment group is relatively younger than the control group and has relatively a higher percentage of Hispanic patients than the control. The gender distribution of the two groups is quite similar with slightly higher female proportion in the control group (Figure 19).

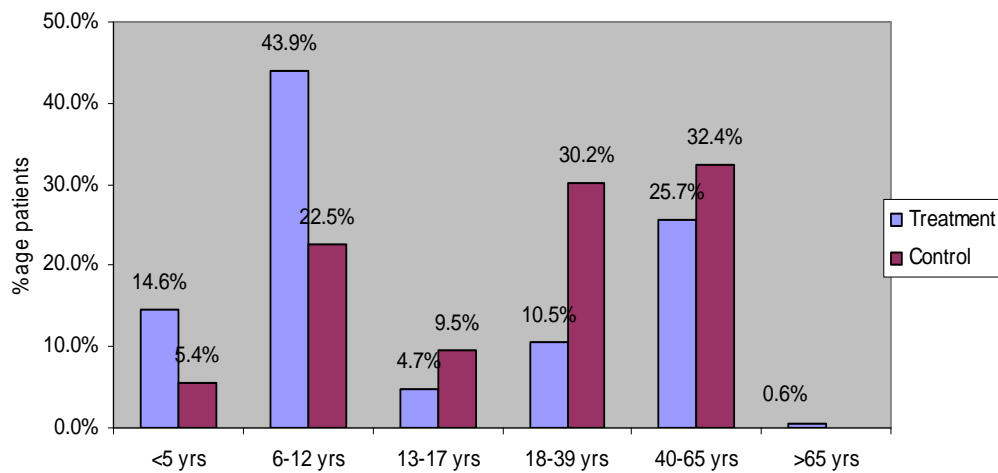


Figure 17: Age distribution comparison between control & treatment

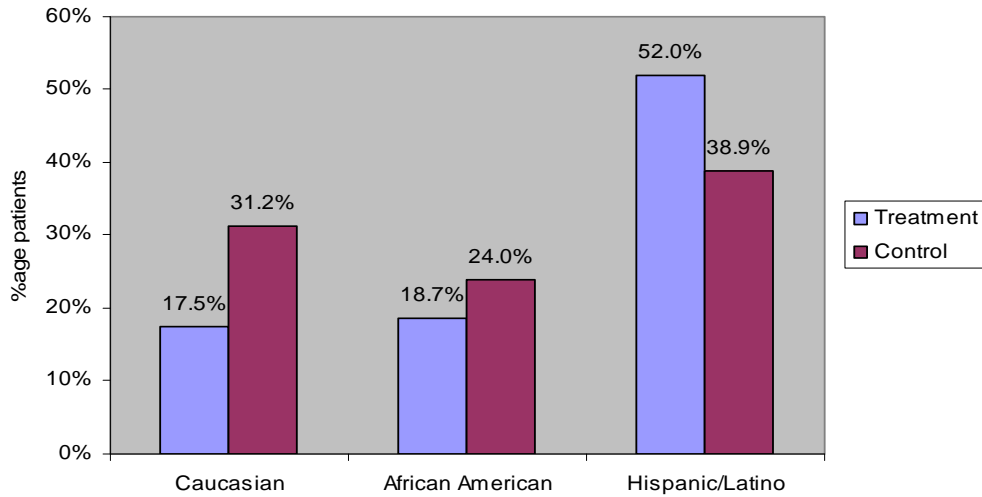


Figure 18: Race/Ethnicity in control & treatment groups

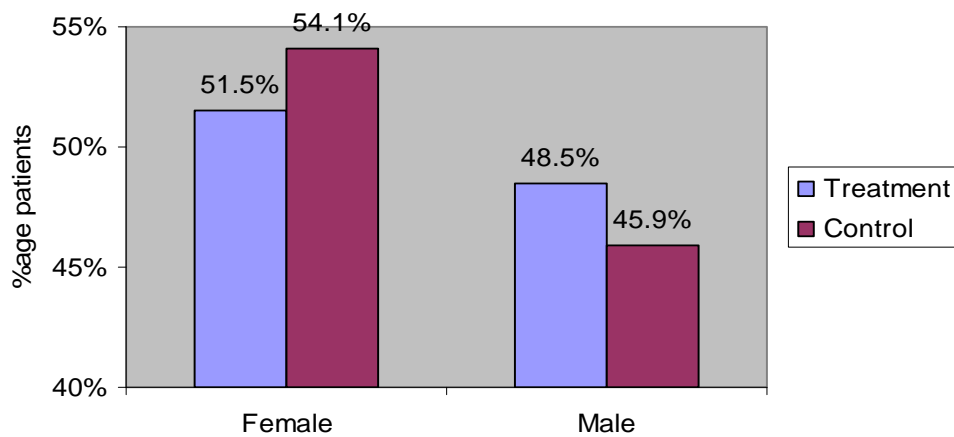


Figure 19: Gender distribution in control & treatment groups

The treatment and control groups when compared for prior utilization over the same time period, i.e. one year, show some differences. The prior utilization indicates that the enrolled patient group had a higher utilization of services in the prior year than the control group (Table 7). There may be a couple of possible explanations for this difference. First, the enrolled patients comprise of a higher proportion of children that are more likely to end up in ED or in hospital if their asthma is not well managed. Second, it is also possible that the more sick patients (high utilizers) are more likely to enroll in the program.

Table 7: Utilization comparison between different groups prior to the intervention

<i>Pre-intervention</i>	Control (average)		All Enrolled (average)		Enrolled >6m (average)	
ED visits	55	(0.3)	99	(0.6)	59	(0.4)
IP visits	19	(0.1)	33	(0.2)	26	(0.7)
Encounters	74	(0.3)	132	(0.8)	85	(1.1)
Total LOS (days)	58.1	(0.3)	62.9	(0.4)	47	(0.5)

The quality of life measures for asthma patients include three key aspects: number of symptom-free days, number of symptom free nights and number of physically active days. These three measures are used to assess the severity and control of asthma in patients and are the basis for the categorization of patients into the four categories identified by NHLBI/NAEPP Guidelines. A successful intervention will increase the number of symptom-free days and nights and also increase the days a person is physically active. The results of the program show (Figure 20), that the symptom free days in the last 14 days increase on the average from 7.6 days per patient to 10.6 days per patient. Similarly the symptom free nights also increase on the average from 20.8 to 23.5 days in the last 30 days. However the average days of physical activity increased only slightly.

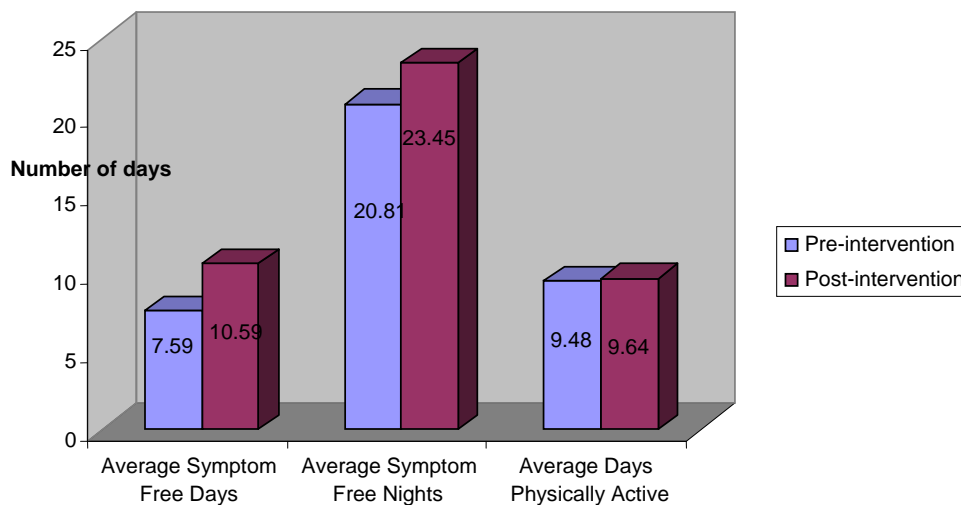


Figure 20: Quality of Life measures of enrolled patients

Financial Analysis

In the absence of cost data, we can use estimated expenditure using national averages to calculate the return on investment of the ICC-Asthma Network program. The ICC has used State of Texas disease-specific Medicaid payment rates as proxy pricing and return on investment calculations. An average per diem reimbursement rate is used for inpatient encounters using FY 2004 Texas Medicaid fee-for-service reimbursement for asthma specific (ICD-9 493.xx) inpatient encounters. Similarly, the average per service payments from Texas Medicaid fee-for-service schedule for ED encounters is used to the hospital ED encounters for calculating proxy dollar amounts per encounter. The administrative cost of the program is based on actual expenditures for running the ICC-Asthma Network. This mainly includes salaries of the staff, benefits, and other operating costs for supplies, printing etc. Table 8 shows some of the calculations of return on investment ratio (cost-benefit ratio) for the program. We have used the more conservative decrease numbers from Figure 14 for extrapolated post-intervention utilization in the group with more than 6-months duration in the program.

Table 8: Financial benefit of the program for enrolled patients using program effect on patients with more than 6 months duration and using proxy pricing methodology

<i>n=172</i>	
Total operating expenditures (reported) (salaries + benefits + other expenses (supplies + printing etc))	= \$ 98,489
Potential saving in ED visits (decrease by 40%) <i>total ED visits * Proxy cost per visit * estimated reduction in ED visits post-intervention</i>	= \$ 40,798
Potential saving in IP visits (decrease by 95%) <i>total IP visits * Proxy cost per visit * estimated reduction in IP visits post-intervention</i>	= \$ 244,802
Net benefit for enrolled patients using program effect on patients with >6 months in the program <i>(Potential savings in ED+IP visits) – Total operating expenditures</i>	= \$ 187,022

The above calculations are based only on the cost savings using the post-intervention effect of the program in decreasing utilization in patients enrolled in the program for at least 6 months and their mean post-intervention utilization extrapolated for a 12-month period. However, as shown in Figure 17, mean utilization of asthma patients in the

control or comparison group actually increases during the same time period in 2007-2008. The actual benefit for the intervention then will be the decrease expected in a control group patient going through the program, which will be significantly higher than used in calculating financial benefits in Table 8. The revised calculations using this program effect is shown in Table 9.

Table 9: Potential financial benefit for control group patients if given the intervention and using proxy pricing methodology

<i>n=172</i>	
Total operating expenditures (reported) (salaries + benefits + other expenses (supplies + printing etc))	= \$ 98,489
Potential saving in ED visits <i>total ED visits * Proxy cost per visit * estimated reduction in ED visits post-intervention</i>	= \$ 132,431
Potential saving in IP visits <i>total IP visits * Proxy cost per visit * estimated reduction in IP visits post- intervention</i>	= \$ 505,148
Net savings from the potential effect on control-group patients <i>(Potential savings in ED+IP visits) – Total operating expenditures</i>	= \$ 539,090
Return on Investment for the program <i>net saving/total operating expenditure OR (total saving-cost)/cost</i>	= 5.5
Savings per patient enrolled, n=172: <i>net benefit/n</i>	= \$ 3,134
Savings per encounter (IP/ED), n=132: <i>net benefit/n</i>	= \$ 4,084

The calculations using proxy pricing methodology show that for every dollar spent on the operations of the asthma program, about \$5.5 worth of services can be potentially saved on emergency and inpatient utilization alone. Per patient net benefit from the intervention comes out to about \$3,134. In order to understand the implication of this finding, we can simply look at the potential savings if all the patients in Williamson County were enrolled in this program and the program effects were similar to what we have found in the ICC-Asthma Network. During the period of operation of the program (June 2007-May 2008), I-Care data showed 1,062 patients from Williamson County with an ED (889) or IP (173) encounter in the network. Hence, all these patients fulfilled the eligibility criteria. The total number of ED visits by these patients was 1,112 and total number of IP visits was 191. Using the results of this program, a potential saving in healthcare costs in ED and IP

utilization of \$3,328,563 may be expected from a larger intervention in the Williamson County. If we use per encounter benefit calculations, then the potential net benefit of the program comes to around \$5.3 million in one year from reduced utilization through better management of asthma. This also assumes that the program costs per patient or per encounter remain similar to what they were for the ICC-Asthma Network.

According to Department of State Health Services' draft report there were 135 actual admissions for adult asthma in Williamson County in 2005, at an average charge of \$11,049 per patient.¹⁴ Using that number instead of the proxy pricing methodology, the net benefit for inpatient services alone in the enrolled group would be \$711,003, which is significantly greater than the number we get using the proxy pricing method (\$505,148). This shows that the proxy pricing methodology we use is giving rather conservative estimates of the net benefits.

Discussion

There are some limitations to this evaluation that need to be mentioned before discussing the conclusions and recommendations from the ICC-Asthma Network program. First, one year is a rather short period of time to fully evaluate the success and outcomes of an intervention that aims at improving chronic disease management in patients through education and care coordination. Second, the recruitment into the program, like most new interventions, was not steady over the course of the program. It slowly ramped up during the program which effectively curtails the total duration of the program to less than the 12-month time period being evaluated here. Third, only 6% of the total eligible patients were enrolled in the program, which is low particularly looking at the remarkable improvements seen in those who did get enrolled. Fourth, the telephone response rates for recruitment were fairly slim resulting in a small sample size. The outreach calling was being done during working hours thus missing out on many patients who are unavailable during the day. Fifth, I-Care database includes patient data identified by its members according to payer classification in their records. Not everyone sends payer information.

¹⁴ Department of State Health Services. County Profiles (Williamson County). Available at <http://www.dshs.state.tx.us/ph/county.shtm>. Accessed July 6, 2008.

The payer information may not always be accurate, so there may be indigent patients who receive services from the network but are not reported to I-Care database. Sixth, the follow-up period for patients after the intervention varied and so we relied on average duration in the program. Seventh, some of the data used for the evaluation are self-reported and are subject to the limitations of self-reported data (such as recall bias¹⁵). Eighth, I-Care database does not differentiate between primary diagnosis and any accompanying diagnosis. Hence, we assume that the diagnosis of asthma in the patient record means that it was one of the presenting problems in ED or IP. Conversely, it is also possible that asthma patients who came with related symptoms did not have asthma mentioned in the diagnosis and were not included in our analysis. Ninth, I-Care database does not have reliable information about primary care physician of most patients. This information would be very helpful in determining how many of these patients were using ED or IP visits as their sole source of care. Tenth, we could not get information on how often was the Medicaider® program used to screen patients for eligibility. It was supposed to be done for all patients without any health coverage but we had no way to verify that easily.

The availability of data also limits the type of evaluation design used. A prospective cohort study design with control and treatment groups would have given much more robust results than a retrospective cohort study using administrative data. A larger sample would also have allowed us to look at impact of the program in certain age groups or in patients in a particular severity class. The calculations of decrease in utilization are subject to the limitations on the unavailability of 12 month data post-intervention. We therefore, use the available post-intervention utilization data without making any assumptions of how it is extrapolated over the next 12 months. We do, however, check the sensitivity of our analysis by using only those patients with more than 6-months duration post-intervention and find that outcomes are not very different. The same analysis conducted after at least 6 months of the end of the intervention program will

¹⁵ Hassan E. Recall bias can be a threat to retrospective and prospective research designs. *The Internet Journal of Epidemiology*. 2006;3(2).

allow a better analysis, although we doubt that any of the results described here will be overturned.

Asthma education programs and case management techniques have been shown to reduce utilization and improve outcomes. Wissow *et al* reported a 50% reduction in acute care in children aged 0 to 5 years in an inner city asthma program that included parent education and assessment of asthma patients with feedback to primary care providers.¹⁶ Guttman *et al* used a population-based cohort study from 152 EDs in Canada for 2- to 17- year-olds who had previous visit to ED. They found access to pediatricians and preprinted order sheets in EDs significantly reduced return visits.¹⁷ Yilmaz & Akkaya showed that proper drug use and usual care of patients are not sufficient for asthma treatment but asthma education was an important component of therapy.¹⁸ Brown *et al* showed a significant reduction in ED visits in children using home visits by an asthma educator.¹⁹ Kotses *et al* reported developing and evaluating a self-management program for adult asthma. The treatment group showed fewer asthma symptoms and physician visits.²⁰

The ICC-Asthma Network program shows significant improvements in outcomes with 40% reduction in ED visits, 95% reduction in inpatient visits, and 96% reduction in length of hospital stay of patients before and after the intervention. It showed cost savings of \$3,134 per patient and an overall net savings of \$539,090. The overall direction of the effects of the program is not very different from what is shown in evaluation of other such programs. Another case management program using RCTs for outreach to adult asthma patients in four EDs found a 56% reduction in ED utilization and 39% reduction in hospitalizations. It calculated cost savings of about \$106,874 from the program.²¹

¹⁶ Wissow LS, Warshow M, Box J, Baker D. Case management and quality assurance to improve care of inner-city children with asthma. *Am J Dis Child* 1988;142(7).

¹⁷ Guttman A, Agorski B, Austin PC, et al. Effectiveness of emergency department asthma management strategies on return visits in children: A population-based study. 2007 *Pediatrics*;120(6)

¹⁸ Yilmaz A, Akkaya E. Evaluation of long-term efficacy of an asthma education programme in an out-patient clinic. *Respir Med* 2002;96:519-524.

¹⁹ Brown MD, Reeves MJ, Meyerson K, et al. Randomized trial of a comprehensive asthma education program after an emergency department visit. *Ann Allergy Asthma Immunol* 2006;97(1):44-51.

²⁰ Kotses H, Bernstein L, Bernstein D, et al. A self-management program for adult asthma. Part 1: Development and evaluation. *J Allergy Clin Immunol* 1995;95(2):529-40.

²¹ Dwan J. The value of RCPs as asthma/COPD case managers. *Respir Care*, 2002

Kropfelder evaluated a case management program for children in an inner city setting. The program showed 50% decrease in ED and 66% decrease in hospitalizations.²² Lieu *et al* showed written management plans reduce risk of hospitalization (46%) and ED visits (55%).²³ A three-fold reduction in readmission rates were found in an outpatient program designed to reduce asthma exacerbations among adults.²⁴ However, the ICC-Network program, as far as we know, is unique in its effective use of health information exchange to identify and track patients in a community.

Conclusions & Recommendations

The results of the ICC-Asthma Network program clearly show the benefits of such an intervention. There is a measurable difference in outcomes both in terms of utilization of services and quality of life measures. The economic benefits of such a program are also demonstrated by using the data and applying proxy pricing methodology. The value and role of I-Care database in identifying patients, tracking their utilization and in conducting meaningful evaluation of the program are unique aspects of this intervention.

Some of the recommendations from the experience of the program relate to the administration of the program and collection of data:

- A larger program should be initiated in the community to benefit more asthma patients through education and self-management. ICC-Asthma Network program clearly shows that the benefits of an outreach program far outweigh the cost of operating such a program. I-Care database allows a unique opportunity to coordinate care for asthma across the community. Economies of scale will kick in to further improve the ROI of such a program at a larger scale. Recruitment of patients, training of staff, collection of data, and evaluation of the program can all be centralized while the program is being conducted in different locations.
- The process of selecting and training outreach staff can be improved to ensure a staff that is bilingual and able to effectively convince patients to participate in the

²² Kropfelder L. A case management approach to pediatric asthma. *Pediatr Nurs* 1997;23(1):81.

²³ Lieu TA, Quesenberry CP Jr, Capra AM, et al. Outpatient management practices associated with reduced risk of pediatric asthma hospitalization and emergency department visits. *Pediatrics* 1998;101(5):951-2.

²⁴ Mayo PH, Richman J, Harris HW. Results of a program to reduce admissions for adult asthma. 1990. *Ann Intern Med.* 112(11):864-71

program. This will help in reducing the initial launch-time of the project and increase the enrollment of patients.

- Protocols for conducting telephone health survey methodology, such as used in BRFSS, may be adopted to increase the effectiveness of recruitment through telephones. Evening or weekend callings can significantly increase the probability of contacting patients.
- Since the program specifically targets indigent population, many in this population may not have telephones. In such cases, in-person recruiting may be needed for high risk families with no telephones. Some studies have shown positive results using this method.²⁵ In-person contacts are more expensive than telephone outreach efforts but they can be used in specific circumstances.
- A more comprehensive evaluation-design methodology may be adopted at the beginning of the project and data collected accordingly. A cohort control-treatment study with a survey of those patients who declined to participate will help in getting QoL information from the control group and understand any barriers to entry into the program.
- The follow-up of patients who enrolled in the program should continue for at least one year after the program to evaluate the post-intervention follow-up efforts. Since the program aims at behavior change involving adoption of self-management techniques, it is important to understand the support required to help the patients after the intervention.
- A concerted effort is needed to further expand the clinical data from participating clinics, so that a complete picture of care across the community can be drawn. Currently, I-Care database has reasonably good utilization data but very limited clinical data. Similarly, the payer information is also sketchy because it is captured at the time of the encounter and is not confirmed at the time of billing.
- The ICC-Asthma Network program should be used as a learning experience for similar initiatives using I-Care database to develop programs for other chronic diseases in the community.

²⁵ Wissow LS, Warshow M, Box J, Baker D. Case management and quality assurance to improve care of inner-city children with asthma. *Am J Dis Child* 1988;142(7).

The ICC-Asthma Network has successfully demonstrated the benefits of patient education and case management for chronic disease. It clearly shows improved outcomes and cost savings. Most importantly, it lays the foundation for a community-wide effort to expand this program and hence reduce the prevalence, morbidity and mortality due to asthma. The key role of a health information exchange is a unique feature of this program. I-Care database helped in identification of eligible patients, in tracking the use of services, and in evaluating outcomes of the program. The successful use of I-Care database in the ICC-Asthma Network program should help the community identify other areas in which chronic disease care can be coordinated and made more effective and efficient using I-Care database.