

# Pharmacist Management of Adult Asthma at an Indian Health Service Facility

LCDR Kevin McDermott, PharmD, BCPS, AE-C

A pharmacist-managed adult asthma clinic improved asthma outcomes, patient satisfaction, cost burden, and readmission rates at the Shiprock, New Mexico, Indian Health Service facility.

According to the Centers for Disease Control and Prevention, asthma prevalence in the U.S. increased between 2001 and 2010 and is now at its highest level. In 2010, about 25.7 million people had asthma: 18.7 million adults (8%) and 7 million children (9%). Despite well-known treatment options, asthma continues to be poorly controlled. In 2009 there were 1.6 million emergency department (ED) visits, 497,300 hospitalizations, and 3,404 deaths related to asthma. Additionally, in 2008 the disease affected attendance at school and work with 10.5 million and 14.2 million missed school days and workdays, respectively.<sup>1-5</sup>

The American Indian and Alaska Native (AIAN) populations have not escaped the realities of asthma. According to a 2010 report of the National Center for Health Statistics, AIAN populations also have a high prevalence of asthma at 14.2%. This percentage is much higher than that of the general population.<sup>1</sup>

**LCDR McDermott** is a clinical pharmacist with the U.S. Public Health Commissioned Corps and is attached to the Indian Health Service at Northern Navajo Medical Center in Shiprock, New Mexico.

Over the past decade, pharmacists have expanded their roles from educators to clinicians with prescriptive authority in various settings. The greatest success has been seen with anticoagulation clinics, both clinically and financially.<sup>6-10</sup> Pharmacists have also demonstrated positive outcomes when involved in cardiovascular clinics.<sup>11-13</sup>

Additionally, pharmacists have been involved with asthma clinics as both educators and prescribers with favorable results clinically and economically.<sup>14-16</sup> A study from Taiwan done by Chan and Wang indicated that pharmacist asthma interventions in an outpatient setting improved the quality of care, reduced cost, and relieved stress on general medical resources.<sup>17</sup> Another study indicated that education by a community pharmacist can improve asthma control in a self-managed program.<sup>18</sup>

In 2007, an asthma medication use evaluation (MUE) was completed at the Northern Navajo Medical Center (NNMC) in Shiprock, New Mexico. The results of the MUE concluded that asthma statistics for the local population differed from that of the national data (Table 1). Overall, the Navajo population served by

the NNMC had a lower incidence of asthma but a higher rate of hospital admissions and ED visits.

One of the primary focus points for the MUE was short-acting beta agonist (SABA) refills. According to national guidelines, using a SABA 2 or more times per week (not for exercise-induced bronchospasms) would indicate a patient was not well controlled.<sup>19</sup> This use equates to 2 refills of SABA per year. The MUE found that 51% of patients had  $\geq 3$  refills per year, and 38% of patients had 4 or more refills per year. Based on asthma prevalence and SABA history, it was determined that a specialty clinic could have a positive impact on asthma care.

This study addresses how a specialized adult asthma clinic managed by pharmacists with physician oversight can improve asthma outcomes. Since January 2010, the NNMC has had a program in place and has experienced a concurrent substantial drop in asthma-related ED visits and admissions, an improved level of control, and a decreased cost burden to the facility.

## METHODS

A retrospective chart review was completed on all patients currently

enrolled in the clinic. The Resource and Patient Management System Visit General Retrieval (RPMS VGEN), Electronic Health Record, and the asthma clinic database were used to evaluate patients. The evaluation period began January 1, 2010, and ended December 31, 2011.

Performance improvement inclusion criteria for clinic patients were based on active status in the clinic. Active patients were defined as patients with at least 2 clinic visits and a clinic visit within 3 months of an ED visit or admission. The 3-month cutoff was chosen based on several criteria. First, most patients referred to the clinic were categorized as either not well controlled (NWC) or very poorly controlled (VPC) and required at least a 2- to 4-week follow-up based on guidelines. Second, patients who were categorized as well controlled (WC) were scheduled for clinic visits every 3 months for regular follow-up.

Using all ICD-9 codes for asthma, RPMS VGEN was used to find the number of ED visits and admissions that occurred with asthma as the primary diagnosis from both clinic and nonclinic patients. The inclusion criteria were then applied to the clinic patients, and those not meeting these criteria were returned to the non-clinic pool of patients.

Cost analysis was evaluated based on the results of a random selection of 20 patients from 2009 and 2010 ED and hospital visits at the NNMC. These numbers were averaged to determine ED and admission costs. Length of admission stay was determined from a RPMS VGEN search for each clinic and nonclinic patient admission.

Determination of the level of control was based on the 2007 national asthma guidelines. The guidelines state that the level of

**Table 1. Northern Navaho Medical Center and National Asthma Incidences<sup>1-3</sup>**

	National	American Indian/ Alaska Native	Northern Navaho Medical Center
Asthma prevalence	8% (adult)	14.2%	6.2% (adult)
Admission rates	17/10,000 <sup>a</sup>	No data	34/10,000 <sup>a</sup>
Emergency department visits	64/10,000 <sup>a</sup>	No data	121/10,000 <sup>a</sup>

<sup>a</sup> Local population.

**Table 2. Assessment of Asthma Control in Patients Aged ≥ 12 Years<sup>19</sup>**

Components of Control		Well Controlled	Not Well Controlled	Very Poorly Controlled
Impairment	Symptoms	≤ 2 d/wk	> 2 d/wk	Throughout the day
	Nighttime awakenings	≤ 2 mo	1-3 wk	≥ 4 wk
	Interference with normal activity	None	Some limitations	Extremely limited
	Short-acting beta <sub>2</sub> -agonist for symptom control (not prevention of exercise-induced bronchospasms)	≤ 2 d/wk	> 2 d/wk	Several times a day

control can be determined by either asthma symptoms or by peak flow evaluation.<sup>19</sup> Because of the language barrier that sometimes arises with the treated population, the use of symptom-based evaluation has been observationally superior to providing peak flow meters for home use. At each visit, patients were interviewed using tables from the asthma guidelines. Table 2 is an abbreviated portion of the guidelines representing the assessment

tool used by the clinic. The level of control was determined by selecting the column with the highest severity of impairment.<sup>19</sup>

All patients seen at the clinic were tracked in a database, and their current level of control was documented at each visit. To determine the level of control, the database was reviewed, and those patients with > 1 visit were included in the analysis. The levels of control from the first visit to the most recent visit were compared.

**Table 3. Emergency Department and Hospital Admissions**

Emergency Department Visits 2010–2011				
	Nonclinic Patients	Clinic Patients	Odds Ratio	P value
Patients	279	22	1.61 (1.01–2.59)	.043
Total visits	428	31	1.95 (1.34–2.85)	.001
Hospital Admissions				
	Nonclinic Patients	Clinic Patients	Odds Ratio	P value
Patients	53	7	2.64 (1.18–5.91)	.026
Total visits	71	8	2.97 (1.42–6.22)	.018

**Table 4. Total Number of Emergency Department/Hospital Visits Pre-/Postclinic**

	2008–2009	2010–2011	Change (%)
Emergency department visits	123	31	–75
Hospital admissions	20	8	–60

**Table 5. Actual Cost Savings**

		No. Visits/ Admissions	Median Cost (\$)	2-Year Cost (\$)
2008–2009 (before enrollment)	ED	123	373	45,879
	Admissions	20	1,199	23,980
	Total			69,859
2010–2011 (after enrollment)	ED	31	373	11,563
	Admissions	8	1,199	9,592
	Total			21,155
<b>Total 2-Year Cost Savings</b>				48,704
<b>Annualized Cost Savings</b>				24,352

ED = emergency department.

Patient surveys were completed at each visit. These surveys included questions to assist the pharmacy provider in classifying the level of control, patient satisfaction with asthma care, and patient perception of asthma control. Approval from the Navajo Area Institutional Review

Board was obtained for data publication. Odds ratios were used to determine the impact of the clinic, using a 95% confidence interval.

**RESULTS**

For the review period, 2,997 patients were coded as having some form of

asthma, resulting in 12,739 asthma visits within the medical center.

**ED Visits and Hospital Admissions**

Of these 2,997 patients, 301 visited the ED between 2010 and 2011 with 22 being active asthma clinic patients. These 22 active clinic patients accounted for 31 ED visits. The remaining 279 patients had 428 visits with a total of 459 ED visits from clinic and nonclinic patients. Sixty patients were hospitalized for asthma with 7 of them active asthma clinic patients. The 7 clinic patients admitted accounted for 8 admissions. There is a statistical significance in total ED visits and admissions as well as for individual patients (Table 3).

To determine the clinic impact, a 2-year analysis of patient pre- and postclinic enrollment was done. Search criteria for RPMS VGEN were identical to the study period search except for dates. Those patients enrolled in the clinic during the study period (2010–2011) were evaluated for the 2 years before the clinic startup (2008–2009). The results indicated a decrease in both ED visits and hospital admissions related to asthma for clinic patients (Table 4).

**Cost Data and Length of Stay**

Emergency department and hospital admissions costs were determined from an earlier performance improvement review of the clinic. The median cost of an ED visit was \$373 with a range from \$228 to \$910. The cost range represented the severity of the asthma exacerbation being treated. This cost range was similar to published data that reported a cost range from \$234 to \$400 with an average of \$339 per visit.<sup>20,21</sup> Hospital costs (including ED visit) per day ranged from \$528 to \$2,470 with a median of \$1,199 per day. Table 5 shows the calculated actual annual cost savings

for patients pre- and postenrollment. The cost difference between clinic and nonclinic patients from 2010 to 2011 was calculated to be \$111,000 annually (data not shown). The median length of the hospital stay for clinic and nonclinic patients was 2 days (range, 1-10 and 1-7 days, respectively). The national average was 4.3 days.

From 2008 to 2009, there were 123 ED visits and 20 hospital admissions related to asthma of patients who would later be enrolled in the asthma clinic study. From 2010 to 2011 there were 31 ED visits and 8 hospital asthma admissions (Table 4). These data were used to determine the potential cost savings for the clinic (Table 5). Based on current reductions, the potential annual cost savings was \$85,405 if all adult asthma patients were seen in the pharmacy managed clinic (Table 6).

**Level of Control**

A total of 66 patients had 3 or more visits to the asthma clinic. Of these patients, 30% had no change in control, 60% showed some measure of improvement, and 11% had a decrease in control based on the national guidelines (Table 7).

**Patient Perception**

At each visit, the patient's current perception of asthma control, satisfaction with control, and clinic grade related to asthma care was determined. Of the 66 patients with 3 or more visits, a large portion of the questionnaires were missing when the data were collected. Table 8 shows the results of the data for patients with 3 more visits and 2 completed forms from different visits. These data points may not have been from the first or most recent visits.

From earliest to most recent visit, patient perception of asthma control

**Table 6. Potential Cost Savings**

	Visit Reduction Between 2008-2009 and 2010-2011 (%)	Visits From Nonclinic Patients 2010-2011 (No.)	Total Cost From Nonclinic Patients (\$)	Cost Reduction When % Reduction Applied (\$)
ED	75	428	159,644	119,733
Hospital	60	71	85,129	51,077
<b>2-Year Total</b>				170,810
<b>Annual Potential Savings</b>				85,405

ED = emergency department.

**Table 7. Change in Level of Control Based on Guideline Criteria**

	Number	%	Total	%
<b>No Change</b>				
WC-WC	9	13.6	20	30
NWC-NWC	1	1.5		
VPC-VPC	10	15.2		
<b>Improvement</b>				
VPC-NWC	16	24.2	39	59
VPC-WC	15	22.7		
NWC-WC	8	12.1		
<b>Worsening</b>				
WC-NWC	3	4.5	7	11
WC-VPC	0	0.0		
NWC-VPC	4	6.1		

NWC = not well controlled; WC = well controlled; VPC = very poorly controlled.

compared with clinical guidelines improved moderately. Sixteen patients had a clinical improvement from VPC to NWC with 13 (81%) believing their symptoms were now WC.

**DISCUSSION**

The results of this performance improvement evaluation are encouraging. However, not all positive data may be directly attributed to the asthma clinic. The statistical analysis for this study does not seek to remove confounding variables. Without removing potential confounding variables, questions remain about the accuracy of the outcome.

However, combining the statistical data in Table 3 and the 2-year comparative data in Table 4, strong evidence exists that a positive impact from the clinic had occurred even in the presence of potential confounding variables.

The financial impact of asthma was evident with the 2010 to 2011 cost for ED visits and hospital admissions at \$265,928. Asthma clinic patients made up only 8% (\$21,155) of this cost and yielded an annual cost savings of \$24,352. Obviously, the 8% was a direct result of the number of nonclinic vs clinic patients. However, the cost savings of \$24,352 was

**Table 8. Results of Patient Questionnaire**

Patient Satisfaction in Asthma Control, No. (%) (n = 48)		
No change	28 (58) (24 remained satisfied; 2 somewhat satisfied; 2 not satisfied)	
Improved	13 (27)	
Worsened	7 (15)	
Level of Care (n = 48)		
	Earliest Visit Recorded	Last Visit Recorded
Median score	8	9
Perception of Control, No. (%) (n = 49)		
	Earliest Visit Recorded	Last Visit Recorded
Patient perception matches guideline control	17 (35)	24 (49)
Patient perception better than guideline control	30 (61)	25 (51)
Patient perception worse than guideline control	2 (4)	0

independent of patient numbers and was calculated directly from patients pre- and postenrollment. The potential savings if all current nonclinic patients were enrolled in the clinic was \$85,405 annually.

The savings was only direct cost and did not include indirect costs related to asthma, such as lost work/school days, impact on employer productivity, and so forth. This was calculated after applying the 75% and 60% reduction in ED and hospital costs. As more patients are enrolled in the clinic, the potential cost could become an actual cost savings, based on the assumption that the 75% and 60% reduction stays constant (Figure). Over 1 year, the actual savings of the clinic makes up for 31% of the current ED visits from nonclinic patients. With the addition of the potential savings, the clinic could almost negate the money that is currently spent on asthma care.

Clinic data indicated a positive impact on level of control. Of those patients with 3 or more visits to the asthma clinic, 59% had some form of improvement. Fifteen of those patients (23%) had the biggest improvement: from VPC to WC. While any form of improvement is beneficial, a jump of this magnitude in so many patients is extremely encouraging. Thirty percent of the patients had no change in level of control. Of these, 14% were WC, so it would be hoped that no change would occur. Eleven patients remained at suboptimal control. The most concerning control data were those patients who lost control of their asthma during the 2-year period.

Chronic nonadherence from a select number of clinic patients seemed to be a major problem. Thirty-one ED visits were from 22 patients, and the 8 admissions were from 7 patients. Of the 22 ED patients, 82%

had poor adherence to asthma medications. The hospital data were similar with 6 out of the total 7 (86%) clinic patients reporting poor medication adherence. Additionally, the majority of patients with a decrease in level of control since enrolling in the clinic had a history of poor medication adherence (4 of 7 patients).

In rating the level of asthma care, patients indicated they received the same level of care after enrollment as they did before enrollment. Most of the care given before the clinic was by primary care providers (PCPs), the ED, and urgent care providers. Since the patients rated the level of care equal, it would suggest that pharmacists were providing the same level of care as were these providers, at least from a patient standpoint. Overall, patients were satisfied with their level of control. Most patients were satisfied at enrollment and did not have a change of opinion throughout the study period, and a large number showed increased satisfaction. The patients who showed a decrease in satisfaction of asthma control were those patients who also had no improvement in actual control. Most of these patients stayed at the VPC level. About half these same patients had a history of noncompliance.

There is significant concern regarding those patients who continue to believe they are better controlled than what the guidelines indicate. Sixteen patients moved from VPC to NWC per the guidelines. Thirteen of these patients now believe that their asthma is WC. This belief places the patients at risk for a severe asthma exacerbation. Patients who believe they are WC may be less likely to self-medicate with albuterol or seek medical help during the initial stages of an exacerbation. These patients will need further education to bring



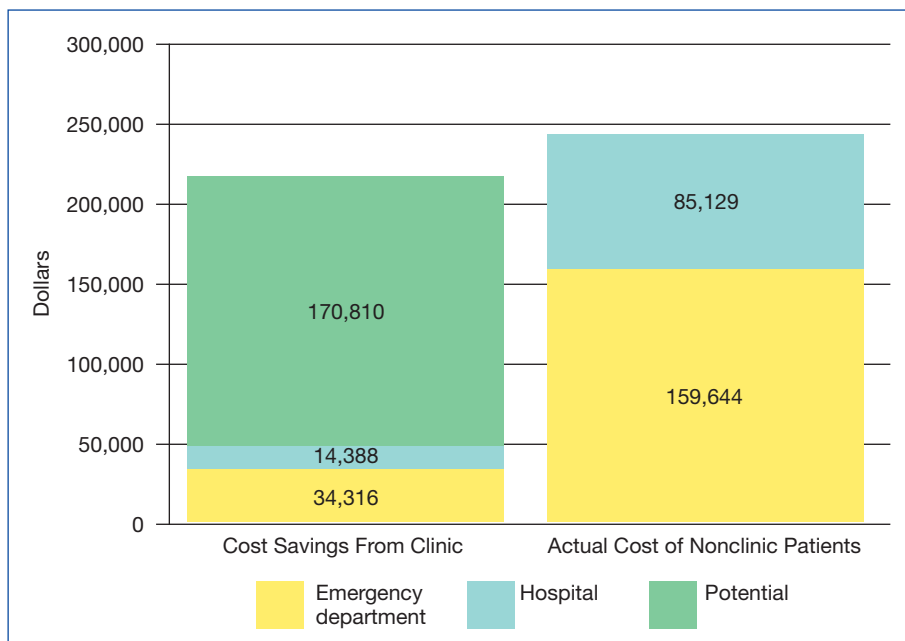
their personal perceptions and actual asthma control together.

**CONCLUSIONS**

Based on clinical results it seems that the NNMC Adult Asthma Clinic has made a positive impact on asthma care. Additionally, significant reduction in the financial burden to the facility is achievable. The results, both clinically and statistically significant, indicate the impact a specialty clinic can provide. Specialty clinics, pharmacy or otherwise, have a history of providing positive outcomes.

As previously noted, no confounding variables were included in the data analysis, which could bias the results, even though data for the same time frame from separate years will reduce some errors. However, there will always be a difference in pollen counts, outbreaks (ie, influenza), temperature changes, and so forth. Such variables should be reduced but not removed completely, based on this performance improvement design. If any of these variables were significantly different, it could alter the results, so a potential weakness is present in this study.

Probably the most important mechanism for the success of the clinic is education. Each visit is set at 30-minute appointments (1 hour for new patients), allowing for a significant amount of time that can be spent on education topics, including pathophysiology, trigger avoidances, and medication use. Patients are asked to bring their medications to the clinic and demonstrate inhaler technique at every visit. Patients who do not bring their inhalers to the clinic will have them filled at the clinic and given to them for demonstration. This type of show-and-tell education allows clinic providers to



**Figure.** Two-Year Clinic Cost Savings Compared With Nonclinic Costs.

correct improper inhaler technique immediately. Having patients actually use their medication seems to influence the patient's inhaler mechanics to a greater extent than does demonstration with a placebo.

In the eyes of the clinic provider, it is important for patients to understand the basic pathophysiology of the disease. The better understanding patients have of a disease, the better they can take part in the treatment. Since the clinic actively engages patients in education topics, it brings patients into an active role in the treatment. As mentioned, the inhaler technique seems to be the most effective first step. However, as patients gain trust in clinic providers due to significant improvement in symptoms secondary to inhaler technique, this trust leads to a dialogue about pathophysiology and triggers.

Another key component in the clinic success is the nature of the clinic itself. Providers in the clinic focus on only 1 disease and the guide-

lines to treat that disease. Therefore, providers in the clinic are trained to be extremely familiar with the treatment of asthma. This is not to imply that a patient's PCP or usual care provider is unfamiliar with the guidelines. It simply means that specialty care involves an extra time commitment to a specific disease. Each clinic provider must attain a high level of asthma knowledge before consideration as a full-time provider. Pharmacists are encouraged to sit for the Certified Asthma Educators examination, Board Certified Pharmacotherapy Specialist examination, and/or obtain the Indian Health Service National Clinical Pharmacy Specialist certification.

Although the clinic has moved in the right direction, there are still several patients who have not had any improvement since being referred to the clinic. These patients have refractory asthma (ie, step 6) and are not able to be treated at this facility, continued poor medication adherence,

or do not have asthma at all. These patients will be flagged and will be evaluated on a case-by-case basis.

In conclusion, the clinic has begun to achieve what it was intended to do: improve asthma control, reduce patient burden on ED staff, and decrease financial burden to the facility. Additionally, there is improvement in the satisfaction of the asthma care and a trend toward the patients' perception of asthma control agreeing with medical guidelines. These findings further support the use of pharmacists in the role as provider for the management of chronic diseases. ●

**Acknowledgements**

Shaile Mehta, MD, is an internal medicine provider at the NNMC. He attended the University of Pittsburgh School of Medicine in Pennsylvania and completed a residency in internal medicine at the University of Michigan in Ann Arbor. Dr. Mehta is certified with the American Board of Internal Medicine.

Erica Markovitz, MD, is an internal medicine provider at the NNMC. She attended the University of Miami School of Medicine in Florida and completed a residency at the University of Michigan. Dr. Markovitz is certified with the American Board of Internal Medicine and the American Board of Pediatrics.

Thad Koppenhafer, PharmD, is the director of pharmacy at the NNMC and the area pharmacy consultant for the Navajo Area of the IHS. He is a member of the American Society of Health-Systems Pharmacists.

CAPT Mark Strong, PharmD, MT (ASCP) is a senior supervisory pharmacist with the U.S. Public Health Commissioned Corps and is assigned to the IHS. He is currently the chief of outpatient pharmacy services at the NNMC.

CDR Clint Krestel, PharmD, is the

assistant chief of pharmacy responsible for Inpatient Pharmacy Services. His professional memberships currently include the American College of Clinical Pharmacy, the American Society of Health-System Pharmacists, and the Commissioned Officers Association.

**Author disclosures**

The author reports no actual or potential conflicts of interest with regard to this article.

**Disclaimer**

The opinions expressed herein are those of the author and do not necessarily reflect those of Federal Practitioner, Frontline Medical Communications Inc., the U.S. Government, or any of its agencies. This article may discuss unlabeled or investigational use of certain drugs. Please review complete prescribing information for specific drugs or drug combinations—including indications, contraindications, warnings, and adverse effects—before administering pharmacologic therapy to patients.

**REFERENCES**

1. Moorman JE, Akinbami LJ, Bailey CM, et al. National surveillance of asthma: United States, 2001-2010. Centers for Disease Control and Prevention Website. National Center for Health Statistics. [http://www.cdc.gov/nchs/data/series/sr\\_03/sr03\\_035.pdf](http://www.cdc.gov/nchs/data/series/sr_03/sr03_035.pdf). Accessed March 10, 2014. *Vital Health Stat.* 2012;3(35):1-67.
2. National Asthma Control Program. Asthma's impact on the nation. Data from the CDC National Asthma Control Program. Centers for Disease Control and Prevention Website. [http://www.cdc.gov/asthma/impacts\\_nation/asthmafactsheet.pdf](http://www.cdc.gov/asthma/impacts_nation/asthmafactsheet.pdf). Accessed March 10, 2014.
3. Schappert AM, Rechtsteiner EA. Ambulatory medical care utilization estimates for 2007. National Center for Health Statistics. Centers for Disease Control and Prevention Website. [http://www.cdc.gov/nchs/data/series/sr\\_13/sr13\\_169.pdf](http://www.cdc.gov/nchs/data/series/sr_13/sr13_169.pdf). Accessed March 10, 2014. *Vital Health Stat.* 2011;13(169):1-38.
4. Kochanek KD, Xu J, Murphy SL, Miniño AM, Kung H-C. Deaths: Final data for 2009. Centers for Disease Control and Prevention Website. National Center for Health Statistics. [http://www.cdc.gov/nchs/data/nvsr/nvsr60/nvsr60\\_03.pdf](http://www.cdc.gov/nchs/data/nvsr/nvsr60/nvsr60_03.pdf). Accessed March 10, 2014. *Natl Vital Statistics Rep.* 2011;60(3):1-117.
5. Barnes PM, Adams PF, Powell-Griner E. Health characteristics of the American Indian or Alaska

- Native adult population: United States, 2004-2008. Centers for Disease Control and Prevention Website. National Center for Health Statistics. <http://www.cdc.gov/nchs/data/nhsr/nhsr020.pdf>. Accessed March 10, 2014. *Natl Health Stat Report.* 2010;20:1-23.
6. Garwood CL, Dumo P, Baringhaus SN, Laban KM. Quality of anticoagulation care in patients discharged from a pharmacist-managed anticoagulation clinic after stabilization of warfarin therapy. *Pharmacotherapy.* 2008;28(1):20-26.
7. Gray DR, Garabedian-Ruffalo SM, Chretien SD. Cost-justification of a clinical pharmacist-managed anticoagulation clinic. *Ann Pharmacother.* 2007;41(3):496-501.
8. Ernst ME, Brandt KB. Evaluation of 4 years of clinical pharmacist anticoagulation case management in a rural, private physician office. *J Am Pharm Assoc.* 2003;43(5):630-636.
9. Poon IO, Lal L, Brown EN, Braun UK. The impact of pharmacist-managed oral anticoagulation therapy in older veterans. *J Clin Pharm Ther.* 2007;32(1):21-29.
10. Dager WE, Branch JM, King JH, et al. Optimization of inpatient warfarin therapy: Impact of daily consultation by a pharmacist-managed anticoagulation service. *Ann Pharmacother.* 2000;34(5):567-572.
11. Morello CM, Zadovny EB, Cording MA, Suemoto RT, Skog J, Harari A. Development and clinical outcomes of pharmacist-managed diabetes care clinics. *Am J Health Syst Pharm.* 2006;63(14):1325-1331.
12. Lowey A, Moore S, Norris C, Wright D, Silcock J, Hammond P. The cost-effectiveness of pharmacist-led treatment of cardiac risk in patients with type 2 diabetes. *Pharm World Sci.* 2007;29(5):541-545.
13. Erhun WO, Aghani EO, Bolaji EE. Positive benefits of a pharmacist-managed hypertension clinic in Nigeria. *Public Health.* 2005;119(9):792-798.
14. Hatoum HT, Witte KW, Hutchinson RA. Patient care contributions of clinical pharmacists in four ambulatory care clinics. *Hosp Pharm.* 1992;27(3):203-206, 208-209.
15. Pauley TR, Magee MJ, Cury JD. Pharmacist-managed, physician-directed asthma management program reduces emergency department visits. *Ann Pharmacother.* 1995;29(1):5-9.
16. Nack JA. Homecare management of the asthma patient. *U.S. Pharmacist.* 1998;23(7). [http://legacy.uspharmacist.com/oldformat.asp?url=newlook/files/Home/ACF2FEE.cfm&pub\\_id=8&article\\_id=127](http://legacy.uspharmacist.com/oldformat.asp?url=newlook/files/Home/ACF2FEE.cfm&pub_id=8&article_id=127). Accessed March 10, 2014.
17. Chan AL, Wang HY. Pharmaco-economic assessment of clinical pharmacist interventions for patients with moderate to severe asthma in outpatient clinics: Experience in Taiwan. *Clin Drug Investig.* 2004;24(10):603-609.
18. Barbabel D, Eldridge S, Griffiths C. Can a self-management programme delivered by a community pharmacist improve asthma control? A randomised trial. *Thorax.* 2003;58(10):851-854.
19. U.S. Department of Health and Human Services, National Institutes of Health, National Heart Lung and Blood Institute. National Asthma Education and Prevention Program, Expert Panel 3. *Guidelines for the Diagnosis and Management of Asthma. Summary Report 2007.* Bethesda, MD: National Institutes of Health; 2007. NIH publication Number 0805846.
20. Stanford R, McLaughlin T, Okamoto LJ. The cost of asthma in the emergency department and hospital. *Am J Respir Crit Care Med.* 1999;160(1):211-215.
21. Williams RM. The cost of visits to emergency departments. *N Engl J Med.* 1996;334(10):642-646.