Impact of Clinical Pharmacy on Asthma in Pregnancy in a Maternal-Fetal Care Clinic: A Pilot Study

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Alicia B. Forinash, PharmD¹, Danielle Chamness, PharmD²,
Abigail M. Yancey, PharmD¹, Jamie Koerner, PharmD³, Katherine Mathews, MD⁴,
Collin Miller, MSW⁴, Judy Thompson, RN⁴, and Thomas Myles, MD⁴

Abstract

Background: Asthma complicates 4% to 8% of pregnancies. The impact of clinical pharmacists providing asthma management and education to obstetric patients is unknown. **Objective:** Evaluate the impact of and patient satisfaction with clinical pharmacy services on asthma in pregnancy. **Methods:** This prospective quasi-experimental study enrolled 30 pregnant patients with asthma and assessed perceived asthma understanding, control, and inhaler technique before and after a clinical pharmacist visit and education. The primary outcome was change in pre- and postsurvey scores. Items were rated on a 5-point Likert-type scale; higher scores represented higher perceived knowledge or satisfaction. Secondary outcomes included inhaler technique scores, asthma control, correlating patient-specific factors with the primary outcome, and level of patient satisfaction with clinical pharmacy services. **Results:** Perceived knowledge of asthma in pregnancy median score (maximum score 50) significantly increased with clinical pharmacy education (37.5 pre vs 49 post, $P = .001$). Prior to clinical pharmacy services, patients highly rated their perceived knowledge of asthma in pregnancy with median scores on 7 of 10 items between 4 and 5. Despite this, significant changes were observed on 9 items. The proportion of patients with controlled asthma significantly increased after the pharmacist visit (33.3% vs 90%, $P < .001$). Satisfaction with clinical pharmacy services was overwhelmingly positive with average scores on all items 4.5 to 5. Inhaler technique scores significantly increased from baseline to follow-up (4 vs 7, $P = .001$). **Conclusions:** Pharmacists significantly improved patient perceived knowledge about asthma, asthma control, and inhaler technique. Patients were overwhelmingly satisfied with the care provided by the pharmacist.

Keywords

asthma, pregnancy, pharmacy services, patient education

Introduction

Asthma is a common medical condition that can potentially complicate 4% to 8% of pregnancies.¹ It is standard of care for patients at the SSM Maternal Fetal Care Center (MFCC) to undergo comprehensive clinical pharmacy visits, in addition to physician education, as part of their asthma management. During the first pharmacy visit, the pharmacist reviews the patient's asthma history, completes an asthma-related review of systems, performs peak flow monitoring, develops an asthma action plan, and individualizes pharmacologic therapy based on symptom control. Additionally, education is provided on inhaler technique, using the asthma action plan, and avoiding risks of uncontrolled asthma in pregnancy.

The clinical pharmacist and pharmacy resident at the MFCC have been highly involved with a variety of disease state management and education programs including

asthma. However, the impact and patient satisfaction of these services have not previously been assessed. Clinical pharmacy services have been shown to improve patient outcomes and satisfaction in a variety of areas, including hyperlipidemia and anticoagulation, but there is an absence of data in the obstetrics/gynecology setting.^{2,3}

This prospective quasi-experimental study assessed the impact of and patient satisfaction with clinical pharmacy services on asthma in pregnancy in the MFCC.

¹St Louis College of Pharmacy, St Louis, MO, USA

²Corum Health Services, Inc, St. Louis, MO, USA

³University of Missouri Kansas City, Columbia, MO, USA

⁴St Louis University, St Louis, MO, USA

Corresponding Author:

Alicia B Forinash, St Louis College of Pharmacy, 4588 Parkview Place, St Louis, MO 63110, USA.

Email: Alicia.Forinash@stlcop.edu

Materials and Methods

This study was conducted from May 2014 to May 2015 at the MFCC at SSM Health St Mary's in St Louis, Missouri, where an interdisciplinary teaching clinic serves an uninsured and underinsured population. The interdisciplinary team includes attending, fellow, and resident physicians, medical students, clinical pharmacist, pharmacy resident, pharmacy students, advanced practice nurses, dietician, certified diabetic nurse educators, genetic counselors, and ultrasound technicians. The clinical pharmacy team includes 1 pharmacist, 1 pharmacy resident, and 2 advanced pharmacy practice experience students. The pharmacist is a full-time faculty member that provides direct patient care at least 5½ days per week. There are 2 advanced practice pharmacy students at the site for 5-week rotations 6 to 7 modules (of 9 total) per year. Currently, the pharmacy resident is in this service at least 16 weeks per year but can choose to complete electives in this area as well. Reasons for referral to the pharmacy team include but are not limited to asthma, psychiatric disorders, smoking cessation, nonadherence, diabetes, anticoagulation, and hypertension. The clinical pharmacist visits include medication reconciliation, review of social history, vaccine history, allergies, review of systems, in-depth medication and disease state education, assessment for all medical conditions and medications, and recommendations for optimizing management and monitoring. This study was approved by the institutional review boards at Saint Louis University and St Louis College of Pharmacy.

Patients were included in the study if they were pregnant females ≥ 18 years old with an asthma diagnosis who were current patients at the MFCC. They were excluded if they were unwilling to participate in the survey; were not currently prescribed any inhalers; did not complete the second visit and postsurvey even if they took the presurvey; did not speak English; or were already seen for asthma by the clinical pharmacy team during this pregnancy prior to study initiation.

Potential patients were referred to the clinical pharmacy team for asthma management by physicians in the clinic; or identified through an EPIC chart review performed by the clinical pharmacist looking for asthma in the past medical history or asthma medications in the medications list for all the patients scheduled for the clinic each day. The following pertinent information was collected from each patient's chart: drug, dose, route, and frequency of each inhaler on profile; patient date of birth; parity and gravity; gestational age at first clinical pharmacy visit; comorbid disease states; medications; and pharmacy refill information via calling each patient's pharmacy for the last 2 fill dates.

If the patient met inclusion criteria, the clinical pharmacist delivered a presurvey with a cover letter for the front desk to give to the patient to complete while waiting to be

seen. The survey consisted of 10 questions using a Likert-type scale that assessed perceived knowledge regarding asthma in pregnancy. The cover letter explained the basis of the survey and that by taking the survey, the patient would be providing informed consent to be part of the study. The letter highlighted that the asthma visit with a clinical pharmacist is part of the standard of care for asthma patients in the office and is not an extra component for the study. The standard first visit included assessment of asthma control, inhaler technique, peak flow monitoring, developing asthma action plan, recommendations for management of asthma in pregnancy, medication reconciliation, as well as education on asthma in pregnancy, inhaler technique, use of a spacer and peak flow monitoring, and asthma action plan. The clinical pharmacist also gathered information on the patient allergies, social history, vaccine history, acute pregnancy condition, and questions related to other medical history. The opportunity to clarify any questions about the letter or survey was offered.

The clinical pharmacist, pharmacy resident, or pharmacy students conducted a standard first visit at a minimum of 15 minutes in length. If a pharmacy student completed the visit, the student was directly supervised by either the clinical pharmacist or pharmacy resident to ensure that all information was covered appropriately. Asthma control status, categorized based on the National Heart, Lung, and Blood Institute (NHLBI) guidelines, before and after clinical pharmacy services was compared.⁴ Inhaler technique for prescribed inhalers was also assessed. Each step of the metered dose inhaler technique was worth 1 point with a maximum score of 9. Correct demonstration of that step was awarded a point. If patients could not demonstrate a step correctly, they received no points for that step. Pertinent information was recorded on a coded data collection sheet after the visit, and the sheet was saved for the patient's next visit in order to help track potential improvements.

The second visit with a clinical pharmacist occurred at least 3 weeks after the initial visit and included a review of education from the first visit, assessment of asthma control, and evaluation of inhaler technique as well as administration of the postsurvey in the same manner as the first visit. The postsurvey was completed prior to seeing the pharmacist for the second visit. It was administered prior to the second visit to assess the impact and retention of first visit. The postsurvey consisted of the same 10 questions using a Likert-type scale that assessed perceived knowledge regarding asthma in pregnancy as well 13 questions using a Likert-type scale to assess satisfaction with the pharmacist from the first visit.

The primary outcome of the study was the change in the total presurvey and postsurvey score. Secondary outcomes included correlating the following variables to the primary outcome: age, baseline inhaler score, parity and gravity, gestational age at first clinical pharmacy visit, whether the

patient was on rescue inhalers alone versus both rescue and controller inhalers, baseline asthma control status, and number of comorbidities. Other secondary outcomes included level of patient satisfaction with clinical pharmacy services; change in inhaler technique score from visit 1 to visit 2 after receiving pharmacist education; and change in asthma control status from visit 1 to visit 2.

The number of 30 patients for the primary outcome was chosen based on an estimated total sample size of 25 (effect size .5, α .05, power .8, Wilcoxon signed-rank test-matched pairs, a priori). Items assessing satisfaction with clinical pharmacy services as well as items assessing perceived knowledge were rated on a 5-point Likert-type scale from 1 “strongly disagree” to 5 “strongly agree.” Higher scores represent greater perceived knowledge and represent greater satisfaction, respectively. Continuous variables were expressed as means and standard deviations or medians and ranges. Categorical variables were expressed as numbers and percentages. The Wilcoxon signed-rank test was utilized to compare continuous variables. Asthma control pre- and postclinical pharmacy visit was evaluated with a McNemar’s test. A backward stepping regression model was performed to examine the relationship between secondary variables and the primary outcome of interest. Cronbach’s α was used to measure internal consistency of the scale utilized for the primary outcome. A P value of less than .05 was used to denote statistical significance. All analyses were performed using SPSS version 21.0 for Windows.

Results

Thirty pregnant women with asthma completed a survey before and after consultation with the pharmacist. At enrollment, patients were an average age 26.91 ± 5.03 years with an average gestational age of 23.66 ± 7.60 weeks, and 70% were only on albuterol for asthma (Table 1). On average, patients completed the postsurvey 45.83 ± 26.27 days after the presurvey. Additionally, 66.7% had uncontrolled asthma at the first visit and had long-term controller therapy added by the clinical pharmacist at the initial pharmacy visit.

Prior to receiving clinical pharmacy services, patients rated their perceived knowledge of asthma in pregnancy quite high. At baseline, median scores on 7 out of 10 items were between 4 and 5. Two items had a median score of 3 (neutral) with only 1 item receiving a median score of 2.5 (between disagree-neutral). Despite high baseline knowledge, significant changes were observed on 9 out of 10 items (Table 2). The most noticeable change was observed on the item addressing knowledge of management when peak flow readings are in the red, yellow, or green zone.

For the primary outcome of total change in perceived knowledge from baseline to follow-up, each item was summed to create a composite score. Individual items demonstrated high internal consistency with a Cronbach’s α of

Table 1. Sample Characteristics of 30 Women.

Characteristic	n	%
Age (years)		
19-24	12	40.0
25-29	12	40.0
30+	6	20.0
Trimester at enrollment		
First	4	13.3
Second	14	46.7
Third	13	40.0
Gravidity (mean and SD)	2.8 ± 1.7	
Primiparous	9	30.0
Multiparous	21	70.0
Time between pre- and postassessment (days)		
<40	18	60.0
40+	12	40.0
Number of comorbidities (mean and SD)	2.6 ± 1.8	
Baseline inhaler score (mean and SD)	3.6 ± 1.4	
Inhaler status		
Rescue only	21	70.0
Rescue + control	9	30.0
Baseline NHLBI control status		
Uncontrolled	20	66.7
Controlled	10	33.3

Abbreviations: SD, standard deviation; NHLBI, National Heart, Lung, and Blood Institute.

.85. A Wilcoxon signed-rank test indicated a significant difference in perceived knowledge from baseline to follow-up ($P = .001$). At baseline, the median composite score was 37.5 compared to 49.0 at follow-up (Table 3). Patient satisfaction with clinical pharmacy services was overwhelmingly positive with average scores on all items between 4.5 and 5 (Table 4).

When the primary outcome of total change in perceived knowledge from pre to post was examined in relation to secondary outcome variables (age, gestational age at enrollment [trimester at enrollment], gravidity, parity [primiparous vs multiparous], number of days between pre- and postvisit survey, inhaler status [rescue only vs rescue + control], and baseline inhaler score) no significant differences emerged in univariate comparisons or the full multivariate regression model. However, the study was not powered to detect differences for secondary outcome variables.

Control of asthma symptoms was assessed using NHLBI guidelines before and after receiving clinical pharmacy services. The proportion of participants with controlled asthma symptoms was significantly greater after receiving clinical pharmacy services ($P < .001$). At baseline, 33.3% of women had controlled asthma symptoms compared to 90% at follow-up.

Table 2. Comparison of Pretest and Posttest Scores on Perceived Knowledge Items for 30 Women^a.

Item	Pre Median	Pre Mean	Pre Range	Post Median	Post Mean	Post Range	P
I know when to use my inhalers	5.0	4.47	1.0-5.0	5.0	4.83	3.0-5.0	.007
I know how to use my inhalers correctly	5.0	4.63	1.0-5.0	5.0	4.80	4.0-5.0	.366
I am comfortable with the safety of my inhalers during pregnancy	5.0	4.23	1.0-5.0	5.0	4.73	3.0-5.0	.014
I understand the risks of uncontrolled asthma in pregnancy	3.0	3.27	1.0-5.0	5.0	4.67	2.0-5.0	.001
I know what it means for my asthma to be well controlled	4.0	4.10	1.0-5.0	5.0	4.80	3.0-5.0	.002
I understand how a peak flow meter monitors my asthma	3.0	3.10	1.0-5.0	5.0	4.72	2.0-5.0	.001
I know what to do if my peak flow is in the green, yellow, or red zone	2.5	2.87	1.0-5.0	5.0	4.63	2.0-5.0	.001
I am comfortable using all my medications during pregnancy	4.0	3.90	1.0-5.0	5.0	4.83	4.0-5.0	.001
I am satisfied with the control of my asthma symptoms	4.0	3.63	1.0-5.0	5.0	4.53	2.0-5.0	.001
I understand the difference between pregnancy shortness of breath and true asthma symptoms	4.0	3.53	1.0-5.0	5.0	4.73	4.0-5.0	.001

^aWilcoxon signed-rank tests were conducted to compare differences between scores before and after pharmacy consultation.

Table 3. Comparison of Sum Pretest and Posttest Scores on Perceived Knowledge Items for 30 Women^a.

	Pre Median	Pre IQR	Post Median	Post IQR	P
Sum of knowledge score	37.5	34.0-41.25	49.0	46.75-50.00	.001

Abbreviation: IQR, interquartile range.

^aWilcoxon signed-rank test was conducted to compare differences between scores before and after pharmacy consultation.

Inhaler technique scores were compared before and after receiving clinical pharmacy services. Inhaler scores significantly improved from baseline to follow-up ($P = .001$). At baseline, the median score was 4 (interquartile range 2.0-5.0) compared to 7 (interquartile range 6.0-8.0) at follow-up (maximum score of 9).

Discussion

Poorly controlled asthma during pregnancy can lead to increased risk of premature delivery, low birth weight, need for cesarean section, preeclampsia, fetal growth restriction, and maternal morbidity and mortality due to lack of oxygenation to both the mother and fetus.¹ The majority of medications used to manage asthma are not associated with risk in pregnancy, and it has been found that it is safer to treat and control asthma in pregnancy than to have asthma symptoms or exacerbations during pregnancy.⁵

Asthma management during pregnancy involves extensive patient evaluation and education, including asthma history, asthma-related review of systems, peak flow monitoring, asthma action plan, inhaler education, individualizing

pharmacologic therapy based on symptom control, risks of uncontrolled asthma in pregnancy, avoiding or controlling triggers, and other patient-specific pieces.¹ These education, monitoring, and management components are key for achieving and maintaining better control of asthma in pregnancy and decreasing the risk of adverse maternal and fetal outcomes.⁵ The data from this trial show the benefit of including clinical pharmacy support as a part of asthma management in an obstetrics practice. This supports the new American College of Obstetricians and Gynecologists task force report on team-based care.⁶ Patients demonstrated significant improvement in perceived knowledge about asthma, inhaler technique, and asthma control. In addition, patients were highly satisfied with the care provided by the clinical pharmacy team.

Strengths of this study are that it evaluates the impact of clinical pharmacy services in an area where this has not previously been assessed. To the best of the authors' knowledge, there are only a handful of clinical pharmacy specialists who provide care within obstetrics/gynecology offices. Another strength is that although the study included a subjective component for the patients' perceived

Table 4. Mean Pharmacist Satisfaction Scores for 30 Women^a.

Item	Mean $\pm$ SD	Range
Your comfort discussing your care with the pharmacist	4.73 $\pm$ 0.52	3.0-5.0
The pharmacist's interest in your health	4.80 $\pm$ 0.48	3.0-5.0
How well the pharmacist helps you understand your asthma	4.80 $\pm$ 0.48	3.0-5.0
How well your pharmacist answers your questions	4.00 $\pm$ 0.48	3.0-5.0
The respect shown to you by the pharmacist	4.87 $\pm$ 0.43	3.0-5.0
The pharmacist's efforts to make sure that your medicine works well	4.87 $\pm$ 0.43	3.0-5.0
The amount of time the pharmacist offers to spend with you	4.76 $\pm$ 0.57	3.0-5.0
The pharmacist's efforts to improve problems or concerns with medications	4.83 $\pm$ 0.46	3.0-5.0
Your desire to see the pharmacist at future visits	4.55 $\pm$ 0.78	2.0-5.0
The pharmacist's ability to improve your asthma control	4.76 $\pm$ 0.58	3.0-5.0
How well the pharmacist helps you understand the safety of your medications during pregnancy	4.83 $\pm$ 0.47	3.0-5.0
The pharmacist's ability to address pregnancy issues such as nausea, heartburn, or constipation	4.72 $\pm$ 0.59	3.0-5.0
How well the pharmacist explains how your medications work	4.83 $\pm$ 0.47	3.0-5.0

Abbreviation: SD, standard deviation.

^aOne satisfaction score was missing for the final 5 items.

knowledge of asthma, the critique of inhaler technique was evaluated using specifically detailed objective criteria, providing clinical data evaluating the benefit of the clinical pharmacist's service. Limitations of the study include the small sample size limiting the ability to detect a difference in secondary outcomes. Although the study population was small in this study, it did meet power and detected a significant difference in patient perceived knowledge on asthma. Additionally, asthma control and inhaler score significantly improved after pharmacist visit. This study evaluated patient perception of asthma knowledge rather than testing actual knowledge changes.

Conclusions

Surveys indicated that pharmacists significantly improved patient perceived knowledge about asthma and inhaler technique. Additionally, patients were overwhelmingly satisfied with the care provided by the pharmacist. This data help support the role to expand clinical pharmacy within obstetric care to enhance asthma management and patient education in partnership with physician care.

Authors' Note

This study was presented at the 82nd Central Association of Obstetricians and Gynecologists Meeting; October 21-24, 2015; Charleston, SC.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Alicia Forinash is a coauthor to *Briggs Drug Use in*

Pregnancy and Lactation. She has received payment for writing but not royalties.

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