BRIEF PRACTICE REPORT

Pharmacist-Led Model to Reduce Hospital Readmissions
in Medically Complex Children

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OBJECTIVES: This pilot study investigated the feasibility and effect on health care utilization of medically complex children participating in a pharmacist-led model for care coordination. Quality of life and satisfaction with care were secondarily assessed for each patient.

METHODS: Four medically complex children were enrolled and contacted by the pharmacist weekly for 5 consecutive months. Time for each encounter with a patient was collected. Each patient's hospital admissions, days of stay, emergency department visits, and clinic visits were recorded. At enrollment and at the end of the study, each caregiver completed the PedsQL 4.0 questionnaire to evaluate the child's quality of life and the Patient Assessment of Care for Chronic Conditions questionnaire to assess satisfaction with care. Patients aged 5 years and older completed an age-appropriate version of the PedsQL 4.0 as well.

RESULTS: The pharmacist spent on average 60 to 80 minutes per patient per week. Hospital admissions and days of stay decreased for 3 patients and increased for 1 patient during this study. Quality of life increased for 2 patients and decreased for 2 patients and satisfaction with care increased for all 4 caregivers.

CONCLUSIONS: This model was feasible for a pharmacist to coordinate and required frequent physician involvement. Health care utilization varied between patients, but overall decreased for the 4 patients pooled. Changes in quality of life varied and may be attributed to using a survey that was not specific to medically complex children. Overall, caregivers were highly satisfied with this service and the health care their child received.

INDEX TERMS: care coordination, child, medical home, patient-centered, pediatric

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INTRODUCTION

Children with special health care needs (CSHCN), as defined by the Maternal and Child Health Bureau, “are those who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally.”¹ This definition includes about 15% of children in the United States² who, in accordance with Title V of the Social Security Act, require family-centered, community-based, coordinated care.³ The medical home model is widely recognized as a way to provide such care to these patients.

The medical home model was shown to be

feasible when implemented across 6 pediatric practices caring for 150 CSHCN over a 2-year period. Children who participated in this nurse practitioner-led, community-based medical home had significantly fewer hospitalizations but no change in number of emergency department visits. The model was estimated to cost \$400 per child per year.⁴

Children with at least 1 complex chronic condition account for a greater proportion of hospital admissions, hospital days, and hospital charges, compared to other children.⁵ Health care spending, hospital length of stay, and inpatient mortality increase as the number of complex chronic conditions increases.⁵ As the definition of CSHCN is broad, it is reasonable to focus special attention on the subset of CSHCN who are medi-

cally complex with multiple chronic conditions and medications.

While the American Academy of Pediatrics promotes the traditional community-based medical home, a hospital-based model may be beneficial for those children with multiple complex conditions who are frequently hospitalized. It has been proposed that a “key worker,” who does not have to be a physician but can have a range of background training, coordinate each patient’s care across all systems and serve as a primary point of contact for the family. For children already receiving most of their care from a hospital’s outpatient clinics, emergency department, and inpatient units, there could be a great benefit to both the hospital in terms of cost and to the patients in terms of quality of care if a hospital-based medical home model were implemented.⁶

The purpose of this study was to pilot a hospital-based model aimed at providing patient-centered coordinated care for medically complex pediatric patients with multiple chronic conditions and medications, using a pharmacist as the key worker.

METHODS

This single center, prospective, pilot study was approved by the institutional review board at West Virginia University. A legal guardian of each patient provided written informed consent, and patients who were at least 8 years old provided written informed assent. Patients aged 2 to 18 years were eligible for inclusion if they had at least two 30-day readmissions in 2014 and at least 2 additional admissions per year each of the past 3 years. Patients enrolled in the Congenital Heart Infant Home Monitoring Program, an existing program at this institution, as well as patients receiving hospice care or oncology treatment, were excluded from this study. Of the 11 patients who met selection criteria, 4 were selected by the project team, which included 2 pediatricians and 3 pediatric pharmacists. Patients were selected who had multiple complex disease states and chronic medications.

This study used a novel pharmacist-led model for patient care, similar in intent to the medical home model. In this patient-centered model, the study pharmacist set specific goals with each patient and caregiver and helped coordinate care

between multiple providers for each patient. The pharmacist called every patient or caregiver once a week for at least the first month, at which point the frequency of phone calls could decrease at the discretion of the pharmacist. The pharmacist met with the patients when they came in for clinic visits or were hospitalized. Every phone conversation was documented in the electronic medical record. Patients and caregivers were also able to contact the pharmacist via private phone or email at any time. All questions or issues regarding a patient that were beyond the scope of practice of the pharmacist were brought to the attention of a physician by telephone or electronic communication through the hospital’s electronic medical record system, depending on the urgency of the problem.

The pharmacist made standard-of-care interventions including extensive patient and caregiver education, coordinating care with other health care providers, answering urgent questions, thorough medication reconciliation on every admission and discharge, help obtaining new prescriptions and resolving problems at outpatient pharmacies, decreasing polypharmacy, and providing positive reinforcement and motivation to the patients and caregivers. Interdisciplinary meetings were held every 6 to 8 weeks with the study team to discuss each patient’s goals, barriers, and patient-specific care plans.

Baseline and demographic data were collected from patient and caregiver interview and from the electronic medical record. Each caregiver completed a validated assessment of health literacy called The Newest Vital Sign.⁷

Health care utilization was evaluated by comparing the emergency department visits, clinic visits, hospital admissions, total days of stay, and 30-day readmissions for each patient during the 5 months immediately before enrollment to the 5 months during this study. All data were collected from the electronic medical record. To account for health care utilization at other institutions, caregivers were asked during the weekly phone calls if the child had received any care outside of this health care system that week, and if so it was recorded.

The time the pharmacist spent on any activities providing or coordinating care for each patient was recorded. Each time the pharmacist had an encounter with the patient or caregiver, including a phone call, a visit in clinic or the hospital,

Table 1. Patient Characteristics

Patient	Age, Sex	Primary Diagnosis	No. of Chronic Medications	Admissions (30-Day Readmissions) During 12 Months Before Study Enrollment
1	4 yr, male	Hyper IgE syndrome	17	8 (3)
2	4 yr, female	History of non-accidental trauma	21	7 (3)
3	15 yr, female	Cystic fibrosis	19	8 (4)
4	9 yr, male	Nephrotic syndrome	19	17 (13)

IgE, Immunoglobulin E

reviewing the patient's medical record, or speaking to other health care providers to coordinate care for the patient, the time and details of the encounter were recorded.

Quality of life was assessed by using the PedsQL 4.0, a 23-item validated questionnaire that assesses physical, emotional, social, and school functioning of children.^{8,9} Each child aged 5 years and older completed an age-appropriate version of the questionnaire at the beginning and end of the study. The primary caregiver of each patient completed the parent-proxy version of the questionnaire. The PedsQL 4.0 uses a 5-point Likert scale, which is linearly transformed to a 0 to 100 scale (Likert score of 0 equals 100; 1 equals 75; 2 equals 50; 3 equals 25; and 4 equals 0). The items are summed and divided by the total number of questions answered, and a mean score is reported.

To assess satisfaction with quality of care, caregivers completed the Patient Assessment of Care for Chronic Conditions (PACIC-20) survey at the beginning and at the end of the study. The PACIC-20 survey uses a 5-point Likert scale for its 20 questions. The mean score is calculated by summing the scores reported and dividing by the number of questions answered.¹⁰

The primary objectives of this study included 1) feasibility—to determine the time needed for the pharmacist to provide care in the proposed model in terms of hours per patient per week; and 2) effectiveness—to determine the impact of this model on health care utilization of select medically complex children over a course of 5 consecutive months as measured by hospital admissions, days of stay, emergency department visits, and clinic visits.

The secondary objectives of this study included 1) to identify any change in quality of life of the patient after participation in this model and 2)

to assess caregiver satisfaction with the quality of care the child received while participating in this model.

As this was a pilot study, it was not powered to detect statistically significant changes. Descriptive statistics were used to report all outcomes.

RESULTS

The 4 patients enrolled in this study ranged in age from 4 to 15 years, were on 17 or more chronic medications, and each had between 7 and 17 admissions in the 12 months before enrollment (Table 1). All 4 primary caregivers were mothers of their child, 2 of whom were single. All 4 caregivers had adequate health literacy as assessed by the Newest Vital Sign, and lived between 3 and 30 miles to the nearest medical center.

The pharmacist spent on average 60 to 80 minutes per patient per week, and averaged 2 encounters per patient per week. However, this time was highly variable ranging from 10 minutes to more than 5 hours per patient per week depending on the health status and demands of the patient at that time. Some time was spent on evenings and weekends, for example, if a patient was discharged from the hospital on a Friday the pharmacist would follow-up with a phone call that weekend. While the pharmacist had the option to decrease the frequency of phone calls after 1 month of enrollment, this did not occur for any of the patients, as their needs did not decrease during the 5-month study period. The pharmacist spent a total of 105 hours on patient care for these 4 patients during the study period.

For all 4 patients, Emergency Department visits were overall very infrequent and did not change during the study period. The frequency of clinic visits also did not change substantially during the study period, with 50 total clinic visits for

Figure 1. Hospital admissions for each patient and all 4 patients combined (total) before and during the study period.

■ Five months before the study; □ Five months during the study

Figure 2. Thirty-day hospital readmissions for each patient and all 4 patients combined (total) before and during the study period.

■ Five months before the study; □ Five months during the study

the 4 patients combined during the 5 months before enrollment and 48 total clinic visits during the study period. Hospital admissions and days of stay decreased for patients 1, 3, and 4 and increased for patient 2 during the study period (Figure 1). The number of 30-day readmissions decreased for patients 1 and 4, increased for patient 2, and did not change for patient 3 (Figure 2). The total days of hospitalization for the 4 patients pooled decreased by 50 days, a 40% relative reduction (Figure 3).

by the pharmacist during the 5-month study. In terms of outpatient prescription assistance, the pharmacist obtained a new prescription 27 times, resolved a prior authorization 5 times, and facilitated transfer of a prescription to another pharmacy 6 times.

DISCUSSION

Medically complex children require frequent communication and timely follow-up in order to

Quality of life as measured by the PedsQL survey, where a higher score on a scale of 0 to 100 indicates better quality of life, varied for the 4 patients enrolled (Table 2). Patient 2, who had an increase in hospital admissions and days of stay, had an improvement in quality of life, whereas patient 1, who had a decrease in health care utilization, had a decrease in quality of life. Satisfaction with care, as reported by each caregiver using the PACIC-20, where a higher score on the 5-point Likert scale indicates greater satisfaction, increased for all 4 patients (Table 3).

Upon reflection of all recorded interventions that the pharmacist made during the study period, it was apparent that most involved medication reconciliation and assistance obtaining outpatient prescriptions. The pharmacist reviewed each patient's medications on the first or second day of hospitalization and contacted the hospital team to discuss any discrepancies between their current medications and home medications. There were 30 documented medication reconciliation errors made on hospital admissions that were amended

Figure 3. Days of hospital stay for each patient and all 4 patients combined (total) before and during the study period.

■ Five months before the study; □ Five months during the study

detect and prevent potential problems. The pharmacist was able to make a substantial number of interventions to resolve problems and coordinate care for these patients but required frequent physician involvement. The greatest difficulty in resolving a problem for a patient when physician involvement was needed was finding the correct physician and determining the best way to get in contact with him/her in order to get a timely response. An ideal model would have a physician champion for patients who would be available to answer questions and resolve any problem detected by the pharmacist.

The pharmacist had a major impact on accuracy of medication reconciliation when patients were admitted to the hospital. Being very familiar with these patients and how they take their chronic medications, the pharmacist was able to serve as an important link to ensure ac-

curacy and appropriateness of medications at transitions of care. Some of the medication reconciliation errors occurred because the patient was taking a medication at home differently than how it was recorded in the outpatient medication list in the electronic medical record. Other errors occurred in ordering medications scheduled in the hospital when patients take them as needed at home, which may have resulted in overuse of certain drugs, particularly antihistamines and laxatives, while hospitalized. Consistent and thorough updating of the outpatient

medication list and strict adherence to reordering medications based on this list may help decrease the number of medication errors made on hospital admissions.

Some limitations of this study include that it was a small, single center, pilot study. It was difficult to capture the time that the pharmacist spent critically thinking or brainstorming about these patients, thus the time recorded may have been an underestimate of the actual time spent. Data on health care utilization at other institutions before enrollment were not available. In regard to the primary outcome, health care utilization was compared during different seasons of the year, from May through October to November through April. These medically complex patients have diseases that wax and wane, and may be affected by the time of year. Specifically, patient 2 had an increase in hospitalizations during the

Table 2. Secondary Outcome: Quality of Life (PedsQL 4.0)

		Pre Study	Post Study	Change
Patient 1	Caregiver	40	17.5	-22.5
Patient 2	Caregiver	25	47.5	+22.5
Patient 3	Caregiver	65	47.5	-17.5
	Child	85	57.5	-27.5
Patient 4	Caregiver	17.5	52.5	+35
	Child	45	45	0

Based on a 0 to 4 Likert scale transferred to a 0 to 100 scale where a higher score corresponds to a better quality of life

Table 3. Secondary Outcome: Satisfaction with Care (Patient Assessment of Care for Chronic Conditions, PACIC-20)

	Pre Study	Post Study
Patient 1	3.8	4
Patient 2	2.6	2.8
Patient 3	2.5	3.8
Patient 4	1.8	2.3

Based on a 0 to 4 point Likert scale where a higher score corresponds to increased satisfaction

study period of November through April. Three of the 5 hospitalizations for this patient were due to respiratory infections, which are more common during these winter months. The PedsQL is not specific for medically complex children and some questions did not apply for certain patients (e.g., asking how a child with a feeding tube does with eating). Caregivers and patients were unsure how to answer some of these questions. Additionally, the validated PedsQL scoring system and PACIC-20 calculate a mean score, which is not an ideal measure for ordinal data.

Based on the increase in satisfaction with care and positive feedback from patients and caregivers, it is clear that this model is beneficial from a patient's perspective. While 5 months is a short duration to observe a change in health care utilization, 3 of the 4 patients had a decrease in hospital admissions and days of stay. This pharmacist-led model for patient-centered care coordination has the potential to substantially decrease health care utilization of medically complex children. Larger, long-term studies are warranted to investigate the cost-effectiveness of such a model.

CONCLUSIONS

This model was feasible for a pharmacist to participate in and required on average 60 to 80 minutes per patient per week. Health care utilization of the 4 patients varied, with a decrease in hospital admissions and days of stay for 3 of the 4 patients enrolled over a period of 5 consecutive months. Quality of life varied as well, with an increase in quality of life reported for 2 patients and a decrease in quality of life reported for 2 patients. Satisfaction with health care as reported by the caregiver increased for all 4 patients.

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Abbreviations CSHCN, children with special health care needs; PACIC-20, Patient Assessment of Care for Chronic Conditions

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