Comprehensive Health Management Pharmacist-Delivered Model: Impact on Healthcare Utilization and Costs

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ABSTRACT

OBJECTIVES: To (1) examine the impact of the Comprehensive Health Management Patient Service (CHaMPS) on unplanned hospital admissions and emergency department (ED) visits in patients with chronic conditions, (2) describe the number and type of pharmacist interventions, and (3) determine the cost savings of CHaMPS.

STUDY DESIGN: Retrospective, cross-sectional design with a matched comparator group.

METHODS: CHaMPS integrated pharmacists within family medicine clinics to optimize medication use among patients with chronic conditions. Outcomes were the change in unplanned hospital admissions and ED visits from baseline to 180- and 365-day postintervention periods between the CHaMPS and propensity-matched comparator groups. Descriptive, bivariate (*t* tests and McNemar tests), and multivariate (general linear models) statistical analyses were used. Pharmacist interventions are reported and a cost-benefit analysis was conducted.

RESULTS: A total of 624 patients (312 in the CHaMPS group and 312 in the comparator group) were included. Unplanned hospital admissions decreased in the CHaMPS group and increased in the comparator group (not significant). ED visits remained stable in the CHaMPS group but increased significantly in the comparator group, resulting in a significant mean change in ED visits between the groups at the 180- and 365-day postintervention periods ($P = .03$ for both periods). Pharmacists provided a total of 5705 medication-related problem, education, and medication reconciliation interventions (18.3 per patient). The benefit-cost ratio ranged from 2.1:1 to 2.6:1.

CONCLUSIONS: CHaMPS achieved its goals by demonstrating a positive impact on ED visits and a benefit-cost ratio greater than 1.0. The cost savings of the embedded pharmacist model are most beneficial from a payer perspective or an accountable care organization approach to healthcare.

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In 2016, the cost of healthcare reached $3.3 trillion,[1] with an estimated 85% of these costs attributable to chronic conditions.[2] Nearly two-thirds of Americans have at least 1 chronic condition, with 42% having 2 or more, and the chronic disease burden is increasing.[3] Given that medications are the primary treatment for chronic conditions, some stakeholders have recommended more emphasis on managing medications for chronic conditions.[4-6] Without proper medication management, problems such as medication nonadherence, suboptimal dosing regimens, and adverse drug events can lead to costly emergency department (ED) and hospital visits.[4,6,7] In fact, a recent report estimated that nonoptimized medication therapy results in approximately $530 billion in medication-related morbidity and mortality costs for healthcare payers each year,[4] and another found that medication nonadherence leads to increased costs of up to $289 billion annually.[8] National organizations, such as the CDC[9] and the Patient-Centered Primary Care Collaborative,[6] as well as a report to the United States Surgeon General,[10] have highlighted the pharmacist's role in optimizing medication outcomes on healthcare teams. Nevertheless, the integration of pharmacists into team-based care teams has not been widely adopted. For example, a study of patient-centered medical homes (PCMHs) reported that only 9% included a pharmacist.[11] One challenge to integrating pharmacists within care teams is the fact that pharmacists are not recognized providers for Medicare reimbursement, which influences coverage decisions by other payers. Further, reports have shown mixed results regarding the impact of pharmacists on reducing ED and hospital visits.[12] However, recent reports have found cost savings driven by a reduction in ED and hospital use.[13,14] With a shift to healthcare models that focus on value-based payments for achieving quality indicators, such as accountable care organizations, pharmacists have the opportunity to contribute to patient outcomes by using their unique knowledge and skills regarding optimization of medication use.

The current study examines a pharmacist–physician model, Comprehensive Health Management Patient Service (CHaMPS), which embedded pharmacists in family medicine clinics to provide comprehensive medication management (CMM) to patients with

chronic conditions. This retrospective, cross-sectional study with a matched comparator group adds to the contemporary evidence related to the impact of pharmacists on health services utilization and costs for patients with chronic conditions. The objectives were to (1) examine the impact of CHaMPS on unplanned hospital admissions and ED visits, (2) describe the number and type of pharmacist interventions for CHaMPS patients, and (3) conduct a cost-benefit analysis to determine the cost savings of CHaMPS.

TAKEAWAY POINTS

Pharmacists were embedded within family medicine clinics to deliver comprehensive medication management to patients with chronic conditions.

- Emergency department visits significantly increased in the comparator group at 180- and 365-day postintervention periods.
- The intervention resulted in a cost savings of $2.10 to $2.60 for every $1.00 spent.
- Outcomes were a result of 5705 medication-related problem, education, and medication reconciliation interventions (18.3 per patient) delivered by pharmacists.

METHODS

Study Design and Population

The Martin Health System electronic health record (EHR) system was the data source. Martin Health System, located in Stuart, Florida, is a nonprofit, community-based healthcare organization with 3 hospitals and 7 family medicine clinics. The CHaMPS group consisted of 312 patients who had a minimum of 3 face-to-face pharmacist visits, were enrolled in CHaMPS for at least 90 days, and met eligibility criteria in 2015 or 2016. CHaMPS eligibility criteria included (1) diagnosis of at least 1 of 5 specific disease states (diabetes, congestive heart failure [CHF], hypertension, hyperlipidemia, and asthma/chronic obstructive pulmonary disease [COPD]); (2) at least 1 ED visit or hospital admission in the previous 18 months with an ED or admitting diagnosis related to one of the selected disease states; and (3) a physician referral to CHaMPS. The comparator group consisted of patients who met CHaMPS eligibility criteria in 2015 or 2016 but were not referred to CHaMPS. Also, the patient's physician had to have 10 or fewer referrals to CHaMPS. A total of 899 patients met comparator group eligibility criteria. Propensity score matching, using nearest neighbor matching without replacement, was applied to match CHaMPS and comparator group patients on a 1-to-1 basis. The matching variables included age, gender, race, insurance type, Charlson Comorbidity Index (CCI) score, current smoker status (yes/no), body mass index (BMI), and diagnosis (yes/no) of diabetes, CHF, hypertension, hyperlipidemia, and asthma/COPD. After the matching criteria were applied, 312 patients were identified for the comparator group.

Pharmacist–Physician Care Model

CHaMPS was based on the principles of CMM.[6] The first CHaMPS encounter, a face-to-face pharmacist visit, was scheduled within 14 days of referral, with subsequent face-to-face visits at 2- to 3-week intervals for 1 to 2 months and as needed thereafter. The initial visit was 60 minutes, and subsequent visits ranged from 30 to 60 minutes depending on patient needs. During the initial CHaMPS visit, individual therapeutic goals were set for the patient's chronic disease(s) based on evidence-based guidelines and interaction with the patient and their primary provider. Medication-related problems (MRPs) were identified and pharmacists performed interventions in collaboration with the patient or physician to resolve them. Pharmacists communicated with physicians about recommendations via the EHR and face-to-face. The patient's clinical status, which included review of all symptoms and signs, relevant laboratory results, and monitoring measures, was assessed at each visit. A medication care plan included a list of the patient's disease state(s), pertinent laboratory results compared against goals, and medications. Medication optimization was monitored by the pharmacists and disease status was updated based on feedback from patients and providers. Pharmacists delivered CHaMPS at 4 family medicine clinics and spent 2 to 3 days a week in each clinic.

Outcomes

Study outcomes were the differences in numbers of unplanned hospital admissions and ED visits between the CHaMPS and comparator groups in the preintervention and postintervention periods. The preintervention period was defined in 2 ways: the periods 180 and 365 days before the first CHaMPS visit (CHaMPS group) or assigned index date (comparator group). The postintervention period was also defined in 2 ways: the periods 180 and 365 days after the first CHaMPS visit or assigned index date. The type and number of pharmacist interventions are also reported. A benefit-cost ratio was calculated based on absolute differences in estimated cost savings between the 2 groups. Because the CHaMPS intervention was a comprehensive approach to managing chronic conditions, the impact of the intervention on condition-specific unplanned hospital admissions and ED visits was not examined.

Statistical Methods

Descriptive statistics were calculated for all variables. Paired *t* tests or McNemar tests examined baseline differences between the matched CHaMPS and comparator groups on demographic variables (age, gender, race, insurance type) and health-related variables (CCI score; current smoker status [yes/no]; BMI; diagnosis [yes/no] of diabetes, CHF, hypertension, hyperlipidemia, and/or asthma/COPD; baseline hospitalization and ED visits, defined as number of visits 1 year before enrollment or index date). Paired *t* tests or independent samples *t* tests were used to assess pre–post differences for ED visits and unplanned hospital admissions

TABLE 1. Demographic and Health-Related Variables for Matched CHaMPS and Comparator Groups

Variable	CHaMPS (n = 312)	Comparator (n = 312)	*P*
Age in years, mean (SD)	65.6 (11.1)	67.2 (12.5)	.09
Gender, n (%)			.21
Women	157 (50.3)	141 (45.2)	
Men	155 (49.7)	171 (54.8)	
Race, n (%)			.20
White	244 (78.2)	257 (82.4)	
Nonwhite	68 (21.8)	55 (17.6)	
Insurance, n (%)			.53
Medicare/Medicaid	224 (71.8)	215 (68.9)	
Commercial/other	88 (28.2)	97 (31.1)	
CCI score, n (%)			.10
0-2	145 (46.5)	167 (53.5)	
3-4	100 (32.1)	86 (27.6)	
≥5	67 (21.5)	59 (18.9)	
Smoking, n (%)	44 (14.1)	38 (12.2)	.49
Body mass index, n (%)			.92
<25	42 (13.5)	42 (13.5)	
25-29.9	69 (22.1)	81 (26.0)	
≥30	201 (64.4)	189 (60.6)	
Diabetes, n (%)	296 (94.9)	281 (90.1)	.02[a]
Hypertension, n (%)	271 (86.9)	273 (87.5)	.81
Hyperlipidemia, n (%)	233 (74.7)	104 (33.3)	<.0001[a]
CHF, n (%)	41 (13.1)	39 (12.5)	.82
Asthma/COPD, n (%)	85 (27.2)	71 (22.8)	.19

CCI indicates Charlson Comorbidity Index; CHaMPS, Comprehensive Health Management Patient Service; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease.

[a]Statistically significant at $P < .05$.

within each group. Generalized linear models determined differences between the CHaMPS and comparator groups for number of unplanned hospital admissions at 180 and 365 days in the postintervention period and number of ED visits at 180 and 365 days in the preintervention period. For all analyses, the primary independent variable was CHaMPS enrollee (yes/no) and covariates included the aforementioned demographic and health-related variables. All analyses were conducted using SAS 9.4 (SAS Institute; Cary, North Carolina). Results were significant at $P < .05$.

A benefit-cost analysis was conducted to determine the difference in hospital and ED costs between the preintervention and postintervention periods of the CHaMPS and comparator groups. Program inputs included direct costs, which were comprised of CHaMPS personnel salary and fringe benefits using estimates from the 2017 Bureau of Labor Statistics data[15-18] and a 30% fringe benefit rate. Program costs for 2015 and 2016 are reported, and the average of the 2 years was used to calculate the program costs for the 1-year intervention period. Pharmacist salaries and fringe benefits were calculated for direct patient care and implementation activities. Time spent delivering CHaMPS patient care was converted to full-time equivalents (FTEs) assuming that 1.0 FTE equaled 2080 hours per year. Implementation activities included developing protocols and working with clinic and information technology (IT) staff to introduce the program and customize the EHR for CHaMPS, respectively. CHaMPS personnel included a program manager (responsible for patient and data management), administrative assistants (responsible for tasks such as scheduling and rooming patients), and IT staff (responsible for customizing the EHR and maintaining reports to track outcomes). Indirect costs, such as overhead and rent, were excluded because these expenses were absorbed by the CHaMPS clinics. Program outputs included the cost estimates of hospitalizations and ED visits using mean per event costs from the 2016 Medical Expenditure Panel Survey.[19] Cost estimates were adjusted to 2017 dollars using the Medical Consumer Price Index. Other studies that have examined the cost benefits of pharmacist services have used a similar approach for estimating utilization costs.[14,20] The benefit-cost ratio was calculated using the following formula: net benefit (absolute value of difference between CHaMPS and comparator groups in pre–post change in ED and hospital costs) divided by CHaMPS program costs. A value greater than 1 indicated a positive benefit. Given that program implementation costs are generally amortized over a 5- to 10-year period, the benefit-cost ratio was calculated with and without implementation costs.

RESULTS

A total of 624 patients (312 in the CHaMPS group and 312 in the comparator group) were included. **Table 1** describes demographic and health-related variables for the matched CHaMPS and comparator groups. At baseline, the CHaMPS and comparator groups had similar mean (SD) ages at 65.6 (11.1) years and 67.2 (12.5) years, respectively. The gender composition was about half women and half men in both groups. The majority in both groups were white and had Medicare/Medicaid insurance. There was a statistically significant difference in the proportion of patients with diabetes between the 2 groups (94.9% in CHaMPS vs 90.1% in comparator). The most marked difference at baseline was the significantly higher proportion of patients with hyperlipidemia in the CHaMPS group (74.7%) versus the comparator group (33.3%).

Unplanned Hospital Admissions and ED Visits

As summarized in **Table 2**, in the CHaMPS group, the mean (SD) number of unplanned hospital admissions decreased from 0.29 (0.68) in the 180-day preintervention period to 0.19 (0.53) in the 180-day postintervention period ($P = .01$). Unplanned admissions also decreased from 0.41 (0.95) in the 365-day preintervention period to 0.33 (0.80) in the 365-day postintervention period, although not significantly. In the comparator group, the mean number of unplanned admissions increased slightly from 0.18 (0.66) in the 180-day preintervention period to 0.21 (0.68) in the 180-day

TABLE 2. Mean Unplanned Admissions and ED Visits for Matched CHaMPS and Comparator Groups at Baseline and 180-Day Postintervention Period and Baseline and 365-Day Postintervention Period

	CHaMPS Group					Comparator Group					CHaMPS vs Comparator
180 Days											
		Mean (SD)		Mean			Mean (SD)		Mean		
Utilization Measure	n	Baseline	180 Days	Change	*P*	n	Baseline	180 Days	Change	*P*	GLM[a] *P*
Unplanned admissions	312	0.29 (0.68)	0.19 (0.53)	−0.10	.01[b]	312	0.18 (0.66)	0.21 (0.68)	0.03	.55	.95
ED visits	312	0.26 (0.64)	0.26 (0.62)	0.00	1.00	312	0.16 (0.55)	0.29 (0.79)	0.13	.002[b]	.03[b]
365 Days											
		Mean (SD)		Mean			Mean (SD)		Mean		
Utilization Measure	n	Baseline	365 Days	Change	*P*	n	Baseline	365 Days	Change	*P*	GLM[a] *P*
Unplanned admissions	312	0.41 (0.95)	0.33 (0.80)	−0.08	.15	312	0.29 (1.15)	0.35 (1.14)	0.06	.42	.75
ED visits	312	0.44 (0.89)	0.43 (0.92)	−0.01	.90	312	0.30 (0.97)	0.48 (1.24)	0.18	.003[b]	.03[b]

CHaMPS indicates Comprehensive Health Management Patient Service; ED, emergency department; GLM, generalized linear model.

[a]Covariates controlled for in the GLM model included enrollment time (in days), age, gender, race, Charlson Comorbidity Index score, baseline hospitalizations, baseline ED visits, current smoker status (yes/no), body mass index, and diagnosis (yes/no) of diabetes, hypertension, hyperlipidemia, congestive heart failure, and/or asthma/chronic obstructive pulmonary disease.

[b]Statistically significant at $P < .05$.

postintervention period (not significant) and from 0.29 (1.15) in the 365-day preintervention period to 0.35 (1.14) in the 365-day postintervention period (not significant). The change in the mean number of unplanned admissions between the CHaMPS and comparator groups, while controlling for demographic and health-related variables, was not significant at the 180- or 365-day postintervention periods.

In the CHaMPS group, the mean (SD) number of ED visits remained constant for both the 180-day (0.26 [0.64] for the 180-day preintervention period and 0.26 [0.62] for the 180-day postintervention period) and 365-day (0.44 [0.89] for the 365-day preintervention period and 0.43 [0.92] for the 365-day postintervention period) periods, resulting in no significant difference in the number of ED visits within the CHaMPS group from the preintervention to postintervention periods. However, in the comparator group, the mean number of ED visits increased significantly in both the 180-day (0.16 [0.55] for the 180-day preintervention period and 0.29 [0.79] for the 180-day postintervention period; $P = .002$) and 365-day (0.30 [0.97] for the 365-day preintervention period and 0.48 [1.24] for the 365-day postintervention period; $P = .003$) periods. The change in the mean number of ED visits between the CHaMPS and comparator groups, while controlling for demographic and health-related variables, was significant at the 180- and 365-day postintervention periods ($P = .03$ for both).

Type and Number of Pharmacist Interventions

Table 3 summarizes the type and number of MRP interventions, as well as education-related and medication reconciliation–related interventions. There were 1218 MRP interventions (3.9 per patient), with the most common being increasing dose (20.8%), refilling a drug (16.8%), and ordering a laboratory test (11.0%). A total of 3113 education interventions (10.0 per patient) were delivered. The majority (72.2%) of these interventions involved patient education about lifestyle factors to improve chronic condition management. Pharmacists made 1374 medication reconciliation interventions (4.4 per patient). The most common were deleting medications that patients were no longer taking from the medication list (33.7%), updating directions (29.8%), and adding current medications to the list (26.9%). Outcomes were documented for 3505 interventions, and they primarily focused on outcomes for MRP and education interventions given that medication reconciliation interventions were made in the EHR in real time and thus immediately resolved. Most (97.5%) of the interventions were considered to have resolved the respective problem identified. The majority of problems (54%) were resolved by directly interacting with the patient, and one-third were resolved by interactions with the care team.

Table 4[19] summarizes the CHaMPS and comparator group costs for ED and hospital use and benefit-cost ratio. The ED and hospital costs were $2,063,083.03 in the preintervention period and $1,672,371.90 in the postintervention period for the CHaMPS group—a decrease of $390,711.13 ($1252.28 less per patient). The ED and hospital use costs were $1,469,297.21 in the preintervention period and $1,779,306.79 in the postintervention period for the comparator group—an increase of $310,009.58 ($993.62 more per patient). Table 5[15-18] summarizes the CHaMPS program direct costs for 2015 and 2016. Considering this, the net benefit of the CHaMPS program during a 1-year intervention period was $700,720.71 ($390,711.13 decrease for CHaMPS group + $310,009.58 increase for comparator group) and the CHaMPS program cost, comprised of salary and fringe benefits for personnel listed in Table 5,[15-18] during a 1-year intervention period with implementation costs was $329,365.43, resulting in a benefit-cost ratio of 2.1:1 ($700,720.71/$329,365.43). The CHaMPS program cost during a 1-year intervention period without implementation costs was $266,071.80, resulting in a benefit-cost ratio

TABLE 3. Type and Number of Pharmacist Interventions and Outcomes for CHaMPS Patients (n = 312)

Variable	n (%)
Medication-related problem intervention (n = 1218)	
Increase dose	253 (20.8)
Refill drug	205 (16.8)
Laboratory test ordered	134 (11.0)
Add drug	108 (8.9)
Sample provided	100 (8.2)
Decrease dose	67 (5.5)
Discontinue drug	63 (5.2)
Change in monitoring	55 (4.5)
Initiation of monitoring	51 (4.2)
Change to another prescription medication	44 (3.6)
Change timing of dose	43 (3.5)
Preventive therapy required	26 (2.1)
Cost-related therapeutic switch	17 (1.4)
Change to over-the-counter medication	16 (1.3)
Change dosage form	4 (0.3)
Other	32 (2.6)
Education intervention (n = 3113)	
Lifestyle factor	2249 (72.2)
Adherence	271 (8.7)
Prescription medication	255 (8.2)
Disease state	187 (6.0)
Over-the-counter medication	74 (2.4)
Preventive care	37 (1.2)
Other	40 (1.3)
Medication reconciliation intervention (n = 1374)	
Medications deleted	463 (33.7)
Directions updated	409 (29.8)
Medication added	369 (26.9)
Medication changed	133 (9.7)
Outcomes (n = 3505)	
Problem resolved: patient	1894 (54.0)
Problem resolved: pharmacist	1192 (34.0)
Problem resolved: physician	333 (9.5)
Problem resolved: other	3 (0.1)
Not known; follow-up needed	76 (2.2)
Denied/rejected	7 (0.2)

CHaMPS indicates Comprehensive Health Management Patient Service.

of 2.6:1 ($700,720.71/$266,071.80). Thus, for every $1.00 spent on the CHaMPS program, $2.10 to $2.60 was saved in ED and hospital costs for the CHaMPS participants. Refer to Table 4[19] for a summary of the benefit-cost ratio calculation.

DISCUSSION

The CHaMPS program showed a positive impact on ED visits and resulted in a positive benefit-cost ratio compared with the matched comparator group. Outcomes were achieved as a result of 5705 interventions relating to MRPs, education, and medication reconciliation (18.3 per patient) delivered by pharmacists. Although some findings, such as the change in unplanned admissions between the CHaMPS and comparator groups, were not significant, the direction of the change for all outcomes in the CHaMPS group indicated progress toward achieving the desired outcomes.

Unplanned hospital admissions decreased in the CHaMPS group and increased somewhat in the comparator group, although this difference between the 2 groups was not statistically significant. ED visits were stable at the 180- and 365-day postintervention periods for the CHaMPS patients. In contrast, ED visits for the comparator group increased significantly during the postintervention periods, and the change in ED visits was significant between the 2 groups for both postintervention periods. A systematic review of pharmacist interventions found mixed results with regard to the impact of pharmacist interventions on hospitalizations and ED visits, with about half of studies reporting positive findings.[12] Results from a recent study, which implemented a similar care model and focused on chronic disease management, found that pharmacist interventions did not affect ED visits but did significantly decrease hospitalizations.[14] Another study reported a significant decrease in medication-related hospitalizations as a result of a pharmacy medication management intervention, although the intervention focused on older adults who were at risk for experiencing a medication problem.[13] The fact that, in the current study, the comparator group ED visits increased, whereas the CHaMPS group ED visits stayed the same, is important given that ED visits can increase healthcare costs. This finding may be a result of the patient-centered medication care plans and chronic disease and medication education interventions that were delivered by CHaMPS. Although the difference in unplanned hospital admissions was not statistically significant between the 2 groups, the difference likely has clinical significance and was reflected in the positive findings of the cost analysis.

The cost analysis revealed a cost savings of $2.10 to $2.60 in hospital and ED costs for every $1.00 spent on the CHaMPS program. In the current model, these cost savings are realized by a payer, such as Medicare, rather than directly benefitting the health system, because the savings resulted from decreased utilization of services. The cost savings would be more applicable to health systems that adopt accountable care organization models with cost-reduction incentives and embed pharmacists as members of the primary care team. A recent article reported a 5-to-1 return on investment (ROI) for a similar chronic disease–focused pharmacist intervention in 23 primary care clinics in southwest Virginia. Although the ROI was higher when compared with the CHaMPS program, the only program costs included were pharmacist salary and fringe benefits; initial development and implementation program costs were not included in the ROI calculation.[14] Findings were similar to a medication management pharmacist intervention, which focused on managing medications for all chronic conditions, in a group of 88 Medicaid patients in Connecticut that found an ROI

TABLE 4. Summary of CHaMPS and Comparator Group ED and Hospital Costs, Net Benefit, and Benefit-Cost Ratio With and Without Development and Implementation Costs[19]

CHaMPS Patients: Total ED and Hospital Costs (n = 312)					
	Number of Encounters	Preintervention Costs	Number of Encounters	Postintervention Costs	Difference (post minus pre)
ED visit costs[a]	136	$139,862.02	133	$136,776.83	–
Hospital costs[b]	129	$1,923,221.01	103	$1,535,595.07	–
ED and hospital costs	–	$2,063,083.03	–	$1,672,371.90	–$390,711.13
Comparator Patients: Total ED and Hospital Costs (n = 312)					
	Number of Encounters	Preintervention Costs	Number of Encounters	Postintervention Costs	Difference (post minus pre)
ED visit costs[a]	95	$97,697.73	150	$154,259.58	–
Hospital costs[b]	92	$1,371,599.48	109	$1,625,047.21	–
ED and hospital costs	–	$1,469,297.21	–	$1,779,306.79	$310,009.58
Net benefit (absolute value of difference between CHaMPS and comparator groups in pre–post change in ED and hospital costs)					$700,720.71
Benefit-cost ratio with development and implementation costs (Net benefit/CHaMPS program costs = $700,720.71/$329,365.43)					2.1:1
Benefit-cost ratio without development and implementation costs (Net benefit/CHaMPS program costs = $700,720.71/$266,071.80)					2.6:1

CHaMPS indicates Comprehensive Health Management Patient Service; ED, emergency department.

[a]Estimate for ED visit costs was $1028.40 per event using Medical Expenditure Panel Survey 2016 data[19] and converting to 2017 dollars using the Medical Consumer Price Index.

[b]Estimate for hospital visit costs was $14,908.69 per event using Medical Expenditure Panel Survey 2016 data[19] and converting to 2017 dollars using the Medical Consumer Price Index.

TABLE 5. Direct Costs of CHaMPS Program in 2015 (year 1) and 2016 (year 2)[15-18]

Direct Costs[a] With Development and Implementation								
Personnel Type	2017 Salary Estimate	30% Fringe	Salary + Fringe	FTE Year 1	Total Year 1	FTE Year 2	Total Year 2	Mean Cost Years 1 and 2
Pharmacist: direct patient care	$129,833	$38,950	$168,783	0.90	$151,904.70	1.45	$244,735.35	–
Pharmacist: development and implementation	$129,833	$38,950	$168,783	0.50	$84,391.50	0.25	$42,195.75	–
Program manager	$55,000	$16,500	$71,500	0.80	$57,200.00	0.80	$57,200.00	–
Administrative assistants	$32,710	$9813	$42,523	0.10	$4252.30	0.10	$4252.30	–
IT staff	$64,610	$19,383	$83,993	0.10	$8399.30	0.05	$4199.65	–
Total					$306,147.80		$352,583.05	$329,365.43
Direct Costs[a] Without Development and Implementation								
Personnel Type	2017 Salary Estimate	30% Fringe	Salary + Fringe	FTE Year 1	Total Year 1	FTE Year 2	Total Year 2	Mean Cost Years 1 and 2
Pharmacist: direct patient care	$129,833	$38,950	$168,783	0.90	$151,904.70	1.45	$244,735.35	–
Program manager	$55,000	$16,500	$71,500	0.80	$57,200.00	0.80	$57,200.00	–
Administrative assistants	$32,710	$9813	$42,523	0.10	$4252.30	0.10	$4252.30	–
IT staff	$64,610	$19,383	$83,993	0.10	$8399.30	0.05	$4199.65	–
Total					$221,756.30		$310,387.30	$266,071.80

CHaMPS indicates Comprehensive Health Management Patient Service; FTE, full-time equivalent; IT, information technology.

[a]All personnel costs estimated using May 2017 data from Bureau of Labor Statistics.[15-18]

of 2.5:1 when accounting for pharmacist and administrative costs of delivering the intervention.[21] This also aligns with a statewide pharmacist intervention in Hawaii that found a ROI of 2.6:1 when considering savings in medication-related hospitalizations, although the intervention differed from the CHaMPS intervention in that it was delivered primarily in the community setting.[13]

Limitations

Despite constructing a well-matched comparator group on baseline demographic and health-related variables, there were still differences in baseline variables between the 2 groups. This could mean that those in CHaMPS had a greater chance of being referred to the program based on certain factors, such as the physician referral process, that were not considered in the propensity scoring algorithm. It is also possible that other unobservable characteristics may have resulted in selection bias for the CHaMPS group. The unknown factors in the referral process may also have resulted in regression to the mean for both groups. To mitigate the impact of selection bias and regression to the mean, baseline utilization and clinical measures were included as covariates in the multivariate models. Because only 1 hospital EHR was used as the data source, it is possible that hospital admissions and ED visits are underreported. For the cost analysis, only hospital and ED costs were included as benefits. Other costs related to the number of physician office visits and physician time were not included, which may have led to under- or overestimation of the cost savings.

CONCLUSIONS

This study supports the inclusion of pharmacists on healthcare teams. CHaMPS successfully integrated pharmacists within family medicine clinics and yielded a positive benefit-cost ratio. CHaMPS is a robust, patient-centered program that delivered a combination of medication-related, education, and medication reconciliation pharmacist interventions to either stabilize or decrease unplanned admissions and ED visits in patients with chronic conditions. ■

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