Journal of the American Pharmacists Association 57 (2017) 102–108

Contents lists available at ScienceDirect

Journal of the American Pharmacists Association

journal homepage: www.japha.org

EXPERIENCE

Clinical effectiveness and cost savings in diabetes care, supported by pharmacist counselling

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ARTICLE INFO

Article history:
Received 24 May 2015
Accepted 8 August 2016

ABSTRACT

Objective: To determine the effectiveness and cost savings of a real-world, continuous, pharmacist-delivered service with an employed patient population with diabetes over a 5-year period.

Setting: The Patients, Pharmacists Partnerships (P^3 Program) was offered as an "opt-in" benefit to employees of 6 public and private self-insured employers in Maryland and Virginia. Care was provided in ZIP code–matched locations and at 2 employers' worksites.

Practice description: Six hundred two enrolled patients with type 1 and 2 diabetes were studied between July 2006 and May 2012 with an average follow-up of 2.5 years per patient. Of these patients, 162 had health plan cost and utilization data. A network of 50 trained pharmacists provided chronic disease management to patients with diabetes using a common process of care. Communications were provided to patients and physicians.

Practice innovation: Employers provided incentives for patients who opted in, including waived medication copayments and free diabetes self-monitoring supplies. The service was provided at no cost to the patient. A Web-based, electronic medical record that complied with the Health Insurance Portability and Accountability Act helped to standardize care. Quality assurance was conducted to ensure the standard of care.

Evaluation: Glycosylated hemoglobin (A1c), blood pressure, and total health care costs (before and after enrollment).

Results: Statistically significant improvements were shown by mean decreases in A1c (−0.41%, P <0.001), low-density lipoprotein levels (−4.7 mg/dL, P = 0.003), systolic blood pressure (−2.3 mm Hg, P = 0.001), and diastolic blood pressure (−2.4 mm Hg, P <0.001). Total annual health care costs to employers declined by $1031 per beneficiary after the cost of the program was deducted. This 66-month real-world study confirms earlier findings. Employers netted savings through improved clinical outcomes and reduced emergency and hospital utilization when comparing costs 12 months before and after enrollment.

Conclusion: The P^3 program had positive clinical outcomes and economic outcomes. Pharmacist-provided comprehensive medication therapy management services should be included as a required element of insurance offered by employers and health insurance exchanges.

Disclosure: The authors declare no conflicts of interest or financial interests in any product or service mentioned in this article.

Funding: The P^3 Program was previously funded in part by the Maryland Department of Health and Mental Hygiene.

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Diabetes and its risk factors have emerged as a focal point in the employer's quest to improve care and reduce unnecessary direct health care costs. Thirty-four percent of the economic burden of diabetes in the United States is attributed to the privately insured population.[1] Although employers have implemented a variety of wellness and disease-management programs to contain rising health care costs, most are conducted from a lifestyle perspective and do not offer comprehensive medication therapy management (CMTM).[2,3]

http://dx.doi.org/10.1016/j.japh.2016.08.010
1544-3191/

Key Points

Background:

- Six self-insured employers offered a continuous pharmacist-delivered chronic disease management service to employees and their family members with diabetes for up to 3.5 years.
- The service was delivered by 50 licensed pharmacists trained in diabetes management, CMTM, and cardiovascular disease.
- Clinical notes and recommendations were transmitted securely via fax and e-mail to PCPs and endocrinologists after each visit.

Findings:

- An immediate drop in LDL levels and SBP among patients initially not at goal was sustained across the entire observation period.
- The P^3 Program was associated with a significant reduction in average A1c levels in the first 6 months (−0.82%, P <0.001), driven primarily by patients with initial levels outside the clinical goals (−1.45% at 6 months, P <0.001).
- Annual per participant cost reductions of $1031 were driven by a 33% decrease in hospital admissions and emergency department visits in the year following enrollment in the program.

Continuous CMTM services are important for several reasons. Patients with chronic disease, including diabetes, often present with multiple morbidities that need to be treated with complex drug combinations.[4,5] Although medication adherence is a key factor of favorable outcomes and cost effectiveness,[4] patients with diabetes report multiple reasons for nonadherence with their medications,[4,6] including but not limited to forgetting doses, experiencing side effects, misunderstanding directions, prohibitive medication expense, or confusion about how to take a medication.[7-9] In addition, patients experience changes over time in their life-stages, health status, and external factors, affecting their ability to manage their disease.

Pharmacist-driven, patient-centered models of care continue to evolve as effective methods of chronic disease management. Pharmacist-led adherence and behavioral interventions have largely proved to be effective in improving clinical outcomes and reducing costs of care for diabetes and other chronic diseases.[10,11] Long-term, real-world study results can offer relevant information regarding long-term clinical and economic outcomes of CMTM programs.

Objectives

This study aimed to determine the effectiveness and cost savings of a real-world, continuous, pharmacist-delivered service with an employed, relatively well-controlled patient population with diabetes. Effectiveness is measured by the percent change in clinical outcomes between first and last laboratory measures including glycosylated hemoglobin (A1c), low-density lipoprotein (LDL) levels, and blood pressure. The P^3 Program is evaluated in the context of fully integrated care made accessible to employees on an ongoing basis rather than in the context of a single intervention.

Practice description

The innovation

Beginning in 2006 and continuing today, the P^3 Program is offered as a voluntary “opt-in” benefit by self-insured employers in the states of Maryland and Virginia to their covered employees and their dependents as part of their employer's health benefit package. The P^3 Program was designed to address the health care system's growing pressure on patients, who are often left to manage their chronic diseases and to administer their medication regimens.

A network of certified pharmacists provided chronic disease management and self-management coaching following a process of care consistent with the clinical practice guidelines for diabetes and cardiovascular disease management, as appropriate. As an incentive, patients received copayment waivers for disease-specific medications and supplies from their employer throughout their involvement in the program.

Employees with type 1 or type 2 diabetes mellitus were eligible and thus informed about the service through enrollment packets and letters. Patients expressing interest in the program were provided informed consent and Health Information Portability and Accountability Act (HIPAA) forms for signature. Within 14 days, in-person visits were scheduled between patients and their P^3 pharmacist in a matched ZIP code or at the employer's worksite. At baseline and up to quarterly, according to the patient's needs, CMTM visits were conducted following the P^3 Process of Care (Box 1).

Services were delivered by a distributed network of P^3 Program Certified Pharmacists. To gain P^3 status, licensed pharmacists received advanced clinical training in diabetes, cardiovascular disease, CMTM, and patient education and management. New pharmacists also received asthma, chronic obstructive pulmonary disease, and tobacco cessation training. All were trained in the P^3 Process of Care and the pharmacist-driven proprietary HIPAA-compliant electronic medical record (EMR) technology, which focuses on chronic disease management. In addition, the clinical practice site was inspected. The P^3 Program office at the University of Maryland School of Pharmacy conducted quality assurance reviews for each encounter, checking for compliance with protocols and examining clinical, behavioral, and medication adherence outcomes.

After each patient visit, the pharmacist provided secure, written progress notes to the primary care physician (PCP), the endocrinologist, and the health care team via HIPAA-compliant fax, mail, or e-mail. Pharmacists' communications included a medication action plan and medication recommendations related to the standard of care, including referral (e.g., dietician, certified diabetes educator, dentist, podiatrist). Special attention was given to the coordination of disease self-management and optimizing medication. All encounters were documented in the EMR. Patients received printouts of their medication action plan.

Box 1
Components of the P^3 Program initial visit

- Discuss the P^3 Program
- Identify acute symptoms and complaints
- Conduct clinical assessment
  - Relevant medical history—includes primary diagnosis (focus of the encounter), dates of diagnosis, allergies, significant family history, immunization history
  - Medication history—includes comprehensive medication review, prescriptions, over the counter, dietary supplements, samples
  - Lifestyle—behavioral and self-management components
    - Behavioral
      - Medication adherence—identify barriers (cost, inconvenience, side effects)
      - Substance use—tobacco, drug use, alcohol
      - Diet—caffeine, salt, carbohydrate intake (determined by clinical guidelines for chronic disease state)
      - Exercise
    - Self-monitoring
      - Blood glucose
      - Blood pressure
  - Vitals
    - Blood pressure at every visit
    - Height and weight
  - Laboratory values—obtained from patient's primary care provider (LDL, A1c)
- Assess patient self-management capabilities
  - Knowledge about disease state, goals of therapy, actions based on acute change in disease state
- Set goals
  - Patient's long-term goals
  - Two short-term actionable goals each visit
- Follow-up by pharmacist
  - Set next appointment
  - Introduction letter, medication action plan, medication list, and SOAP note sent to physician
  - Medication action plan and medication list given to patient
  - Patient education materials assessment

Abbreviations used: LDL, low-density lipoprotein; A1c, glycosylated hemoglobin.

Initial visit

New patients completed a 1-hour initial visit during which the P^3 pharmacist thoroughly reviewed medical and medication history and assessed the patient's knowledge and health behavior. Such assessment applied to adherence to current medication therapy, diet, smoking behavior, and exercise regimen. In addition, pharmacists answered patients' questions and worked collaboratively with the patients and their PCP in setting 1 long-term health goal and 2 short-term, measurable self-management goals to be completed by the next visit. Clinical values were gathered from physician reports to assess the patient's baseline clinical status, as measured by A1c, blood pressure, weight, and low-density lipoprotein (LDL) levels. Adherence to medication regimens and medical visits was assessed. As indicated in Box 1, a comprehensive review of each patient's medications was performed (assessing safety, appropriateness, and effectiveness of the drug therapy) based on information received from the patients and their PCP. Physician responses to the pharmacist recommendations varied but did not constitute a barrier to participation.

Ongoing visits

Each follow-up visit involved the P^3 pharmacist's collection and assessment of the disease and the medications. Available data such as A1c, glucose, cholesterol, blood pressure, and medication and medical visits adherence were documented from PCP reports. Patients' self-management skills were assessed to ensure knowledge of blood glucose self-monitoring; oral medications; insulin and non–insulin injectable self-administration; nutritional choices; appropriate foot, skin, eye and oral health care; and stress management. Frequently, P^3 pharmacists asked patients to demonstrate their ability to perform tasks and provided individualized education to improve self-management skills and comprehension. Visits were conducted as recommended by the pharmacists or physicians or at the request of the patient.

Evaluation

This retrospective program evaluation covers the period July 2006 through May 2012 with reporting on 602 P^3 Program patients. The study was approved by the University of Maryland Institutional Review Board.

Clinical outcomes

The primary clinical outcome in our analysis was the change in A1c for patients from baseline to the most recent follow-up visit during which the A1c was recorded. Follow-up visits represented real-world practice; therefore, total follow-up time and the number of visits varied across patients. Secondary clinical outcomes were the change from baseline in LDL, systolic blood pressure (SBP), and diastolic blood pressure (DBP). In the exploratory analyses, mean changes in readings of blood pressure were assessed using t tests, at the $P = 0.05$ significance level. Using multivariate regression analyses, we adjusted for demographics and assessed the significance of coefficients at the 95% confidence interval levels. Because this is a real-world study following patients for 66 months and examining average changes in clinical measures at each 6-month interval (recorded within 3 months of the visit), patients with more than one measurement taken in a given period had their last observed measurement for the period used in the study. Analysis was conducted for the combined group of all patients and separately by employer groups.

Given the longitudinal nature of the study, the American Diabetes Association's annually updated evidence-based clinical guidelines were used in the CMTM encounter with pharmacists. Absolute values are reported as change over time. Given the time period of the data, the Eighth Joint National

Committee (JNC8) guidelines and 2012 American Diabetes Association guidelines were used in this evaluation (A1c <7.0%, LDL <100 mg/dL, SBP <130 mm Hg, DBP <80 mm Hg) to determine parameters indicating whether a patient was clinically "in control."

Economic outcomes

Patients' cumulative medical, pharmacy, and total costs, including copayments, were compared for the 12 months before and after their baseline measures. Non–diabetes-related catastrophic medical conditions were excluded from the cost analysis. These cost data were derived from self-insured employer health care utilization data, which was different for each employer. Univariate generalized estimating equations with variances adjusted for clustering by employer were used to estimate the mean difference in annual cumulative costs before and after enrollment.

Results

Clinical outcomes

As we were interested in evaluating the long-term effect of the program, we included in the analysis 602 patients who had at least 1 follow-up measurement taken 3 months after baseline. The remaining 101 of 703 patients were excluded because of missing baseline information or a 3-month delay in last available follow-up.

The baseline characteristics of the 602 patients are shown in Table 1. Just over half of the patients (56%) were female; 44% were white, 19% were black, and the remainder were of other race or ethnicity. The average age was 55 years, the average A1c was 7.6%, average LDL level was 104 mg/dL, and the average BP (SBP/DBP) was 132/78 mm Hg. Patient-employee educational levels ranged from high school education to advanced degrees. Literacy or disability were not a problem for this ambulatory patient population.

On average, patients in this analysis had data for approximately 2.5 years of follow-up. Nearly half of the patients had between 2 and 5 visits during which 1 or more clinical measures were recorded after baseline. One quarter had only 1 follow-up visit, and the remainder had more than 5 follow-up visits. There was an average of approximately 9 months between patients' clinical measurements.

An analysis of all patients using the clinical measures observed at each patient's final visit was performed to examine the average change over the study period. On average, there were statistically significant improvements, as shown by decreases in A1c (−0.41%, P <0.001), LDL (−4.7 mg/dL, P = 0.003), and SBP (−2.3 mm Hg, P = 0.001) and DBP (−2.4 mm Hg, P <0.001).

After stratifying patients with baseline measures outside and within clinical norms, we found that patients who were in worse health initially benefitted more from the P^3 Program. Patients starting within goal remained within goal, although their clinical values exhibited a statistically significant increase in A1c (0.21%, P <0.001), LDL level (13.0 mg/dL, P <0.001), SBP (5.2 mm Hg, P <0.001), and DBP (2.0 mm Hg, P = 0.002) by the time of their last measurement. The average changes in A1c, LDL, SBP, and DBP throughout the 66-month intervals were adjusted for age, sex, and race. Estimates are provided for patients with measurements above and below recommended clinical values at baseline (Table 2).

A more detailed longitudinal analysis was conducted to examine changes across multiple time points (see Appendix, available on japha.org as supplemental content). The P^3 Program was associated with a significant reduction in average A1c levels in the first 6 months (−0.82%, P <0.001), driven primarily by patients with initial levels outside the clinical goals (−1.45% at 6 months, P <0.001). The effect of the intervention dissipated gradually with a positive effect of the program being sustained through 36 months. Similarly, we observed an immediate drop in LDL levels (−20.7 mg/dL after 12 months, P <0.001) among patients initially not at goal; this improvement was sustained across the entire observation period. There was a non–statistically significant increase in LDL levels among patients within initial clinical normal levels. The same trends were observed for blood pressure, whereby there was also early and sustained improvement in both SBP (−4.9 mm Hg at 12 months, P <0.001) and DBP (−5.5 mm Hg at 12 months, P <0.001) for patients with baseline levels above

Table 1
Baseline characteristics of P^3 participants by employer (N = 602)

P^3 patient characteristics	Employer					
	1	2	3	4	5	6
No. of patients	152	110	79	33	186	42
Sex						
Male (%)	44.1	28.2	59.5	24.2	46.2	66.7
Female (%)	55.9	71.8	40.5	75.8	53.8	33.3
Race						
Black (%)	30.9	30.9	31.7	6.1	0.5	9.5
White (%)	46.7	47.3	43.0	24.2	46.8	23.8
Other (%)	22.4	21.8	25.3	69.7	52.7	66.7
Age (Mean, y)	54.0	53.7	50.1	58.0	57.4	60.2
Follow up for HbA1c (Mean, d)	829	895	702	670	1111	747
Follow up for LDL (Mean, d)	944	905	549	519	1104	641
Follow up for BP (Mean, d)	866	999	795	721	721	746
Mean HbA1c at baseline (%)	7.6	7.2	8.1	7.2	7.7	7.2
Mean LDL at baseline (mg/dL)	119.3	94.2	89.0	96.1	103.9	94.1
Mean SBP at baseline (mm Hg)	132.8	137.4	125.5	130.5	130.4	129.9
Mean DBP at baseline (mm Hg)	76.1	82.6	76.6	77.2	78.1	82.9

Abbreviations used: HbA1c, glycosylated hemoglobin; LDL, low-density lipoprotein; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 2
Change in clinical characteristics from baseline to P³ participants' last measurement (N = 602)

Clinical indicator	Employer						All employers	*P* value
	1	2	3	4	5	6		
No. of patients	152	110	79	33	186	42	602	—
Change in HbA1c from baseline at last FU (%)	−0.51	−0.03[a]	−0.60	−0.42	−0.54	−0.15[a]	−0.41	<0.001
Baseline HbA1c ≥7.0% (n = 337)	−1.02	−0.41	−0.79	−0.95	−1.07	−1.21	−0.90	<0.001
Baseline HbA1c <7.0% (n = 265)	0.18	0.30	0.08[a]	0.08[a]	0.12[a]	0.51	0.21	<0.001
Change in LDL from baseline at last FU (mg/dL)	3.4[a]	−9.3	0.4[a]	−8.2[a]	−7.1	−13.4	−4.7	0.003
Baseline LDL ≥100 mg/dL (n = 291)	−6.7	−32.7	−13.1	−28.4	−24.5	−43.5	−19.3	<0.001
Baseline LDL <100 mg/dL (n = 239)	44.0	7.9	8.4[a]	2.0[a]	14.2	0.5[a]	13.0	<0.001
Change in SBP from baseline at last FU (mm Hg)	−5.0	−2.0[a]	0.7[a]	−1.8[a]	−1.8[a]	−1.3[a]	−2.3	0.001
Baseline SBP ≥130 mm Hg (n = 289)	−11.6	−9.8	−6.7	−6.7	−7.6	−9.1	−9.2	<0.001
Baseline SBP <130 mm Hg (n = 262)	2.9	10.3	5.4	2.2[a]	4.4	10.1	5.2	<0.001
Change in DBP from baseline at last FU (mm Hg)	−1.8	−4.3	−1.4[a]	−1.4[a]	−1.7	−5.6	−2.4	<0.001
Baseline DBP ≥80 mm Hg (n = 256)	−7.5	−7.0	−6.7	−7.4	−7.9	−9.0	−7.5	<0.001
Baseline DBP <80 mm Hg (n = 295)	0.9[a]	0.0[a]	3.5	3.9	2.8	3.2[a]	2.0	0.002

Abbreviations used: FU, follow-up; HbA1c, glycosylated hemoglobin; LDL, low-density lipoprotein; SBP, systolic blood pressure; DBP, diastolic blood pressure.
[a] Not statistically significant at $P = 0.05$. All other estimates are statistically significant.

clinical norms. Those with baseline levels within the clinical goals had a non–statistically significant increase in SBP and DBP levels.

Health care cost

Complete medical and pharmacy claims data for before and after the P³ program were available for 162 patients from 3 employer groups (Table 3). The average per-patient all-cause medical care costs significantly declined by $1321 (26%, $P < 0.001$). This decline was driven by a 33% decrease in hospital admissions and emergency department visits in the year following enrollment in the program—a decline from 1.13 to 0.75 per patient per year. This decrease in medical costs was accompanied by an increase of $603 (17%, $P = 0.20$) per patient per year in prescription drug costs to the employer. Summing the differences in all-cause medical and prescription medical costs and delivery of the P³ Program, savings averaged $717 (8.3%) per patient per year in total annual health care costs to employers ($P = 0.32$), unadjusted for changes in copayments for diabetes-related medications and supplies averaging $309 per patient, which were waived for the patient but paid by the employer in the second year. When we subtracted this figure from employer's estimated post-year pharmacy cost, annual prescription drug costs increased by $295 (8%, $P = 0.52$) per patient, resulting in total annual health care costs decline of $1031 (12%, $P = 0.15$) per patient.

Although the sample of patients on whom we had available cost data was a subset of the overall sample of 602, the trend for reduction in total costs was correlated with improvement in clinical parameters, similar to the overall sample. As illustrated in Table 3, this subset of patients had lower A1c (−0.34%, $P = 0.002$) and lower SBP (−2.51 mm Hg, $P = 0.08$) and DBP (−1.77 mm Hg, $P = 0.04$), but similar LDL levels (−1.66 mg/dL, $P = 0.586$), on average. A major driver in the decline of the overall health care costs to the employers for P³ patients was achieved by a reduction in hospital admissions and emergency department visits 12 months after enrollments compared with the baseline of 12 months preceding enrollment in the P³ Program. On average, we noted an overall reduction of 33% in the number of hospital admissions and emergency department visits.

Discussion

The results herein add to findings from programs that have demonstrated the value of an employer-funded, collaborative diabetes management program using the patient-centered engagement approach underpinning the P³ Process of Care.[10,11] The P³ Program resulted in lower costs to payers. This program evaluation is unique in the longitudinal nature of the study in a real-world setting without full integration into employer health plans with no discrete beginning and end dates.

Our data show that costs of increased medication use, as more patients received and adhered to the medications

Table 3
Costs before and after P³ intervention in P³ participants with clinical and cost data (n = 162)

Category of cost	Costs			[95% CI] Cost difference ($)		% Change	*P* value
	Baseline ($)	1 year after ($)	Mean difference[a]				
Mean medical cost	5133	3807	−1321	−2017	−624	−25.8	<0.001
Mean pharmacy cost	3520	4125	603	−324	1531	17.2	0.20
−$309 PMPY pharmacy copayment[b]	3520	3816	295	−633	1222	8.4	0.52
Mean Total ($)	8654	7931	−717	−2125	690	−8.3	0.32
−$309 PMPY pharmacy copayment[b]	8654	7622	−1031	−2434	381	−11.9	0.15

Abbreviations used: CI, confidence interval; PMPY, per member per year.
[a] Mean cost difference estimates from generalized estimating equations with adjusted variance for clustering by employers.
[b] Costs with adjustment for change in benefit structure (subtract average of $309 PMPY copayment from pharmacy costs in year after baseline).

prescribed to them, were offset by decreased medical costs over time. This suggests that the benefits to patients and payers may be cumulative, over many years, rather than episodic in nature. Patients starting within goal remained within goal, although their clinical values exhibited a statistically significant increase in A1c by the time of their last measurement. Because patients were within goal, such increases might not be considered clinically significant. CMTM builds on medication adherence in parallel with improved self-care knowledge, skills, and performance to keep patients in or closer to their clinical goals.

The clinical outcome analysis showed that the average effect of the P^3 Program services on therapeutic goals tended to decrease over time, as seen in many other clinical programs. This may be due to program patients becoming less sensitive to engagement over time.[12] Alternatively, the patients could have become overconfident in their ability to self-manage their disease and to be less compliant with appointments. Therefore, there are still opportunities to improve long-term strategies for provider-supported patient self-management interventions.

Limitations

While a linear regression analysis between the clinical outcomes and the costs could contribute to our discussion of the program, clinical data were tied to patient-pharmacist visits, and health utilization data were tied to baseline and 1-year increments. This was due in part to the difficulty gathering third-party data from diverse carriers and yearly changes in prescription drug benefit and health plans by employers. When pharmacist-delivered services are included in electronic health systems and reimbursement for pharmacist-delivered care occurs within billing codes, these data will be more readily available as an integrated rather than parallel data source.

The study is not without limitations. The P^3 Program was offered to covered employees as a voluntary health benefit with continuous enrollment. For this reason, the estimated improvements in clinical and cost outcomes noted could be influenced by several biases. Those who opted into the program may or may not have been healthier or more motivated, or experienced reduced self-efficacy compared with employees who did not participate. As with most clinical program evaluations, randomization was not possible. In addition, all services were delivered face-to-face, but variations could exist among delivery site.

While point-of-care testing offers tremendous opportunity for involvement in clinical management, P^3 Program pharmacists were unable to order clinical laboratory tests, such as A1c and LDL. Thus, the clinical values do not coincide directly with P^3 Program visits. Rather, the test results reflect PCP records of laboratory test results.

Studies of physician and patient experiences could enrich this analysis. Plans are now in motion to expand our current studies using validated instruments for patient satisfaction in ambulatory services and less well-studied interdisciplinary collaborations that focus on behavior modification, healthy lifestyles, and physical activity[13] alongside medication-related issues.

Future implications

The average age of the workforce is continuing to rise and along with it the prevalence of high-cost chronic conditions.[14] Requiring pharmacist-provided CMTM for chronic disease management as an element in employer benefit plans could improve population health and reduce health costs while optimizing workforce productivity.[15]

Despite the benefits of better adherence and self-care, a majority of costly medication problems in a primary care setting occur between clinicians, including ineffective and duplicative prescribing, lack of care coordination, and inconsistent monitoring.[16] Future work should further examine types of interdisciplinary cooperation based on the P^3 Program's model with incentives aligned for stakeholders in collaborative care. One approach to improve the value is that employers align payment systems with financial incentives for physicians, patients, and pharmacists to collaborate in patient-centered care. For instance, private accountable care organizations, integrated health care networks, or patient-centered medical homes could support sustainable roles for pharmacist-providers of medication management services as part of team-based care.[16,17] Payment arrangements—including bundled and global payments, care coordination fees, performance targets and bonus incentives, or shared savings—could be used. However, pharmacist provider status is an overshadowing factor in most emerging payment models. Clearly, the inclusion of pharmacist-delivered services in ICD-10 coding could be helpful in future studies considering both costs and clinical outcomes.[16,18]

During this study period, pharmacist-delivered care was not integrated into the state-operated health information exchange. Yet, with input into the health information exchange, pharmacist providers could access information to optimize the development of the medication action plan that is codeveloped by the patient. In addition, pharmacist reports could provide valuable information for clinical decisions by PCPs, specialists, and auxiliary health care personnel. Increasingly, electronic patient coordination is critical to optimizing clinical care and reducing preventable medication misadventures.

Conclusion

With ever-rising costs of health care, employers can turn to CMTM as a sustainable and clinically effective program to lower medical spending and promote a more productive workforce. Options are available for companies to expand beyond health promotion initiatives to include highly valuable services in health benefit design. Collaborative care models are aligned with the goals of value-based insurance design (VBID).[19] One key element of both the P^3 Program and the VBID approach is the reduction of copayments for condition-specific medications and supplies to incentivize greater use of low-cost and effective preventive care. Programs that feature continual face-to-face counseling, coaching, and medication monitoring by skilled professionals could complement the goals of VBID.[12,15]

Considering the overall health and economic burden imposed by chronic illness and the large fraction of the U.S. population covered by employer-sponsored insurance, such options as tax incentives may help to accelerate employers'

adoption of medication management services and coordinated care models. Employer purchasing power could influence the long-term viability of promising programs in the health care system.[20]

Acknowledgments

The authors acknowledge Dawn Shojai, PharmD, (P^3 Clinical Director at the time of paper) and Wendy Cohan, MPA (University of Maryland School of Pharmacy, the P^3 Pharmacist Network, the Maryland Pharmacist Association, and the Maryland, Virginia and Mid-Atlantic Business Coalitions on Health) for their support.

References

1. Goetzel RZ, Pei X, Tabrizi MJ, et al. Ten modifiable health risk factors are linked to more than one-fifth of employer-employee health care spending. *Health Aff (Millwood)*. 2012;31(11):2474–2484.
2. Hartman M, Martin AB, Benson J, Catlin A. National health spending in 2011: overall growth remains low, but some payers and services show signs of acceleration. *Health Aff (Millwood)*. 2013;32(1):87–99.
3. Claxton G, Rae M, Panchal N, et al. Health benefits in 2013: moderate premium increases in employer-sponsored plans. *Health Aff (Millwood)*. 2013;32(9):1667–1676.
4. Rodriguez de Bittner M. *Drug Therapy Management Report on the Study to Access the Outcomes Achieved by Drug Therapy Management Agreements*. Maryland Board of Pharmacy Report to the General Assembly; 2010.
5. Hertz RP, Unger AN, Lustik MB. Adherence with pharmacotherapy for type 2 diabetes: a retrospective cohort study of adults with employer-sponsored health insurance. *Clin Ther*. 2005;27(7):1064–1073.
6. Odegard PS, Carpinito G, Christensen DB. Medication adherence program: adherence challenges and interventions in type 2 diabetes. *J Am Pharm Assoc (2003)*. 2013;53(3):267–272.
7. Kripalani S, Yao X, Haynes RB. Interventions to enhance medication adherence in chronic medical conditions: a systematic review. *Arch Intern Med*. 2007;167(6):540–550.
8. Mehuys E, Van Bortel L, De Bolle L, et al. Effectiveness of a community pharmacist intervention in diabetes care: a randomized controlled trial. *J Clin Pharm Ther*. 2011;36(5):602–613.
9. Doucette WR, Witry MJ, Farris KB, McDonough RP. Community pharmacist-provided extended diabetes care. *Ann Pharmacother*. 2009;43(5):882–889.
10. Cranor CW, Bunting BA, Christensen DB. The Asheville Project: long-term clinical and economic outcomes of a community pharmacy diabetes care program. *J Am Pharm Assoc (Wash)*. 2003;43(2):173–184.
11. Fera T, Bluml BM, Ellis WM, Schaller CW, Garrett DG. The Diabetes Ten City Challenge: interim clinical and humanistic outcomes of a multisite community pharmacy diabetes care program. *J Am Pharm Assoc (2003)*. 2008;48(2):181–190.
12. Brennan TA, Dollear TJ, Hu M, et al. An integrated pharmacy-based program improved medication prescription and adherence rates in diabetes patients. *Health Aff (Millwood)*. 2012;31(1):120–129.
13. Shaya GE, Al-Mallah M, Hung R, et al. High exercise capacity attenuates the risk of early mortality after a first myocardial infarction. *Mayo Clin Proc*. 2016;91(2):129–139.
14. Lee DJ, Fleming LE, LeBlanc WG, et al. Health status and risk indicator trends of the aging US health care workforce. *J Occup Environ Med*. 2012;54(4):497–503.
15. Vojta D, De Sa J, Prospect T, Stevens S. Effective interventions for stemming the growing crisis of diabetes and prediabetes: a national payer's perspective. *Health Aff (Millwood)*. 2012;31(1):20–26.
16. Smith M, Bates DW, Bodenheimer TS. Pharmacists belong in accountable care organizations and integrated care teams. *Health Aff (Millwood)*. 2013;32(11):1963–1970.
17. Smith M, Bates DW, Bodenheimer T, Cleary PD. Why pharmacists belong in the medical home. *Health Aff (Millwood)*. 2010;29(5):906–913.
18. Salmon RB, Sanderson MI, Walters BA, Kennedy K, Flores RC, Muney AM. A collaborative accountable care model in three practices showed promising early results on costs and quality of care. *Health Aff (Millwood)*. 2012;31(11):2379–2387.
19. Chernew ME, Rosen AB, Fendrick AM. Value-based insurance design. *Health Aff (Millwood)*. 2007;26(2):w195–w203.
20. Allen H, Nobel JJ, Burton WN. Making health care reform work: where physician and employer interests converge. *JAMA*. 2012;308(23):2465–2466.

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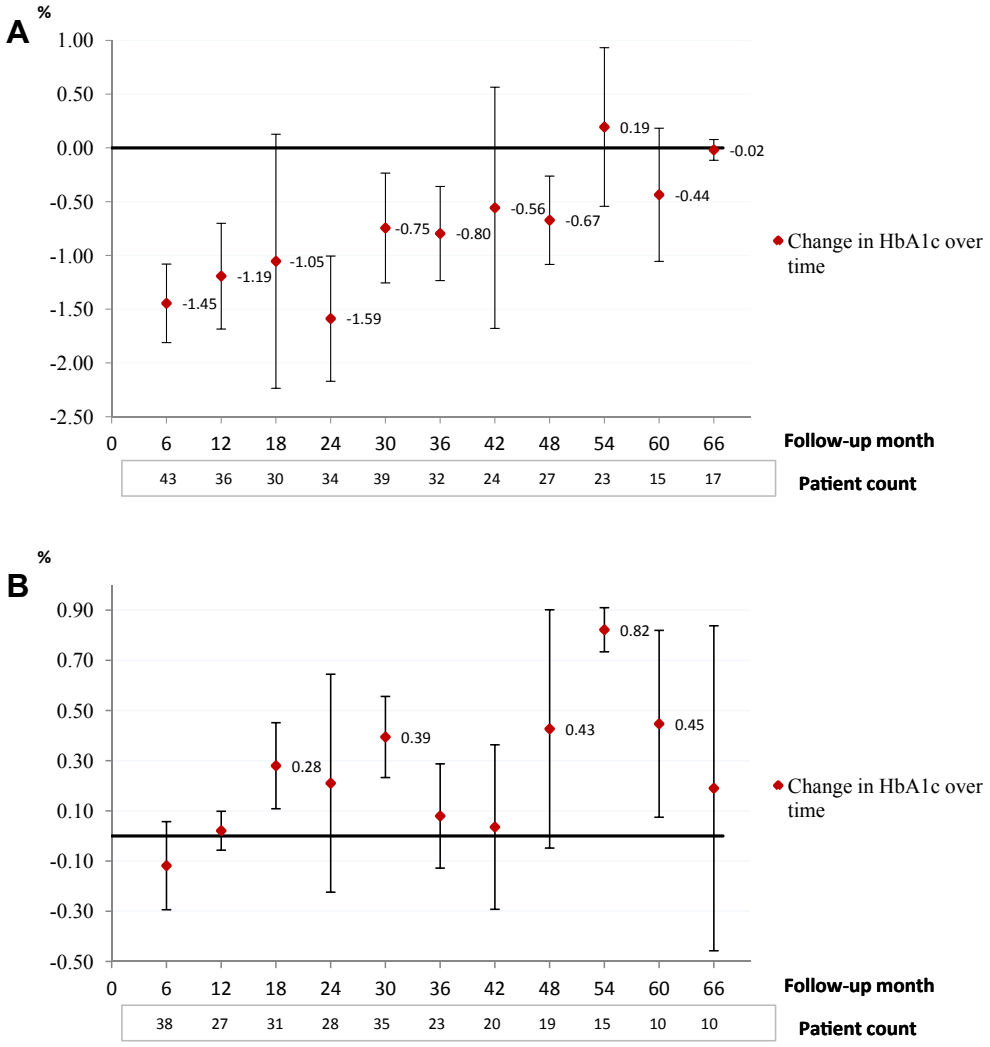
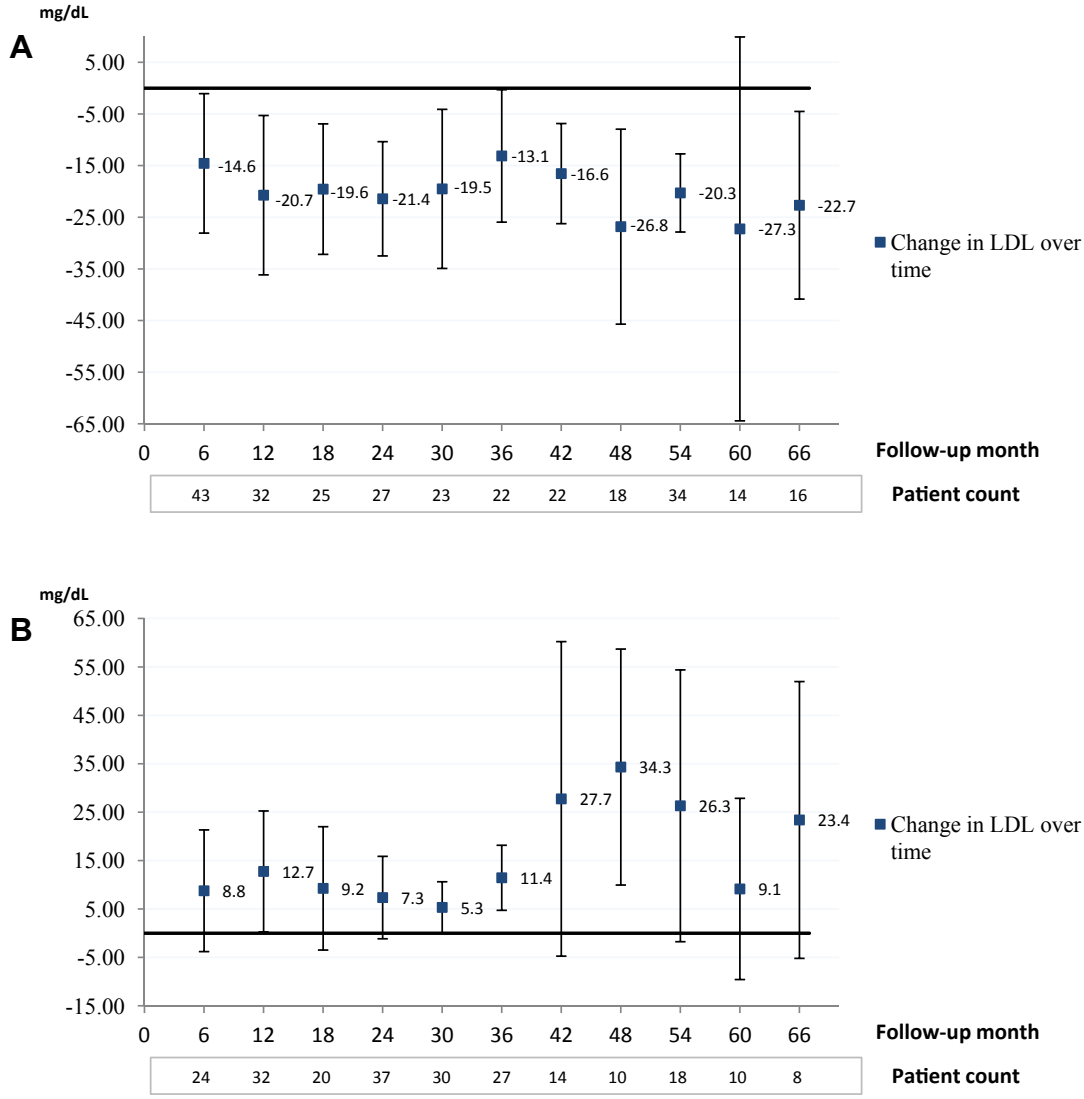
Appendix

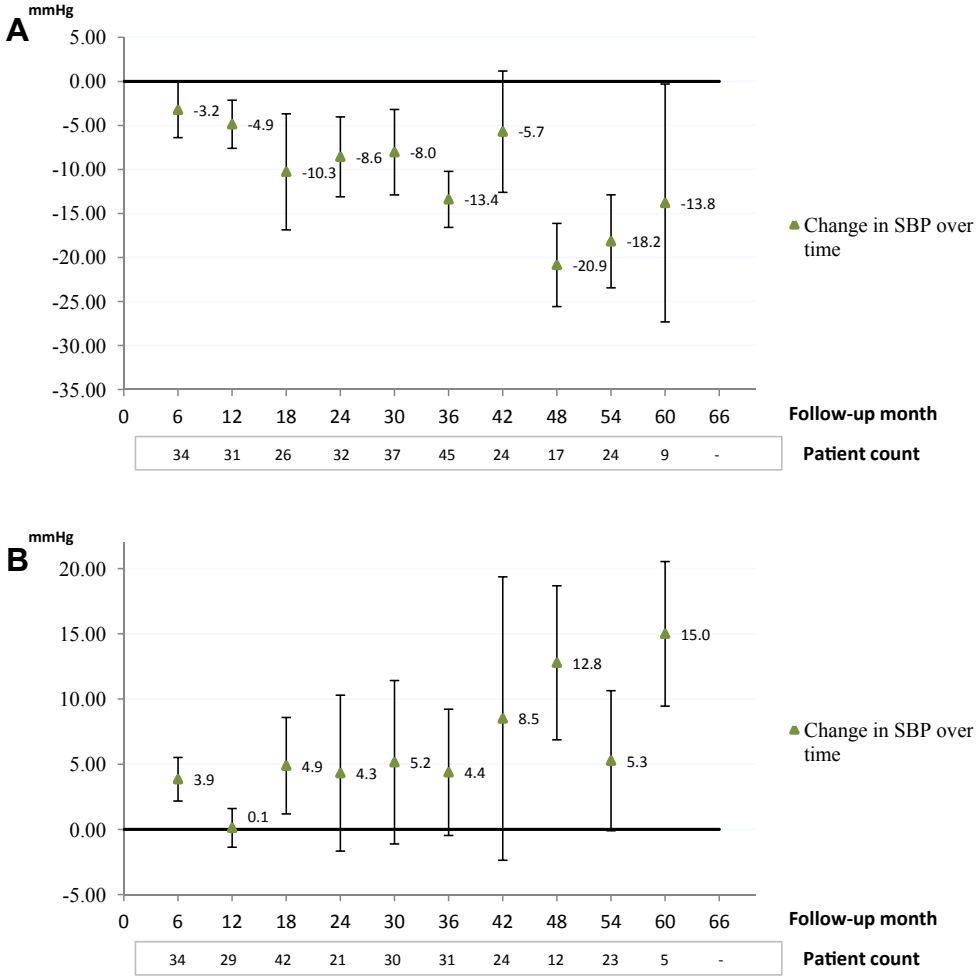
The following figures demonstrate the detailed longitudinal analysis of the monthly change in clinical measures across the 66-month study period.



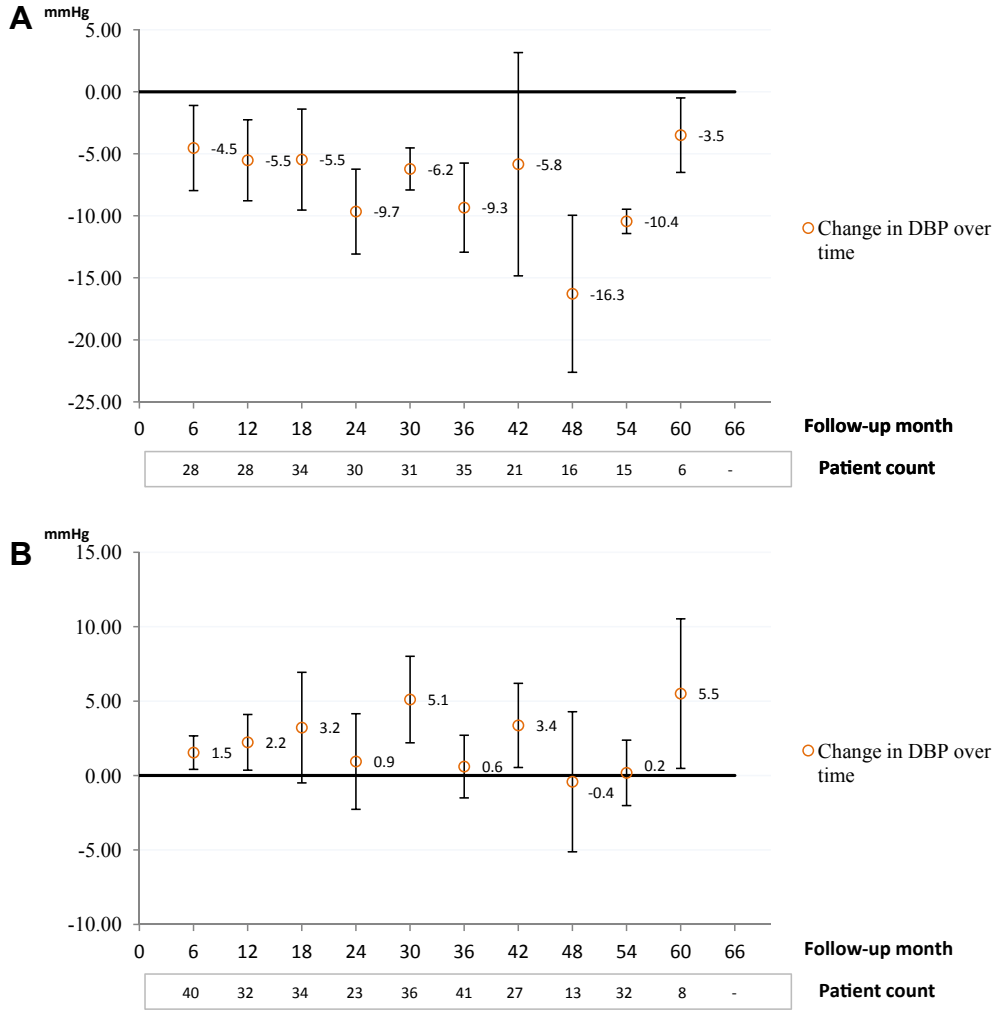
Appendix Figure 1. (A) Change in glycosylated hemoglobin (HbA1c) over time in P^3 participants with baseline HbA1c $\geq$7% (adjusted for age, race, sex, and clustering within insurance). (B) Change in HbA1c over time in P^3 participants with baseline HbA1c <7% (adjusted for age, race, sex, and clustering within insurance).



Appendix Figure 2. (A) Change in low-density lipoprotein (LDL) level over time in P^3 participants with baseline LDL ≥100 mg/dL (adjusted for age, race, sex, and clustering within insurance). (B) Change in LDL level over time in P^3 participants with baseline LD <100 mg/dL (adjusted for age, race, sex, and clustering within insurance).



Appendix Figure 3. (A) Change in systolic blood pressure (SBP) over time in P³ participants with baseline SBP ≥130 mm Hg (adjusted for age, race, sex, and clustering within insurance). (B) Change in SBP over time in P³ participants with baseline SBP <130 mm Hg (adjusted for age, race, sex, and clustering within insurance).



Appendix Figure 4. (A) Change in diastolic blood pressure (DBP) over time in P^3 participants with baseline DBP ≥80 mm Hg (adjusted for age, race, sex, and clustering within insurance). (B) Change in DBP over time in P^3 participants with baseline DBP <80 mm Hg (adjusted for age, race, sex, and clustering within insurance).