

Evaluation of an Academic-Community Partnership to Implement MTM Services in Rural Communities to Improve Pharmaceutical Care for Patients with Diabetes and/or Hypertension

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ABSTRACT

BACKGROUND: Although the current methods of medication therapy management (MTM) delivery have demonstrably improved therapeutic, safety, economic, and humanistic health outcomes, patient- and prescriber-level barriers persist, limiting its reach and effectiveness.

OBJECTIVE: To assess telephonic- and community-based clinical pharmacy services in improving health indicators for rural, underserved patients.

METHODS: In 2014, an established MTM provider created a novel, collaborative pilot program with independent retail and community health center pharmacies to provide comprehensive, telephonic MTM services to rural Arizonans. This pilot program used a combined telephonic- and community-based pharmacist approach in the provision of MTM services for rural, underserved Arizona populations. Adults with diabetes mellitus and/or hypertension, seen by a prescriber or who filled prescriptions at a contracted, rural facility in 2014, were eligible to participate. Initial MTM telephonic consultations were conducted, and recommendations were communicated to patients' prescribers and/or pharmacists. Patients received a follow-up telephone call at standard intervals, depending on risk severity.

RESULTS: A total of 517 patients participated, and 237 medication-related and 1,102 health promotion interventions were completed. Positive trends were observed in fasting blood glucose, postprandial glucose, and diastolic blood pressure. Broad variation in prescriber acceptance of pharmacist recommendations was observed (27%-60%).

CONCLUSIONS: Study results provide initial evidence to support the efficacy of collaborative efforts in the provision of MTM services for improving health indicators and safety measures while potentially reducing health care disparities. While the results are encouraging, future research is warranted in more diverse populations and settings.

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What this study adds

- This pilot program evaluation describes and evaluates a novel method of MTM delivery, using a partnership between a centralized MTM provider and several community pharmacy sites.
- This approach demonstrates enhanced patient acceptance, while improving such health indicators as biomarkers, gaps in care, and medication-related problems.

The advent of medication therapy management (MTM) was a major hallmark in addressing medication-related issues, while simultaneously expanding the role of pharmacists from medication dispensers to integrated members of interprofessional, clinical health care teams. MTM is defined by the American Pharmacists Association as “a service or group of services that optimize therapeutic outcomes for individual patients” and consists of 5 core elements: (1) a comprehensive or targeted medication therapy review (CMR); (2) creation or formulation of a personal medication record; (3) development of a medication-related action plan; (4) implementation of the action plan through interventions and referrals; and (5) documentation and follow-up.¹ The Medicare Prescription Drug, Improvement and Modernization Act requires that all Part D sponsors provide MTM services to eligible beneficiaries.² Individual sponsors, such as health plans or MTM providers, determine the logistics of MTM delivery, yet most use a single or combined delivery model (e.g., telephonic, face-to-face, or combination of the two) to fulfill this requirement.³

While a growing body of literature demonstrates the efficacy of MTM in improving patient-related health measures and lowering health care costs,⁴⁻⁷ CMR completion rates—the first step in the provision of MTM services and a measurable benchmark of program reach—remain relatively low (23.8%-49.8%), depending on the delivery approach used.⁸ Furthermore, even the most commonly used MTM delivery models face substantial patient- and prescriber-related barriers, thus limiting the service's reach and effectiveness.⁹

What is already known about this subject

- Medication therapy management (MTM) has demonstrably improved therapeutic, safety, economic, and humanistic health outcomes, yet barriers remain that affect optimal participation.
- Comprehensive medication review completion rates remain relatively low (23.8%-49.8%), depending on the delivery approach used.
- Several patient- and prescriber-level limitations have been identified, including patient acceptance of MTM services and prescriber acceptance of recommendations generated via MTM services.

Patients can choose to opt-out of MTM services, so patient engagement is critical to improve participation and retention. In addition, many patients have reservations about pharmacists serving in a nondispensing capacity.¹⁰ Also, a general lack of patient understanding exists regarding the prescriber-MTM pharmacy staff relationship, yet it is one of the most important factors in determining patient participation in MTM services.¹¹ On the prescriber side, acceptance rates of MTM recommendations made by pharmacists are lower than desired and vary widely (14.1%-60%).¹²⁻¹⁴ Lack of prescriber awareness of MTM services presents another challenge.¹⁵

To address these barriers, some sponsors have attempted to improve strategies or promotional approaches.^{8,16} Others have established stricter eligibility criteria and varying levels of MTM services to improve efficacy or integrated more targeted MTM programs into clinics.^{17,18} Observational data suggest that patients desire a collaborative relationship between their prescribers and their MTM providers.¹¹ However, to our knowledge, no published research exists on collaboration between a centralized, telephonic, comprehensive MTM provider and community-based pharmacists and/or prescribers. Thus, a knowledge gap exists surrounding the logistics and efficacy of such a program. Yet, this collaborative concept is uniquely suited to help overcome the aforementioned barriers and to increase the reach and efficacy of MTM services.

In 2014, an established MTM provider created a novel, collaborative pilot program with independent retail and community health center pharmacies to provide comprehensive, telephonic MTM services to rural Arizonans. The objective of this program evaluation was to assess the ability of telephonic and community-based clinical pharmacy services to improve health indicators for rural, underserved patients, who typically experience a shorter life expectancy, health workforce recruitment challenges, and decreased access to hospital facilities.^{19,20}

Methods

Project Design and Study Population

This program evaluation project employed a pre-post design to assess the effect of MTM services (intervention). Patients were followed for a 1-year period.

Eligible patients met the following criteria: (a) received care at one of the community partner sites; (b) were aged 18 years or older; (c) had a current diagnosis of hypertension and/or diabetes mellitus; and (d) were currently living in a rural Arizona community. The participating community sites were considered rural, based on the definition in the Arizona statute.²¹ The Institutional Review Board deemed this project as a program evaluation given that the intent was to improve or evaluate a practice or process. Written patient consent was not required; all participants were informed of the program and given the option to participate.

Partner Sites

The MTM provider, housed at a nonrural academic institution, partnered with the participating rural community sites. Selection of community partner sites was based on the following: (a) long-standing relationships with the local academic institution and (b) the ability to target socioeconomically underserved areas to address health disparities as defined by the Centers for Disease Control and Prevention.²² Five contracted rural community partner sites were selected, including 3 independent retail pharmacies, with 2 owned by the same entity (Sites I1, I2, I3); 1 pharmacy imbedded at a Federally Qualified Health Center (Site C1); and 1 Rural Health Clinic pharmacy (Site C2). The sites were dispersed throughout rural areas in Arizona.

Patient Enrollment

Eligible patients were primarily recruited and enrolled by the community partner sites in person and via telephone. The centrally located MTM provider also furnished flyers for mail and e-mail dissemination and periodically conducted telephonic recruitment. Partner site personnel introduced and offered the pilot program to eligible patients. After a patient agreed to participate, site personnel completed a patient registration form and sent it to the MTM provider. Once the form was received, the MTM pharmacist contacted the patient to provide telephonic MTM services from a centralized, nonrural academic site (Figure 1).

Definition of Roles

The role of the centralized MTM pharmacist included providing comprehensive MTM services (e.g., CMR) to patients; sending recommendations to partner sites (i.e., community pharmacist and/or prescriber); and conducting follow-up patient consultations. In addition, staff at the partner sites recruited patients; discussed recommendations made by the MTM pharmacist with the patients (e.g, medication initiation, patient follow-up, recommended vaccinations, and dosing changes); and conducted periodic reviews of medication history to assess recommendation outcomes.

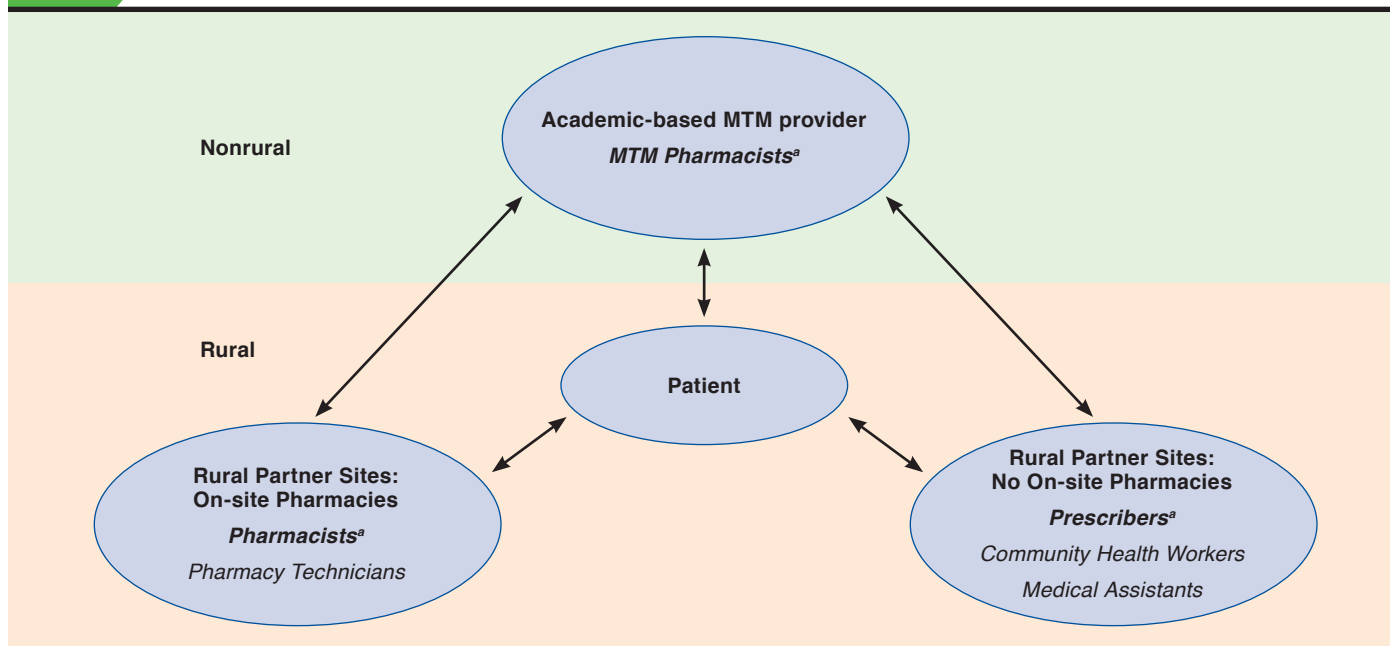
Partner site staff included community health workers, medical assistants, pharmacists, and/or prescribers, depending on the respective site. At one community partner site (Site C2), community health workers, or *promotoras*, served as front-line health aides (e.g., community representatives). When possible, community health workers were present in the patient's home during the initial CMR to assist the patient during the medication reconciliation portion of the CMR; ensure patient understanding; and document any recommendations made during the call.

MTM Services

The MTM provider followed the American Pharmacists Association's Core Elements of an MTM Service Model,¹ with

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FIGURE 1 Interprofessional MTM Provider and Rural Partner Sites in Provision of MTM Services



^aIndicates key point of contact.
MTM = medication therapy management.

special emphasis on patient laboratory results and self-monitoring, appropriateness of therapy, medication-related problems, and health promotion. Interventions and referrals were communicated directly to staff at the respective community partner sites. Pharmacists at the on-site pharmacy sites (I1, I2, and I3) received the direct communication from the MTM pharmacist, while prescribers were the main point of contact at the health center sites (C1 and C2).

MTM pharmacists conducted a 30-day, follow-up review for identified high-risk patients to ensure that previously made interventions and/or recommendations were addressed appropriately. If patients did not meet the high-risk criteria, MTM pharmacists conducted a 90-day, follow-up review. High-risk criteria included hemoglobin A1c > 7%, average fasting blood glucose level (FBG) > 130, frequent hypoglycemia, presence of diabetic complications, missing preventive screenings, blood pressure not at individualized goal, uncontrolled respiratory symptoms, confusion regarding inhaler use, fluid overload symptoms, missing fluid management plan, and any medication nonadherence. If deemed necessary, MTM pharmacists conducted additional follow-up (e.g., alarm symptoms present such as unusual bleeding or hypertensive urgencies and significant drug-drug interactions). In cases where the patient was unreachable, the MTM pharmacist completed a direct-to-site outreach. In these instances, the pharmacist provided MTM services based on available information (e.g., site-provided

medication list) and made pertinent recommendations directly to the staff at the community partner site.

Data Collection

Patient demographics were collected for gender, age range, race, ethnicity, and tabulated medical conditions. Laboratory results and self-monitoring data were collected at baseline and follow-up, including systolic and diastolic blood pressure (SBP and DBP), hemoglobin A1c, FBG, and postprandial glucose levels (PPG). When available, laboratory results were obtained from the medical record by partner site staff. In cases where that information was not available, the laboratory results were obtained from the patients (self-report).

Gaps in care were assessed according to national consensus guidelines.²³⁻²⁹ The presence of a statin (3-hydroxy-3-methylglutaryl-coenzyme A reductase inhibitor) was assessed in patients with diabetes and atherosclerotic cardiovascular disease. Presence of a beta-adrenergic blocker was assessed in patients with reduced ejection fraction heart failure and in post-myocardial infarction patients. Inhaled corticosteroid presence was assessed in patients with asthma only; inhaled beta-2 adrenergic agonist presence (such as an albuterol inhaler) was assessed in patients with asthma and chronic obstructive disease. The presence of an inhaled corticosteroid was assessed in patients with asthma. These assessments were only made for patients when it was clinically appropriate based on guidelines.

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TABLE 1 Demographics by Site: Patient Participants

	Site I1 n = 63 n (%)	Site I2 n = 42 n (%)	Site I3 n = 16 n (%)	Site C1 n = 248 n (%)	Site C2 n = 148 n (%)	Total n = 517 n (%)
Gender						
Male	24 (38.1)	19 (45.2)	6 (37.5)	94 (37.9)	39 (26.4) ^a	182 (35.2)
Female	39 (61.9)	23 (54.8)	10 (62.5)	154 (62.1)	109 (73.6)	335 (64.8)
Ethnicity						
Hispanic	4 (6.3)	7 (16.7)	1 (6.3)	50 (20.2) ^b	142 (95.9) ^b	204 (39.5)
Non-Hispanic	50 (79.4)	27 (64.3)	3 (18.8)	181 (73.0)	0 (0.0)	261 (50.5)
Did not disclose	9 (14.3)	8 (19.0)	12 (75.0)	17 (6.9)	6 (4.1)	52 (10.0)
Race						
White	43 (68.3)	33 (78.6)	11 (68.8)	165 (66.5)	111 (75.0) ^c	363 (70.2)
African American	0 (0.0)	0 (0.0)	0 (0.0)	4 (1.6)	0 (0.0)	4 (0.8)
American Indian/Alaska Native	0 (0.0)	0 (0.0)	0 (0.0)	3 (1.2)	0 (0.0)	3 (0.6)
Asian	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Pacific Islander	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Other	1 (1.6)	2 (4.8)	0 (0.0)	41 (16.5)	0 (0.0)	44 (8.5)
Did not disclose	19 (30.2)	7 (16.7)	5 (31.3)	35 (14.1)	37 (25.0)	103 (19.9)
Age range in years						
18-29	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.7)	1 (0.2)
30-39	3 (4.8)	1 (2.4)	0 (0.0)	4 (1.6)	3 (2.0)	11 (2.1)
40-49	3 (4.8)	6 (14.3)	0 (0.0)	20 (8.1)	17 (11.5)	46 (8.9)
50-59	12 (19.0)	6 (14.3)	1 (6.3)	56 (22.6)	44 (29.7)	119 (23.0)
60-64	10 (15.9)	7 (16.7)	2 (12.5)	56 (22.6)	23 (15.5)	98 (19.0)
65-74	20 (31.7)	16 (38.1)	7 (43.8)	73 (29.4)	43 (29.1)	159 (30.8)
≥75	15 (23.8)	6 (14.3)	6 (37.5) ^d	39 (15.7)	17 (11.5)	83 (16.1)
Median age group	65-74	65-74	65-74	65-74	65-74	65-74

Notes: Sites I1, I2, and I3 = independent community pharmacies; sites C1 and C2 = community health center pharmacies. Percentages may not equal 100% due to rounding.
^aC2 had a different gender distribution than C1 and I2 ($P=0.003$).

^bI1 had a different ethnicity composition than C1. C2 had a difference in ethnicity than the other sites ($P<0.05$).

^cC1 had a different race distribution than C2 and I1 ($P=0.003$).

^dI3 had an older patient sample than C1 ($P=0.003$).

The presence of an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker was not assessed during the pilot phase because of changes in hypertension and diabetes guidelines during the setup of clinical algorithms for the program year. A gap in care was measured by a lack of prescription for the previously mentioned drug classes when clinically indicated by nationally accepted guidelines. While the study eligibility criteria only specified hypertension and/or diabetes, patient comorbid conditions were also reviewed for appropriateness of therapy and safety, thus representing comprehensive care provision.

Each patient's medication regimen was reviewed during the initial CMR and quarterly thereafter to ensure that therapy paralleled current chronic disease management guidelines; the MTM pharmacist recommended a medication change to address any inconsistencies. A successful medication therapy intervention was defined as a patient's prescriber making a medication change per the pharmacist's recommendation.

Given that the prevalence of diabetes and hypertension increases with age, the investigators expected the population to include a large percentage of older adults. For this reason, medication regimen safety was assessed according to the Beers Criteria, which outlines inappropriate medications for use in patients aged 65 years and older.³⁰

Identified medication-related problems were recorded during the MTM pharmacist's initial and follow-up calls to patients. Adherence to medication therapy was assessed via patient self-report at baseline and again at follow-up. Specifically, patients were asked about the frequency of missed doses. Nonadherence was defined as missing a dose more than 20% of the time in a given month.

Primary and Secondary Prevention and Health Promotion Activities

Prevention and health promotion activities were assessed and included patient education (e.g., how to identify and appropriately manage hypoglycemic events); missing and/or having

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TABLE 2 Gaps in Care Based on National Consensus Guidelines by Site

When appropriate...	Site I1 n (%)	Site I2 n (%)	Site I3 n (%)	Site C1 n (%)	Site C2 n (%)	Total n (%)
Statin						
Present	30 (81.0)	12 (80.0)	9 (81.8)	162 (78.6) ^a	57 (71.2)	270 (77.4)
Not present—contacted prescriber	7 (19.0)	3 (20.0)	2 (18.2)	44 (21.4)	23 (28.8)	79 (22.6)
Present after recommendation	3 (42.9)	0 (0.0)	0 (0.0)	10 (22.8) ^b	8 (34.8)	21 (26.6)
Beta blocker						
Present	11 (73.3)	2 (100.0)	4 (100.0)	45 (83.3)	5 (71.4)	67 (81.7)
Not present—contacted prescriber	4 (26.7)	0 (0.0)	0 (0.0)	9 (16.7)	2 (28.6)	15 (18.3)
Present after recommendation	3 (75.0)	—	—	4 (44.4)	2 (100.0)	9 (60.0)
Rescue inhaler						
Present	20 (100.0)	3 (75.0)	3 (75.0)	69 (93.2)	6 (85.7) ^c	101 (92.6)
Not present—contacted prescriber	—	1 (25.0)	1 (25.0)	5 (6.8)	1 (14.3)	8 (7.3)
Present after recommendation	—	1 (100.0)	0 (0.0)	1 (20.0)	1 (100.0)	3 (37.5)
Inhaled corticosteroid						
Present	13 (86.7)	4 (100.0)	2 (100.0)	35 (72.9)	3 (75.0)	57 (78.1)
Not present	2 (13.3)	—	—	13 (27.1)	1 (25.0)	16 (21.9)
Present after recommendation	1 (50.0)	—	—	0 (0.0)	0 (0.0)	1 (6.3)

Notes: Sites I1, I2, and I3 = independent community pharmacies; sites C1 and C2 = community health center pharmacies. Percentages may not equal 100% due to rounding.

^aStatin pre-intervention showed a higher proportion of compliance with current guidelines for C1 versus C2 ($P=0.001$).

^bC1 had a positive increase in statin use from pre-intervention to first follow-up ($P=0.002$).

^cC2 ($P=0.002$) had a higher proportion of patients with a rescue inhaler prescribed before intervention than C1.

recommended preventive screenings (e.g., daily foot exams and finger-stick fasting blood sugar for diabetic patients); medication utilization concerns (e.g., not taking medication as prescribed); clinically appropriate vaccination status; and community health care resource referrals (e.g., diabetes education, dietary consultation, and use of community health workers/promotora). Prescribers and/or pharmacists were notified regarding recommended therapy changes or vaccines, when appropriate.

Data Analysis

Chi-square tests (Yates correction used for cell frequency less than 5) were used to compare unpaired nominal data, while McNemar's test was used for paired nominal data, as appropriate. Paired t-tests and Tukey's honestly significant difference tests were used as appropriate to evaluate changes in paired interval-level data. An alpha of 0.05 was selected a priori, and Bonferroni corrections were used in the cases of multiple tests to decrease the possibility of a type I error. Participants who were lost to follow-up were excluded from the analysis. All analyses were performed using SPSS version 24 (IBM, Armonk, NY).

Results

Patient Acceptance of MTM Services and Demographics

The community partner sites enrolled and referred 552 eligible patients to the MTM provider for services. Of these, 517 patients participated by receiving an initial CMR (93.6% acceptance rate).

Roughly two thirds of program participants ($n=517$) were female (64.8%) and had a median age range of 65-74 years. Most participants identified themselves as white (70.2%), while 19.9% did not disclose their race. Overall, half (50.5%) of the participants self-identified as non-Hispanic, followed by Hispanic (39.5%) and some who did not disclose their ethnicity (10%). Patient-reported ethnicity (i.e., Hispanic) differed significantly across 3 of the sites: (C1: 20.2%, I1: 6.3%, and C2: 95.9%; $P<0.05$; Table 1).

Medical Conditions

Participants ($n=517$) had an average of 2.3 chronic conditions; the 2 most common conditions were type 2 diabetes (74.3%) and hypertension (93.8%). Overall, about half of the participants met the high-risk criteria; however, 1 site (Site C2) had fewer high-risk patients (23.8%, $P<0.05$).

Laboratory Results and Self-Monitoring

Overall, positive trends were observed for laboratory results and self-monitoring. Statistically significant results were observed from preprogram to follow-up for sites C1 and C2 for decreases in the following: FBG from 131 to 125 ($P=0.044$); PPG from 174 to 160 ($P=0.024$); and DBP from 77 to 73 ($P<0.001$). Patients at Site C2 also showed a decrease in FBG from 136 to 116 ($P=0.002$) and SBP from 155 to 147 ($P=0.001$).

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TABLE 3 Medication-Related Problems Identified by Site

	Site I1 n (%)	Site I2 n (%)	Site I3 n (%)	Site C1 n (%)	Site C2 n (%)	Total n (%)
Therapy duplications						
Identified	3 (4.8)	4 (9.5)	2 (12.5)	16 (6.5)	5 (2.7)	30 (5.8)
Resolved	3 (100.0)	3 (75.0)	2 (100.0)	12 (75.0)	3 (60.0)	23 (76.6)
New duplications at follow-up	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.8)	0 (0.0)	2 (0.4)
Drug-disease interactions						
Identified	1 (1.6)	1 (2.4)	0 (0.0)	11 (4.4)	2 (1.4)	15 (2.9)
Referred	0 (0.0)	0 (0.0)	0 (0.0)	5 (31.3)	1 (50.0)	6 (40.0)
Resolved	0 (0.0)	0 (0.0)	0 (0.0)	4 (80.0)	0 (0.0)	4 (66.7)
New interaction at follow-up	0 (0.0)	1 (2.4)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)
Drug-drug interactions						
Identified	5 (7.9)	2 (4.8)	0 (0.0)	29 (11.7) ^a	6 (4.1)	42 (8.1)
Referred	3 (60.0)	0 (0.0)	0 (0.0)	10 (34.5)	2 (33.3)	15 (35.7)
Resolved	1 (33.3)	0 (0.0)	0 (0.0)	4 (40.0)	2 (100.0)	7 (46.6)
Safety concerns						
Identified	7 (11.1)	5 (11.9)	0 (0.0)	35 (14.1)	8 (5.4)	55 (10.6)
Referred	4 (57.1)	3 (60.0)	0 (0.0)	29 (82.9)	7 (87.5)	43 (78.2)
Resolved	4 (100.0)	0 (0.0)	0 (0.0)	4 (13.8)	1 (14.3)	9 (20.9)
Dose-related concerns identified						
Too high	3 (42.9)	2 (40.0)	0 (0.0)	13 (44.8)	4 (50.0) ^b	22 (40.0)
Too low	2 (28.6)	3 (60.0)	0 (0.0)	22 (62.9)	4 (50.0)	31 (56.4)
Other	2 (28.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.6)
Adverse drug reactions identified	14 (22.2)	7 (16.7)	3 (18.8)	46 (18.5)	18 (12.2)	88 (17.0)
Medication interventions						237
Interventions per patient						0.46

Notes: Sites I1, I2, and I3= independent community pharmacies; sites C1 and C2= community health center pharmacies. Percentages may not equal 100% due to rounding.

^aC1 had a higher proportion of drug-drug interactions identified than C2 (P=0.016).

^bC1 had a higher number of dose-related concerns than C2 (P=0.011).

Gaps in Care Based on National Consensus Guidelines

Overall, average adherence to national guidelines before intervention was 75% or higher. As a group, the highest observed compliance rate was for rescue inhaler use, with 92.6% of participants with asthma having an active prescription. In addition, 81.7% of patients requiring a beta blocker were appropriately prescribed the medication. The largest gap in care was for patients with respiratory conditions (e.g., asthma), indicated for an inhaled corticosteroid; only 78.1% of patients had an active prescription.

Dependent on the site of care, 7.0%-22.6% of participants needed an intervention to address gaps in care. Prescriber acceptance of MTM pharmacist recommendations to initiate therapy for identified gaps in care was as follows: a beta blocker (60%), a rescue inhaler (38%), an inhaled corticosteroid (6%), and a statin (27%). There was some site-to-site variation surrounding gaps in care. At baseline, 2 sites (I2 and I3) had 100% compliance with beta blocker therapy, while others (I1, C2, and C3) had lower compliance, with 17%-29% of patients requiring an intervention. At each site, about one fifth of patients required an MTM pharmacist intervention for statin

therapy; however, the acceptance rates by prescriber varied widely across sites (0%-43%; Table 2).

Beers List

Approximately 46.8% (n=242) of participants were aged 65 years or older. Of these, 22.7% (n=55) had active prescriptions for high-risk medications per the Beers criteria. A total of 67 high-risk medications were identified, and 50 recommendations were made for alternative therapies to address these issues. The 2 most common high-risk medications identified were first-generation antihistamines (n=15 users) and benzodiazepines (n=13 users).

Medication-Related Problems

There were 237 medication-related interventions, averaging 0.46 interventions per patient. No statistical differences between sites were observed for therapy duplications or drug-disease interactions identified. In contrast, Site C1 had a significantly larger proportion of patients with drug-drug interactions compared with Site C2 (11.7% vs. 4.1%, P=0.016; Table 3).

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TABLE 4 Health Promotion Compliance by Site

	Site I1 n (%)	Site I2 n (%)	Site I3 n (%)	Site C1 n (%)	Site C2 n (%)	Total n (%)
Hypoglycemic event education provided						
Yes	8 (13.7)	1 (2.4)	1 (6.7)	65 (26.8)	30 (21.7)	105 (21.3)
No—not needed	29 (50.0)	11 (26.8)	7 (46.7)	162 (66.9)	56 (40.6)	265 (53.6)
NA—patient does not have DM	21 (36.2)	29 (70.7)	7 (46.7)	15 (6.2)	52 (37.7)	124 (25.1)
Missing preventative screenings^a	15 (23.8)	9 (21.4)	2 (12.5)	150 (60.5)	49 (33.1)	225 (43.5)
Administration errors identified/corrected	1 (1.6)	0 (0.0)	1 (6.3)	1 (0.4)	0 (0.0)	3 (0.6)
Referral to a...						
Community health center	2 (3.2)	0 (0.0)	3 (18.8)	26 (10.5)	11 (7.4)	42 (8.1)
Promotora	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	7 (4.7)	7 (1.4)
Prescriber (high-risk medications)	8 (12.7)	2 (4.8)	1 (6.3)	31 (20.7)	8 (16.3)	50 (9.7)
Vaccine recommendations						
Pneumococcal	26 (45.6)	17 (42.5)	7 (50.0)	122 (49.6)	75 (52.1)	247 (49.3)
Herpes zoster	21 (33.3)	17 (42.5)	8 (61.5)	112 (39.0)	73 (50.3)	231 (45.5)
Influenza	16 (26.2)	18 (42.9)	6 (42.9)	51 (20.6)	55 (38.2)	146 (28.7)
Medication adherence						
Pre-dose missed >6 times in 30 days						
Yes	3 (9.1)	0 (0.0)	0 (0.0)	25 (11.2)	18 (13.8)	46 (11.6)
No	30 (90.9)	21 (100.0)	11 (100.0)	197 (88.8)	112 (86.2)	371 (88.7)
Post-dose missed >6 times in 30 days						
Yes	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (6.1)	3 (2.1)
No	10 (100.0)	2 (100.0)	2 (100.0)	79 (100.0)	46 (93.9)	139 (97.9)
Interventions^b						1,102
Interventions per patient						2.1

Notes: Sites I1, I2, and I3 = independent community pharmacies; sites C1 and C2 = community health center pharmacies. Percentages may not equal 100% due to rounding.

^aThere were more patients at C1 with missing preventative screenings than at I1 ($P < 0.001$), I2 ($P < 0.001$), I3 ($P = 0.001$), and C2 ($P < 0.0001$).

^bSum of the following numbers: patients provided education on management of hypoglycemia (105); preventative screenings recommended (225); administration errors corrected (3); referrals to community health programs (42) or promotoras (7); medications on Beers List referred to prescriber (50); vaccine recommendations made (pneumonia: 247, shingles: 231, flu: 146); and adherence consults conducted with those who missed a dose more than 6 times per 30 days (46).

DM = diabetes mellitus; NA = not applicable.

Health Promotion

There were 1,102 health promotion interventions completed, or approximately 2 interventions per patient. Overall, 43.5% ($n = 225$) of participants were missing necessary preventative screenings (e.g., daily foot exams and eye exams), and some were lacking current vaccinations (pneumococcal 49.3%, herpes zoster 45.7%, and influenza 28.7%). Regarding community resources, about 8% of patients were referred to community health center programs (e.g., diabetes and healthy lifestyle education). Furthermore, 11.4% of patients used *promotoras* at the site (C2) with the integrated program. On average, 88.7% of patients were adherent to their medication regimens, and while not statistically significant, there was a decrease in nonadherent patients at site C2 (13.8%–6.1%; Table 4).

Discussion

Patient acceptance of MTM services was very high (93.6%), especially when compared with previously published approaches.⁸ Recruitment and enrollment of program participants were conducted by the community partner sites, and as a result, patients may have responded more favorably to the invitation

to participate. Patients were recruited to the program on a rolling basis over a 12-month period to ensure recruitment of an adequate sample of participants to enable thorough statistical outcome analysis.

General differences were observed across the rural communities, potentially attributable to variations in demographics and dispersed locations throughout the state. These variations helped strengthen the results, since they reflect the ability to successfully implement this program across geographically, racially, and ethnically diverse Arizona rural communities.

Moreover, there were significant differences in the patients recruited from each site. These differences are based on variations in geography and demographics of the respective rural communities. For example, site C2 is located in a small community near the U.S.-Mexico border, with a much larger percentage of individuals self-identifying as Hispanic/Latino. Site C2 also used *promotoras* as a key component of its outreach and patient care. Integration of these lay health workers in the CMR and MTM processes may help explain why this site had some of the highest resolution rates of medication-related problems and improvements trending towards significance in patient

medication adherence. Conversely, the independent pharmacy sites (I1, I2, and I3), located in the eastern part of the state, had much smaller populations, which were mainly composed of older adults.

While this MTM program was generally effective in improving all patient clinical laboratory values and blood pressure readings, patients at the 2 community health center sites (C1 and C2) experienced statistically significant improvement at follow-up. In addition, the program identified and addressed 240 medication-related problems, resulting in approximately 0.46 medication-related interventions per patient. Medication-related problems were addressed via patient counseling and education, faxing the provider, contacting the pharmacy, or any other relevant intervention. Furthermore, the collaborative health care team approach resulted in identification of missing recommended preventative screenings (e.g., foot exams) and an absence of recommended vaccinations (e.g., flu and pneumonia) for almost half of the participants. Many patients were receiving care at partnering community health centers operating under the medical home model, yet a number of patients had missed recommended preventive health services.

Prescriber acceptance of pharmacist-recommended therapy varied widely for statins (27%) and beta blockers (60%). However, these rates parallel previously published prescriber acceptance rates (20%-60%) for MTM pharmacist recommendations.^{13,14}

These program evaluation results are encouraging, since patients who received telephonic medication reviews experienced, on average, an improvement in biomarkers (e.g., FBG, PPG, and SBP/DBP), with statistically significant improvements observed at some sites. Also, the MTM pharmacists brought many recommendations regarding safety concerns and gaps in care based on national consensus guidelines to the attention of prescribers, which potentially prevented serious complications and adverse drug events.

The success of this pilot program hinged on the collaborative efforts of multiple partners (i.e., site staff members, community health workers [C2], prescribers, and centralized and community pharmacists) in fostering patient trust and acting on recommendations and concerns raised during the CMRs. This hybrid program between academia and the community demonstrated positive health outcome results, while simultaneously promoting an interprofessional and patient-centered care model. This model served as an effective method to empower and engage patients in managing their chronic conditions, as well as to increase professional trust and, thus, acceptance rates of pharmacist-recommended therapies.

Limitations

This program evaluation project has several limitations. Differences in population demographics and the number of participants recruited from each site presented challenges to collecting a sufficiently large enough sample to effectively

compare data across sites. In addition, high participation rates may have been a result of respondent bias, since community sites carried out much of the patient recruitment. Furthermore, participating patients may have exhibited self-selection bias, with the potential to positively skew the results. For example, more highly motivated patients (e.g., desiring to improve their clinical and laboratory values) may have volunteered to participate. This might account for the improvement in clinical laboratory results. However, self-selection would not have unduly influenced the positive safety and preventative health results observed, since these outcomes were independent from patient motivation and relied on interventions from the prescribers.

The diversity across sites also presented challenges with regard to recruitment and retention of patients in the program's first year to ensure thorough statistical outcome analyses. The 12-month recruitment period to achieve an adequate sample of patients may have contributed to the higher observed attrition rates. A total of 131 cases (25%) were lost to follow-up and excluded from the pilot results.

Conclusions

MTM has demonstrably improved therapeutic, safety, economic, and humanistic health outcomes,^{4,7} yet barriers remain that affect optimal participation. The novel pilot program described here addressed some of the existing barriers by implementing an interprofessional, collaborative partnership between an academic institution and community-based pharmacies (independent retail pharmacies and community health center pharmacies) serving rural residents. Research has consistently demonstrated that individuals in rural settings suffer worse health outcomes than their urban dwelling peers.^{19,20} A multitude of factors contribute to this problem, including smaller and less comprehensive health care facilities and shortages of primary and specialist care providers. Moreover, rural populations tend to have older residents, are more socioeconomically disadvantaged, and are becoming more racially and ethnically diverse.³¹ Policies and programs aimed at addressing the disparities between rural and urban dwellers have encouraged partnerships between academic health centers and rural communities.

This pilot program exemplified the benefits of such collaborative efforts, not only with the improvement of patient health indicators, but also in above average patient participation rates in MTM services. However, future research is warranted to study clinical outcomes, as well as prescriber and patient acceptance rates, that result from this type of collaborative MTM intervention model compared with usual care. Larger scale studies, using an integrated approach to MTM services for rural patients, have the potential to positively affect and improve current public health models as a result of reducing medication-related problems and increasing use of preventive services, which ultimately improves patient safety and

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outcomes and reduces health care costs. This combined approach of integrating a large-scale, interprofessional telephonic- and community-based pharmacist approach in provision of MTM services for underserved populations in rural Arizona may conceivably represent a novel opportunity to vastly improve patient and prescriber participation in the delivery of this vital health care service.

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