



Short communication

Impact evaluation of a four-year academic-community partnership in provision of medication management and tertiary prevention services for rural patients with diabetes and/or hypertension

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ABSTRACT

Medication therapy management (MTM) services, including targeted, pharmacist-delivered, tertiary prevention interventions, were provided to rural patients with chronic diseases via an academic-community partnership. The purpose of this investigation was to evaluate the overall program and pre/post patient outcomes from this four-year, multi-site collaboration. Five community health sites collaborated with a university-based MTM provider to deliver services in Arizona (2012–16). Eligible patients: were 18 or older (median 65 years); had a diagnosis of diabetes and/or hypertension; and resided in a rural community. Participants received an initial telephone consultation with the MTM pharmacist; follow-up consultations were conducted after 30 or 90 days for high- and low-risk patients, respectively. Community partner staff collected clinical data and addressed pharmacists' recommendations. Descriptive analysis and bivariate analyses of pre- and post-intervention results were conducted. Most ($n = 410$, 70%) of the 577 participants receiving an initial and follow-up consultation with the MTM pharmacist had both diabetes and hypertension. These individuals showed statistically significant improvements in fasting blood glucose ($p < 0.0001$), hemoglobin A1C ($p = 0.0082$) and systolic blood pressure ($p = 0.009$) while those with only one condition did not demonstrate significant changes. While the pre/post changes in chronic disease control indicators were statistically significant, the clinical significance was low to moderate. Patients with both comorbid diabetes and hypertension experienced benefit from collaborative, targeted MTM pharmacist-delivered, tertiary prevention interventions in tandem with community-based pharmacy resources. This multi-site MTM program showed promise in increasing patients' use of these services, yet effective strategies are needed to expand recruitment of eligible patients in the future.

1. Introduction

Chronic disease management and control is often ineffective at both state and local levels due to limited targeted services to monitor disease maintenance following diagnosis. This is particularly apparent for rural residents and seniors, who are at increased risk for chronic conditions yet often have limited healthcare resources (Health and Disparities: Rural Health Information Hub (RHIfhub), 2017). Multiple chronic condition management often results in polypharmacy leading to challenges with proper administration and subsequent patient adherence-related issues (Johansson et al., 2016).

In 2015, 30.3 million (9.4%) of US adults had diabetes, although many cases remain undiagnosed (National diabetes statistics report,

2017). By age 78, nearly 90% of US individuals will have hypertension (Keenan and Rosendorf, 2011). Diabetes is a risk factor for hypertension, with 60% of US adults experiencing prehypertension or hypertension (Wang and Wang, 2004). Comorbid diabetes and hypertension are common and roughly 70% of patients with diabetes are also prehypertensive or hypertensive. Rural-dwelling individuals typically have higher rates of diabetes (Health and Disparities: Rural Health Information Hub (RHIfhub), 2017) and hypertension than their urban counterparts (O'Connor and Wellenius, 2012). Lifestyle changes are indicated for medical management of both chronic conditions yet, pharmaceutical intervention often is still required (Whelton et al., 2018).

Medication therapy management (MTM) services offer a viable

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solution to help improve health outcomes including reduced medication dosing, hospital readmission rates, and overall healthcare costs, based on ensuring appropriate medication utilization (Viswanathan et al., 2015). Adoption of MTM is low, with roughly 11% of eligible Medicare beneficiaries utilizing the services (Pearson, 2014). Despite this, previous research indicates the benefits of receiving MTM services from academic-based centers (Isetts et al., 2008).

To address this gap in rural healthcare services, a novel, collaborative approach was developed between an academic-based MTM program and community-based providers (e.g., physicians, community pharmacists). The program goal was to improve health outcomes for rural-dwelling individuals with diabetes and/or hypertension. The objective was to evaluate outcomes in a sample of adults with diabetes and/or hypertension receiving MTM services from a collaborative, interprofessional, academic and community-based team.

2. Methods

2.1. Evaluation design

This pre-post evaluation assessed health outcomes for rural-dwelling patients, recruited from community sites, who completed an initial and at least one follow-up appointment with the academic-based MTM pharmacist. The intervention was a structured MTM session delivered at least twice to eligible adults, approximately 90 days apart for low-risk individuals or 30 days apart to high-risk individuals. The outcome measures were ecological-level changes in A1C, systolic blood pressure (SBP), and fasting blood glucose (FBG) between the initial and follow-up sessions. Data collection occurred over the four-year project at five collaborating sites; site participation varied from one to four years. Sites were selected given their prior research relationships with the academic site and included: three retail pharmacies, one pharmacy embedded within a Federally Qualified Health Center (FQHC), and one Rural Health Clinic pharmacy. This project evaluation was approved by the University of Arizona Institutional Review Board.

2.2. Recruitment

Eligible participants were: (a) receiving care at community partner site; (b) aged 18 years or older; (c) diagnosed with diabetes mellitus, hypertension, or both; and (d) residing in underserved rural Arizona counties. Arizonans in rural counties are more likely to be of Hispanic ethnicity (range: 20–85%) and live below the federal poverty level (range: 11–36%) compared to other rural areas in the US. Patient recruitment by partnering sites is described elsewhere (Johnson et al., 2018). Participants were excluded from this data analysis if they failed to complete the second of the two MTM consultations given that they did not have comparison data.

2.3. Medication therapy management

The academic-based MTM pharmacist provided comprehensive telephonic services that met the core elements outlined by the American Pharmacists Association's 2008 MTM Model (Burns, 2008) to each participant. Services included: patient consultation, comprehensive medication review, provision of medication-related recommendations such as redundant prescriptions to primary care provider at partnering site (i.e., community pharmacist or prescriber), and an individualized patient summary letter after every consultation.

The community partner sites provided staff (e.g., medical assistants, pharmacists, or prescribers) to interact with participants. They assisted the academic MTM pharmacist by: collecting clinical values (e.g., A1C); reviewing and discussing the pharmacist's recommendations; performing medication reconciliation in conjunction with the pharmacist; and ensuring patient understanding.

2.4. Data collection

Multiple sources (e.g., chart review, pharmacist consultations) were used to capture data for the patient consultation. Data included: demographics, primary/secondary morbidities, relevant clinical/laboratory data to diagnoses and disease control. Individuals who enrolled in the program but did not complete any appointments were not recorded. Care gaps were recorded for individuals who qualified but lacked a within-drug class prescription per clinical guidelines (Amsterdam et al., 2014; American Diabetes Association, 2014; O'Gara et al., 2013; Stone et al., 2013; Yancy et al., 2013). Data collection methods are described elsewhere (Johnson et al., 2018).

2.5. Data analysis

Descriptive analysis included patients who had a primary chronic condition (e.g., diabetes, hypertension) however, only those who had both baseline and follow-up clinical values for at least one of the three biomarkers (i.e., A1C, FBG, and SBP) associated with one or both conditions ($n = 577$) were included. Participants with only one MTM pharmacist consultation (i.e., the initial but no follow ups) were deemed lost-to-follow-up; a side-by-side descriptive comparison was performed between those who received a follow-up consultation versus those who did not. Chi-square tests compared differences between grouped participants with diabetes, hypertension, or both conditions. ANOVA tests evaluated interval level data changes, with post-hoc pairwise comparisons (Bonferroni corrections) applied as appropriate. A *t*-test was used to estimate pre/post differences in A1C, FBG, and SBP values at the ecological level stratified by chronic condition group. A priori alpha level was set at 0.05; all analyses were two-sided. Assessment of recommendations made to participants related to their medication use and adherence (i.e., presence of appropriate prescriptions for chronic conditions) was performed qualitatively. All analyses were performed in Stata 14 (StataCorp, College Station, TX).

3. Results

3.1. Subject selection

Over the four-year study period, 1015 patients were enrolled in the study and completed at least one MTM consultation session. However, 308 individuals did not complete a second MTM consultation, and thus, were excluded from data analysis. An additional 130 participants were excluded from the analysis as they had insufficient data from the second MTM consultation for inclusion in the pre/post ecological assessment. The final sample cohort for the analytical study included 577 subjects.

3.2. Subject demographics

Of the 577 participants with complete pre/post data, 69.5% had diabetes and hypertension, 22.2% had only hypertension, and 8.3% had only diabetes. Two-thirds were female (65.3%), two-fifths were Hispanic (43.3%) and most identified themselves as white (67.2%). Most were older (> 60 years; median age 65; range 32–89 years), yet significant differences existed between age groups for those with a single condition. Over half (58.8%) were high risk with significantly more of these having diabetes than hypertension (62.5% vs 35.9%, $p < 0.001$). Two sites enlisted community health workers (CHWs); most participants at these two sites ($n = 130$, 73%) had a CHW at their initial consultation (Table 1).

3.3. Comorbid conditions

Subjects had comorbid medical conditions including: atherosclerotic cardiovascular disease (21.1%), asthma (13.9%), chronic obstructive pulmonary disease (9.4%), heart failure (7.3%), and atrial

Table 1

Demographic characteristics of participants with chronic disease(s) in a multi-site medication therapy management (MTM) targeted intervention in Arizona (2012–16).

| | Diabetes only (n = 48) n (%) | Hypertension only (n = 128) n (%) | Both* (n = 401) n (%) | p |
|-------------------|------------------------------|-----------------------------------|-----------------------|----------------------|
| Gender | | | | |
| Male | 15 (7.5) | 39 (19.5) | 146 (73.0) | |
| Female | 33 (8.8) | 89 (23.6) | 255 (67.6) | 0.41 |
| Age | | | | |
| 18–49 | 17 (35.4) | 12 (9.4) | 31 (7.7) | |
| 50–59 | 10 (20.8) | 23 (18.0) | 89 (22.2) | |
| 60–64 | 6 (12.5) | 19 (14.8) | 84 (21.0) | |
| 65–74 | 12 (25.0) | 46 (35.9) | 136 (33.9) | |
| ≥75 | 3 (6.3) | 28 (21.9) | 61 (15.2) | < 0.001 ^a |
| Ethnicity | | | | |
| Hispanic | 21 (8.7) | 61 (25.3) | 159 (66.0) | |
| Non-Hispanic | 15 (6.8) | 42 (19.0) | 164 (74.2) | |
| Unreported | 12 (10.4) | 25 (21.7) | 78 (19.5) | 0.337 |
| Race | | | | |
| White | 30 (7.7) | 93 (24.0) | 265 (68.3) | |
| Other | 16 (10.7) | 32 (21.3) | 102 (68.0) | 0.099 |
| High-risk patient | 30 (62.5) | 46 (35.9) | 263 (65.6) | < 0.001 |
| CHW** present | 11 (22.9) | 36 (28.1) | 83 (20.8) | 0.226 |

The p value refers to differences between the diabetes group and the hypertension group.

*Participants who had both diabetes and hypertension

**CHW = Community Health Worker

^a Post-hoc tests for pairwise comparisons (Bonferroni correction) found significant differences ($p < 0.01$) between disease states for the youngest age group (18–49) and each of the remaining older age groups; no statistically significant differences were observed between other age groups

fibrillation (6.4%).

3.4. Clinical values

Between initial and follow-up consultations, those with a single condition showed no significant changes in mean values for A1c, FBG, or SBP while those with both diabetes and hypertension showed significant decreases in FBG ($p < 0.0001$), A1c ($p = 0.0082$) and SBP ($p = 0.009$) (Table 2). There were no notable differences between sites with regard to MTM effect (i.e., rates of pre/post change did not vary between sites).

3.5. Care gaps

Per clinical practice guidelines, recommendations were made

Table 2

Clinical laboratory values for participants with chronic disease(s) in a multi-site medication therapy management (MTM) targeted intervention in Arizona (2012–16).

| | Complete data N (%) | Missing or incomplete data N (%)* | Mean Value at initial consultation (SD) | Mean Change at follow up consultation (SD) | p |
|----------------------------------|---------------------|-----------------------------------|---|--|----------|
| Diabetes (n = 48) | | | | | |
| A1C (%) | 19 (39.5) | 29 (60.5) | 8.1 (1.9) | +0.2 (0.9) | 0.4572 |
| FBG (mmol/L) | 26 (54.2) | 22 (45.8) | 148.7 (56.5) | −20.1 (59.2) | 0.0957 |
| SBP (mmHg) | 11 (23.0) | 37 (77.0) | 133.4 (18.1) | −9.9 (18.4) | 0.1040 |
| Hypertension (n = 128) | | | | | |
| A1C (%) | 4 (3.0) | 124 (97) | 5.7 (0.6) | +0.1 (1.0) | 0.8218 |
| FBG (mmol/L) | 6 (4.7) | 122 (95.3) | 108.7 (13.7) | 8.7 (20.6) | 0.3510 |
| SBP (mmHg) | 71 (55.5) | 57 (44.5) | 132.0 (15.4) | −3.6 (17.7) | 0.0909 |
| Both conditions (n = 401) | | | | | |
| A1C (%) | 153 (38.2) | 248 (61.8) | 7.9 (1.7) | −0.22 (1.1) | 0.0082 |
| FBG (mmol/L) | 254 (63.3) | 147 (36.7) | 134.0 (42.3) | −10.6 (39.4) | < 0.0001 |
| SBP (mmHg) | 196 (48.9) | 205 (51.1) | 132.6 (18.0) | −0.37 (19.4) | 0.0090 |

A1C = hemoglobin A1C (n = 176 with complete data); FBG = fasting blood glucose (n = 286 with complete data); SBP = systolic blood pressure (n = 278 with complete data); *Mean change estimates exclude these individuals for any given biomarker

related to existing prescriptions for statins (n = 388), beta-blockers (n = 72), rescue inhalers (n = 106), and inhaled corticosteroids (n = 73) (Stone et al., 2013; Yancy et al., 2013; Global Initiative for Asthma, 2017; Initiative, 2017). At initial consultation, a prescription was absent for: 21.6% of individuals needing a statin; 19.4% (n = 14) needing a beta-blocker, 21.9% (n = 16) needing an inhaled corticosteroid, and 8.5% (n = 9) needing a rescue inhaler.

3.6. Missing data and loss to follow up

Of 1,015 enrollees who had at least one MTM session, only 707 (69.7%) completed a follow-up MTM session. There were no statistically significant differences between those who completed two or more MTM sessions versus those lost to follow-up based on demographic data (Table A1). The range of loss to follow-up (LTFU) varied widely by site (range: 18.4%–55.9%). Missing data for biomarkers of interest were high. For example, only 577 of 707 participants completing follow-up consultations with clinical values were included in analyses (Table 2). Additionally, rates of missingness of A1C values varied by site where 0%–56% of patients with both diabetes and hypertension were lacking one or both A1C values.

4. Discussion

The results of this four-year, academic-community partnership MTM project parallel the one-year findings described elsewhere (Johnson et al., 2018). This evaluation showed demonstrable improvements in clinical values for those with both conditions, and aligns with Pinto et al.'s work showing that pharmacist-provided MTM services decrease HbA1c and systolic blood pressure (Pinto et al., 2014). Patients with multiple chronic conditions may benefit from similar programs that promote disease stabilization, possibly related to poly-pharmacy in this group providing pharmacodynamics agonistic effects that were partially addressed by this intervention. Concentrated efforts to improve uptake of MTM services may have a greater effect on clinical indicators and overall adherence by focusing on those with multiple conditions or poor overall disease management.

In this evaluation, patients diagnosed with a single condition showed no statistically significant improvements in disease-status indicators. Although somewhat surprising, this is likely related to the high rates of missing data observed across multiple participating sites. Of note, the site with the highest rate of LTFU (55.9%) had the second-highest rate of missing laboratory values; 36.0% of these patients with both conditions were missing one or both A1C values. This site also had the largest number of enrollees, thus, it is likely that there were a larger number of involved staff members responsible for data collection and entry which may have resulted in higher rates of data entry errors.

Alternatively, this site had a considerable population of seasonal farmworkers so the inconsistencies may be related to enrollees moving away from the clinic catchment area to work in other states or return to their countries of origin. Regardless, ongoing staff training or revising the quality control plan is warranted across all participating sites to help address the high missingness rates.

Approximately one-third of patients did not complete a second appointment with an MTM pharmacist, though reasons for non-completion are unknown. However, similar challenges with retention occurred in the one-year evaluation (Johnson et al., 2018), suggesting the need to develop effective strategies to retain participants. Additional strategies are needed to encourage follow-up beyond telephone calls (e.g., email/text reminders) to encourage retention.

Community pharmacists providing interventions to rural residents can directly impact patient care and medication services (Pinto et al., 2014). Hirsch et al. (Hirsch et al., 2014) found that integrated clinic MTM teams (i.e., pharmacists, primary care providers) were more effective in lowering blood pressure at six-month and nine-month intervals (Hirsch et al., 2014), however the current evaluation using hybridized telephonic/clinical tertiary services may be better suited for reaching rural patients.

This innovative collaboration between academic resources and community healthcare professionals in serving diverse populations offers considerable opportunities to bridge the healthcare delivery gap while simultaneously improving health outcomes. While designated sites were used throughout this project, future work is needed to include more sites to evaluate this interprofessional collaboration in diverse settings and communities.

Integration of CHWs at select rural sites may have positively affected MTM program participation and participants' interactions during the pharmacist consultations. Given that only 22.5% of participants had access to CHWs, it was impossible to detect significance differences in care or outcomes. Furthermore, there were no notable pre/post change differences between sites with CHW assistance versus without. Thus, future studies should strategize to promote the benefits (e.g., community liaison, patient advocate, bilingual/multilingual) of incorporating CHWs in to MTM delivery.

Limitations included that more highly-motivated individuals may have participated who already had well controlled biomarkers, contributing to self-selection bias and offering a potential explanation for lack of significant differences between pre and post intervention clinical values. Second, small sample sizes and missing data in the single-disease groups may have prevented detecting significant differences.

5. Conclusion

This evaluation highlights the benefits of an academic-community collaboration in MTM delivery to rural, underserved patients with both diabetes and hypertension. Future evaluation warrants reaching more patients, ultimately to reduce healthcare delivery gaps in tertiary prevention and improve health outcomes.

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Author contribution statement

TM, TW, and AT conceptualized and facilitated implementation of the research. MJ, SF, and VT oversaw data collection. EJA performed the analyses. EJA, DRT, and AT wrote the manuscript. All authors

reviewed and approved the final version.

Declaration of competing interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2019.101038>.

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