Study to Measure the Impact of Pharmacists and Pharmacy Services (STOMPP) on Medication Non-Adherence: Medication Adherence and Clinical Outcomes

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Abstract

***Objective**: To compare the impact of various pharmacy-based services on medication adherence and clinical outcomes.*

***Design**: Prospective, randomized control trial*

***Setting**: A local endocrinology group (clinic setting) and community pharmacies belonging to a regional integrated delivery network (IDN) in Toledo, OH*

***Population**: Subjects included within this study had type 2 diabetes, were prescribed a minimum of five medications, at least 18 years of age, having the ability to self-administer medications as prescribed, and be able to speak and understand English. Subjects were required to have Paramount health insurance, must be willing and able to provide informed consent, actively participate in the assigned MTM sessions, and have adequate transportation to attend the sessions at a participating pharmacy.*

***Methods**: Patients were recruited through flyers at practice sites, referrals from physicians and pharmacists, and direct mailers. Members of the research team would screen patients to assess their eligibility to participate in the study. Patients who fit the inclusion criteria were randomized into one of the following four different groups: Pill Bottle (PB), Blister Pack (BP), Pill Bottle + Medication Therapy Management (PB+MTM), and Adherence Pharmacy (BP+MTM). Patients enrolled in the BP groups had their medications synchronized. Patients in the AP group were given the option to have their medications delivered, if needed.*

***Practice innovation**: We partnered with a regional integrated delivery network (IDN) with multiple community pharmacy practice sites and a practice group of endocrinologists. A new practice model called Adherence Pharmacy was conceptualized and implemented within the community setting and was accessible to patients.*

***Main Outcomes Measures**: Medication adherence, measured using proportions of days covered (PDC) and pill count scores at baseline, 3 months, 6 months, 9 months, and 12 months; Hemoglobin A1c (HbA1c), body mass index (BMI), systolic blood pressure (SBP), and diastolic blood pressures (DBP) were collected at baseline, 6 months, and 12 months*

***Results**: A mixed-model ANOVA was used to study the impact of these services on medication adherence, using PDC and pill count scores. Results of the 61 patients in the study revealed that there was a statistically significant difference between the PB and BP groups (p=0.008); between the PB and BP+MTM groups (p=0.023); and between the PB+MTM and the BP+MTM groups (p=0.041). Except at baseline, adherence scores at all time points (0, 3, 6, 9, and 12 months) were significant with the patients in the BP and BP+MTM groups having higher adherence compared to those in the PB and PB+MTM groups. Pill count scores had similar results to the PDC measures. Insert data from HBA1c, BMI, SBP and DBP. Clinical outcomes were also analyzed using the mixed between-within ANOVA and were measured at baseline, 6, and 12 months. Patients in the MTM groups reached the American Diabetes Association goal of 7%, whereas the patients in the PB group did not reach a goal at 12 months. All groups, except for the PB only group, indicated a statistically significant change from baseline to 12 months. When comparing body mass index (BMI) scores across groups over time, patients in the BP+MTM group showed the lowest BMI at 12 months. There were not any significant differences across the groups, but patients in the two MTM groups saw greater improvement in their BMI scores than patients in the other two groups. There were no significant differences between groups in SBP and DBP reduction. However, patients in the two BP groups reached a SBP goal sooner (per the Eighth Joint National Committee) than patients in the PB+MTM and PB groups.*

***Conclusion**: Patients had improved clinical outcomes and adherence rates when using blister packaging and medication therapy management services, individually and in combination. Blister packaging seemed to have a greater impact on medication adherence while MTM services helped improve clinical endpoints. However, patients who received the combination of services offered within the AP demonstrated higher improved clinical outcomes and adherence rates when compared to patients who did not. While each of these services was found to be more impactful that dispensing medications in pill bottles, combining them can provide a greater benefit to patients.*

Keywords: medication non-adherence, community pharmacy, pharmacist, adherence pharmacy, health outcomes, medication adherence, blister packaging, medication therapy management, medication synchronization

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Introduction

Nearly 133 million Americans have at least one chronic health condition and take multiple medications.[1] Approximately three in four adults in the United States (U.S.) are non-adherent to their medications and about 50% of patients who have a chronic health condition do not take their medications as prescribed.[2-5] Specifically, the adherence rates for patients with type 2 diabetes ranges from about 36% to 93%.[6] Medication non-adherence is defined as a patient's failure to follow a prescribed therapeutic regimen.[7] Several studies have shown that medication non-adherence is linked to increased morbidity and mortality rates.[8, 9] Because medication non-adherence is a multi-faceted problem, it requires a multi-faceted solution.

In order to resolve the issue of medication non-adherence, it is important to understand the factors affecting a patient's medication-taking behavior. Some of these barriers to medication adherence include forgetting to take their medications, not picking up new prescriptions or refills, not taking medications because of the side effects, costs, transportation issues, lack of understanding, complex medication regimens, and poor health literacy.[2, 3] On average, adults in the U.S. take four prescription medications daily.[10] Patients who are taking multiple medications are at a higher risk of falling victim to medication non-adherence.[11] There are various strategies that can help improve medication non-adherence, including but not limited to, telephone refill reminders, pill boxes, alarms, education programs, and mobile application aids.[12, 13] While each of these methods can help improve medication-taking behavior and medication adherence, they are often either inaccessible to patients or are seldom brought to the patient's attention. Patients in the U.S. make nearly four medical visits to their physicians annually and most physician visits average about 15 minutes.[14, 15] This does not afford doctors an opportunity to effectively engage with their patients in a discussion about their medication-taking behaviors or to identify barriers that prevent them from becoming non-adherent. On the contrary, a patient visits their pharmacy at least once a month and, very often, multiple times if they are on multiple chronic medications.[16] Pharmacies have the ability to offer a large variety of services that can help address the barriers impacting a patient's medication-taking behavior based on their individual characteristics.

Most community pharmacies dispense medications in pill bottles. However, other forms of dispensing medications have existed for years, although they have predominantly been used in non-community pharmacy settings, such as long-term care. Adherence packaging, or blister packaging (BP), is a tool that provides a visual aid to indicate the day and/or time medications should be administered. Dispensing medications in blister packaging rather than pill bottles has been shown to improve adherence and clinical outcomes.[18-20] This can replace pill boxes that patients or caregivers typically fill after receiving their prescriptions in pill bottles.[17] To reduce multiple trips to the pharmacy, pharmacies are able to synchronize patients' medications to be filled on one day. This program is called medication synchronization, or med sync. Med sync is carried out by pharmacy staff members who work with both the patients and their insurance companies to fill their prescriptions. Because blister packs are filled monthly, patients who receive them will usually have their medications synchronized. However, this service is also made available for patients who receive prescriptions in pill bottles alone. Pharmacies who provide med sync have seen an increase in patient satisfaction rates, refills, and return on investment.[21, 22] Another service that provides convenience to patients is the availability to opt-in for delivery of prescriptions. Patients who lead busy lives or who are unable to leave their homes, due to lack of transportation means or because they are home-bound, are unable to receive their medications on time, if at all. Pharmacies can assist patients in overcoming these barriers by providing patients a delivery service option. This ensures that patients are able to receive their prescriptions on time. One setback to this service, however, is that patients may not be prompted to speak with a pharmacist, even when a consultation note is attached to the bag. For patients who are able to come to the pharmacy, they are able to learn more about their prescriptions. Pharmacists have the advantage of being one of the most accessible healthcare professionals and are able to spend more time educating patients on their medications in comparison to other healthcare providers.[23, 24] Medication therapy management (MTM) services are provided by pharmacists to help patients understand their disease state(s) and medications to optimize therapeutic outcomes.[25] These services can be provided to patients face-to-face or telephonically. Several studies have demonstrated that MTM interventions lead to improved clinical outcomes for patients.[26, 27] One study exists that shows that the combination of blister packaging with MTM significantly improves adherence and decreases in hospitalizations; however, it did not determine effects on clinical outcomes and was a retrospective study on a specific population of Medicaid patients.[28] While each of these interventions (blister packaging, med sync, delivery services, and MTM) have shown efficacy in improving adherence rates and clinical outcomes individually, there is a still a need for evaluating the effects of these outcomes when combining these services.

As the role of the pharmacist evolves and continues to expand, pharmacies are becoming better equipped with resources and are starting to offer some of these services. Since the birth of Medicare Prescription Drug, Improvement, and Modernization Act of 2003, MTM services have become an increasingly popular service provided at community pharmacies.[29] Implementing MTM services within the pharmacy workflow requires a paradigm shift in the pharmacy practice model. A traditional pharmacy workflow model involves patients

dropping off a prescription, pharmacy technicians counting pills on a tray and placing them in a pill bottle, and pharmacists verifying the prescription.[26] Pharmacies are in need of a model that incorporates important elements that can optimize patient outcomes. The adherence pharmacy (AP) is an innovative pharmacy practice model that combines use of blister packaging, medication synchronization, MTM services, and the availability of delivery services. These services are offered to patients in a community pharmacy setting. The goal of this study was to compare the impact of various pharmacy-based services on medication adherence and clinical outcomes.

Objective

The objectives of this study were to: 1. examine the effect of an Adherence Pharmacy (AP) practice model on medication adherence when compared to other community pharmacy models for patients with type 2 diabetes; 2. examine the impact of the AP model services on clinical health outcomes when compared to other community pharmacy models for patients with type 2 diabetes.

Methods

Study Design and Study Population

This study used a prospective, randomized control trial design that began in 2014. Researchers partnered with a regional integrated delivery network (IDN) with multiple pharmacy sites and a group of endocrinologists. Patients were recruited through flyers at the practice sites, referrals from physicians and pharmacists, and direct mailers. They were provided with a number to call to express their interest in the study. Members of the research team would screen these patients to assess the eligibility to participate in the study. Patients were enrolled if they met the following criteria: they were able to speak and understand English, 18 years of age or older, diagnosed with type 2 diabetes, and/or hypertension, hyperlipidemia, were currently prescribed a minimum of five medications, could self-administer their medications as prescribed by their doctor, were willing to fill prescriptions at a participating pharmacy, had adequate transportation to attend counseling sessions at a participating pharmacy, were willing to have lab work done as requested and have results delivered by themselves or have the physician fax them to the participating pharmacy, have a connected, in-service phone number to be reached at for telephonic reminders and follow-ups, have Paramount health insurance, and were willing to provide informed consent to participate in the study. They were excluded if they had type 1 diabetes, were diagnosed with a terminal illness and given less than three years to live, pregnant/expected to become pregnant, were planning to leave the area or employer in the next three years, and were currently enrolled in another MTM study. Patients who met the inclusion criteria were randomized into one of the following four groups: Pill Bottle (PB), Blister Pack (BP), Pill Bottle + Medication Therapy Management (PB+MTM), and Adherence Pharmacy (AP)(BP+MTM). Patients enrolled in the BP groups had their medications synchronized. Patients in the AP group were given the option to have their medications delivered, if needed. The research team used a covariate adaptive randomization process to divide subjects into four equally distributed groups. This randomization strategy allowed a new subject to sequentially be assigned to a particular group by taking into account the specific covariates/confounding variables and previous assignments of subjects. This strategy used the method of minimization to assess the imbalance of sample size among several covariates. Our CONSORT flow diagram shows the phases of how patients were randomized and allocated into the four groups.

Setting for MTM Services

Participants received MTM services from clinical pharmacists at one of the participating pharmacy practice sites. There were a total of 6 pharmacists involved in the study, of which 2 pharmacists conducted the MTM services. These two American Pharmacists Association (APhA) MTM-certified pharmacists were trained on the protocol for the study, expectations/roles of MTM, and have previously provided MTM services to patients. There were 5 pharmacy practice sites available and enrolled patients were able to choose which one of the participating pharmacy locations to fill their medications based on their personal preference(s). Subjects in the non-MTM groups did not receive additional services from the pharmacists beyond standard counseling, if they opted to be counseled. Standard counseling included information about what the drug was used for and any special instructions that the subject should have been made aware of while on the medication. This occurred when the medication was picked up.

Follow-up Visits

There were two types of follow-up visits: telephonic and face-to-face. Follow-up visits were conducted over the telephone by a research assistant (RA) at 3, and 9 months to assess adherence, whereas visits at 6 and 12 months were conducted face-to-face with the pharmacist for the MTM group or with a member of the research team for the the non-MTM groups. Ten days prior to each interaction (baseline visits, telephonic follow-ups, etc.) subjects received a reminder phone call. Adherence information was collected via medical and prescription claims data and via pill counts. Follow-up clinical information was extracted from the patients electronic charts or collected by the RA when the patient returned to the pharmacy for their 6- and 12-month visits. The telephonic follow-ups consisted of a self-pill count. The purpose of the face-to-face follow-ups for participants who were randomized in the MTM groups (PB+MTM and BP+MTM) was to counsel them on their medication regimen, disease states, and address any problems or concerns subjects had, create a Patient Medication Record, discuss a Medication Action Plan etc. During the follow-up visits the patients' medication action plans (MAP) were reassessed and goals were adjusted.

Outcome Measures

The primary outcome measures for this paper were medication adherence and clinical outcomes. The authors are currently working on a second paper describing the findings from the humanistic and economic outcomes of the study. Medication adherence was measured by proportion of days covered (PDC) and pill count scores. Researchers used prescription claims data to measure the participants' adherence to medications and to then calculate the PDC. Patients were also trained on how to perform self-pill counts at their initial enrollment visit. During the telephonic follow-up visits at 3 and 9 months, the participants were asked by the research assistant to perform the pill counts while on the phone and to provide the researcher with the information. To validate the self-reported telephonic pill count, patients were asked to bring their unused pill bottles and blister packs to the pharmacy at their 6 and 12 month visit and the RAs performed pill counts.

Clinical outcomes that were measured were hemoglobin A1c (HbA1c), body mass index (BMI) [height and weight were measured to calculate BMI], systolic blood pressure (SBP), and diastolic blood pressure (DBP). Blood pressure recordings were measured at the physician's office by physician office personnel and we were able to access their measurements from their electronic medical record.

Data Analysis

Subject baseline characteristics are listed in Table 1. These comparisons were presented in order to identify any major baseline therapy differences that could potentially affect the results. For all statistical tests, a significance level of 0.05 was used. Post hoc comparisons used the Tukey HSD test or paired sample t-tests to investigate within-group differences. All pairwise comparisons were adjusted with Bonferroni corrections and were assumed to be significant at alpha level 0.05 or 0.0125. All data was assessed prior to final analysis to check for violations to assumptions.

Adherence was measured as a continuous variable ranging from 0 to 1. A mixed model analysis of variance (ANOVA) was used to compare adherence rates between and within the four different groups. Adherence was a categorical variable divided into three levels based on the participants' PDC score: high 1-0.8, intermediate 0.79-0.6, and low adherence <0.6. Clinical outcomes were analyzed using the mixed between-within ANOVA.

Results

Baseline Characteristics

Table 1 shows that there were no statistical significant differences across groups at baseline. In addition to demographics, we analyzed their baseline values of average number of medications, BMI, and Hba1c.

Medication Adherence

Medication adherence (Table 2) was most improved in the groups with BP. Of all the groups, patients enrolled in the BP+MTM group, or the AP group, showed the highest PDC score at 12 months. When measuring the PDC, the interaction between time of measurement and groups was significant with a large effect size (Wilks Lambda=0.57, F(3,57)=7.13, p=0.004, partial eta squared=0.64). There was also a significant main effect for time (Wilks Lambda=0.64, F(4,57)=8.12, p=0.013, partial eta squared=0.22). Additionally, the main effect comparing the four groups was significant with a large effect size (F(3,57)=11.7, p<0.01, partial eta squared=0.53), suggesting a considerable difference in the effectiveness of the groups. Post-hoc comparisons using the Tukey HSD test indicated significant differences in PDC between the PB and BP groups (p=0.008), with patients in the BP group having significantly better adherence scores than patients in the PB group. Additionally, significance was seen between PB and BP+MTM (p=0.023) and the PB+MTM and the BP+MTM (p=0.041) groups. Except at baseline, adherence scores at all time points were significant with patients in the BP and the BP+MTM groups having higher adherence compared to those in the PB and the PB+MTM groups. Even though patients in the PB+MTM group had improved adherence at 3 months, they weren't able to sustain or improve their adherence at the 6-month time point, unlike patients in the two BP groups. However, after speaking with the pharmacist at the 6-month time-points patients who were in the PB+MTM group were able to significantly improve their adherence scores.

When measuring pill count scores (Table 3), the interaction between time of measurement and the groups was significant with a large effect size (Wilks Lambda=0.426, F(3,57)=12.32, p=0.00, partial eta squared=0.43). Similar to the PDC results, the BP+MTM group, or the AP group, showed the highest pill count score at 12 months. Patients with scores <0.60, 0.60-0.79, and 0.80-1 were deemed to have low adherence, intermediate adherence, and high adherence, respectively. Results indicated a significant main effect for time (Wilks Lambda=0.69, F(4,57)=5.862, p<0.001) with a large effect size size (partial eta squared=0.30). Additionally, the main effect comparing the four groups was significant with a large effect size (Wilks Lambda=0.251, F(3,57)=8.61, p=0.006, partial eta squared=0.38), suggesting a considerable difference in the effectiveness of the groups. Post-hoc comparisons using the Tukey HSD test indicated significant differences in adherence between PB and BP groups (p=0.005), with patients in the BP group having significantly better adherence scores than patients in the PB group. Additionally, significant differences were observed between PB and BP+MTM (p=0.002), and again patients in the PB group had significantly lower adherence scores than patients in the BP+MTM group. No other significant differences in mean pill count scores were observed among the other groups. Post-hoc comparisons for various time points indicated significant difference in adherence

between the PB+MTM and the BP group at 6 months (p=0.012), between the BP+MTM and PB+MTM at the 12-months (p=0.031), and between PB+MTM and the PB group at the 12- month (p=0.001) time point. Additionally, significant differences were observed at the p< 0.05 level, between BP+MTM group and the PB group, and the BP and PB group at 6, 9 and 12 months.

Clinical Outcomes

In all measures for clinical outcomes, the BP+MTM group had the most favorable results. For HbA1c (Table 4), patients who were in the BP+MTM group, or the AP group, had the lowest average HbA1c values at the end of the year when compared to the other groups. The interaction between the groups and time was significant (Wilks Lambda=0.79, F(3,56)=5.03, partial eta squared=0.21, p=0.002) and there was a substantial main effect for time (Wilks Lambda=0.8815, F(2,56)=5.67, partial eta squared=0.67, p=0.001), with patients in the two MTM groups improving the most over time, followed by patients in the BP only group. The main effect for groups was also significant (Wilks Lambda=0.37, F(2,56)=21.7, partial eta squared=0.74, p=0.000). Post hoc comparisons indicated significant differences between the two MTM groups and the PB group. There were statistically significant changes from baseline to 6 months and from baseline to 12 months in both MTM groups. All groups except for the PB group had significant changes from baseline to 12 months. Also, patients in the MTM groups reached the ADA goal of 7% and dropped by almost 2% points, while patients in the BP group got close to this goal at the 12-month time point and dropped by 1.4% points. Patients in PB did not reach goal at 12 months.

Results from the analysis of BMI scores (Table 5) indicated a significant main effect for time (Wilks Lambda=0.847, F(2,48)=4.319, p=0.019) and a large effect size (partial eta squared=0.153). Although there weren't any significant differences across groups, 11 patients in the two MTM groups saw greater improvement in their BMI scores than patients in the other 2 groups. scores for patients receiving the BP continuously improved over the course of the year, although this decrease was more gradual than patients in the MTM groups. The lowest average BMI score was seen in the BP+MTM group, or the AP group.

Per the Eighth Joint National Committee (JNC 8), the goal for SBP/DBP is <140/90 mmHg for patients 18 to 59 years of age without major comorbidities and for patients 60 years or older who have diabetes, CKD, or both.[28] According to this guideline, most patients in this study were at goal at baseline. No statistically significant differences were detected between time and group variables for SBP (Table 6). However, at the end of 12 months, the mean SBP of 119.93 mmHg for patients who had packaging and MTM was lower than the mean SBP of all other groups. At 12 months, the patients in the BP+MTM group, or the AP group, showed the lowest average SBP. There was no significant main effect comparing the four groups, suggesting no statistical difference in the effectiveness of the interventions for SBP. A sub-group analysis was performed on a small group of patients (n=17) who weren't at goal at baseline. While these numbers were too small to indicate statistical significance, it must be noted that most patients in the two BP groups reached goal sooner than patients in the PB+MTM and PB groups.

Diastolic blood pressure (DBP) (Table 7) results showed a significant main effect for time (Wilks Lambda=0.859, F(2,48)=3.927, p=0.026) and a large effect size (partial eta squared = 0.141). There were no significant differences between groups and no significant interaction effects. All groups showed a reduction in DBP across the three time periods. Sub-group analysis for patients who weren't at goal at baseline, found a higher number of patients in the BP groups reached goal at 6 months when compared to patients in the other groups. Although, this finding wasn't significant, it did suggest the impact of blister packs and medication synchronization on improving blood pressure.

Discussion

The adherence pharmacy (AP) practice model can play a large role in effectively improving patient outcomes. Findings from this study support the use of adherence packaging, or blister packaging (BP), in improving medication adherence, and the use of MTM services provided by pharmacists. Patients who were in the BP+MTM group saw the most significant improvements both in their adherence rates and clinical outcomes. All patients in the BP groups progressed from low to intermediate adherence to high adherence within the first 3 months of being on adherence packs. One possible reason for this is that blister packs provide a visual aid for patients who may struggle to remember to take their medications.[18-20] Additionally, they continued to see a gradual improvement in their proportion of days covered (PDC) scores, such that the average PDC score for this group was 0.90 at 12 months. Patients who were receiving MTM services saw improvements in their clinical outcomes in comparison to the patients in the pill bottle (PB) only group. The goal of MTMs is to identify medication-related problems, to empower the patient in understanding his or her medications and disease state(s), and to develop a medication action plan for them to address any medication-related issues.[25] As a result of these services, patients were able to achieve significantly improved clinical outcomes. By combining the blister packaging with MTMs, patients were able to see both improved adherence rates and clinical outcomes.

Blister packs have been used in long-term care settings for the past several decades.[32] They are only recently being adopted in community pharmacies. Concerns and perceived barriers to implementing blister packaging services into the pharmacy workflow such as the time spent to manually package patients'

medications, the size of the machines, and the inability to load a large number of medications have prevented pharmacies from offering blister packaging.[33] While not always, packaging is often done by synchronizing patients' medications, thereby eliminating the need for multiple trips to the pharmacy, and/or creating multiple blister packs on a monthly basis. Pharmacies have also expressed their concern for lack of software that can help them efficiently synchronize the patients' medications, thereby adding more time to the dispensing process and hindering workflow in the pharmacy. However, with advances in automation and technology, both these barriers have now been overcome. Machines that package the patients' medications are now much smaller in size, have a greater output, can store and package more medications, and are reasonably priced. There are now multiple software programs that can help with refill synchronization and a number of them can be interfaced with existing pharmacy systems.[34] Integrating this technology in the community pharmacy allows patients to have their medications synchronized to be filled on one day each month and filled in blister packaging to improve their adherence rates.

In this study, both the BP groups and MTM groups had positive outcomes. Investing in either of these services will help a pharmacy offer a better means of improving patient outcomes. However, it is important to note that both of these services improve outcomes by targeting separate primary markers. BPs improve medication adherence, while MTM helps ensure a patient is receiving the most effective treatment option that can help control their disease. Both adherence and clinical outcomes are important markers in patient care. Therefore, in order to see the greatest improvement in patient outcomes, pharmacies would benefit from combining these services. As seen in this study, patients who were in the BP+MTM group received all services offered by the adherence pharmacy (AP) model. This group, by far, had the greatest impact on patient adherence rates and clinical outcomes. Zillich et al produced similar results as ours when evaluating a program that combined MTM with adherence packaging in terms of improvements in adherence. [28] As pharmacies and providers seek to find better ways of targeting medication non-adherence, Adherence Pharmacy seems to provide a possible solution to addressing the non-adherence problem.

Limitations

One major limitation to our study was that the sample size was relatively small, which might suggest a low external validity. Additionally, participants were those who were able to speak and understand English, which removed the barrier pharmacists may face when attempting to provide MTM services to non-English speaking patients. Although there were only two pharmacists with similar experience and certification providing MTM services, the quality of their services was not assessed and may have varied. We also did not assess whether there were differences in the outcomes at the different pharmacies. Although adherence was measured through pill counts and prescription claims data, we could not know for certain if the participant actually took their medications. There may have been a few medication changes that were not assessed during the course of the study. Another limitation for adherence results was that patients in the PB group had the lowest PDC value at baseline in comparison to the other groups. This may have presented some unfavorable bias to that group in that patients may have remained non-adherent throughout the study. However, this bias was unavoidable since the patients were randomized into this group. A limitation in the clinical outcomes, specifically the blood pressure changes, was that only a small group of patients (n=17) were not at the JNC 8 recommended blood pressure goal at baseline. Future studies should focus on larger sample sizes and testing these results in multiple regions of the country.

Conclusion

This study provides a better understanding of the impact that pharmacists and pharmacy-based services, such as blister packs, medication synchronization, MTMs, and delivery can have on patient outcomes. While adherence pharmacy would be an ideal option, starting out with either a MTM program or a blister packaging service can provide pharmacies and their patrons a much better alternative to improving their health than the current practice of simply dispensing medications in pill bottles. With the move toward provider status and pharmacies being held accountable for performance metrics and star ratings, we can no longer rely on a method of dispensing that has worked in the past. Pill bottles have limited impact on improving outcomes of patients with multiple chronic conditions. Based on the findings of this study a key recommendation for pharmacies would be to diversify their service portfolio and provide patients with service options that can truly help improve their overall health.

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Table 1: Baseline Characteristics of Study Patients[†]

	Total[*]	PB (N=14)	BP (N=15)	PB+MTM (N=16)	BP+MTM (N=16)
Gender, F	63.56%	50.0%	66.7%	68.8%	68.75%
Age, years	56.35	50.3	57.8	60.3	57.0
Education, % (N=51)					
Some High School	6.36%	0.0%	6.7%	12.5%	6.25%
High School	8.13%	7.1%	6.7%	12.5%	12.5%
Some College	26.4%	35.7%	20.0%	25.0%	25.0%
Associate's Degree	12.82%	0.0%	20.0%	18.8%	12.5%
Bachelor's Degree	18.05%	21.4%	13.3%	18.8%	18.7%
Graduate Degree	10.36%	28.5%	6.7%	6.25%	0.0%
Income, % (N=51)					
<$30,000	29.3%	21.4%	33.3%	43.8%	18.75%
$30,000-$50,000	22.1%	7.1%	0.0%	31.3%	50.0%
$50,000-$75,000	19.85%	21.4%	26.7%	18.8%	12.5%
$75,000-$100,000	1.6%	0.0%	6.7%	0.0%	0.0%
>$100,000	12.16%	35.7%	6.7%	6.25%	0.0%
Average Number of Medications ± (SD)	9.75 ± (3)	11 ± (1.3)	9 ± (2.5)	8 ± (2.7)	11 ± (2)
BMI, kg/m^2 ± (SD) (N=54)	37.82 ± (4.17)	36.14 ± (4.28)	38.20 ± (2.50)	38.70 ± (3.30)	38.24 ± (4.12)
HbA1c, % ± (SD)	8.63 ± (1.53)	8.7 ± (0.40)	8.5 ± (1.28)	8.8 ± (1.30)	8.5 ± (1.48)

[†]No significant differences across groups
[*]Total N=61, unless specified otherwise

Table 2: Average Proportion of Days Covered Scores

	PB (N=14)[ab]	BP (N=15)[a]	PB+MTM (N=16)[c]	BP+MTM (N=16)[bc]
Baseline	0.49	0.62	0.65	0.63
3 months	0.63	0.85	0.77	0.87
6 months	0.57	0.83	0.58	0.91
9 months	0.50	0.91	0.71	0.92
12 months	0.56	0.90	0.68	0.94

[a]Significant differences between groups (p=0.008)
[b]Significant differences between groups (p=0.023)
[c]Significant difference between groups at 6 months (p=0.041)
[*]Except at baseline, adherence scores at all time points were significant with patients in the BP and BP+MTM groups having higher adherence compared to those in the PB and PB+MTM groups

Table 3: Average Pill Count Scores

	PB (N=14)[abefg]	BP (N=15)[acg]	PB+MTM (N=16)[cde]	BP+MTM (N=16)[bdf]
Baseline	0.5480	0.6150	0.6789	0.6015
3 months	0.6912	0.8517	0.7696	0.8672
6 months	0.5568	0.8315	0.7051	0.7774
9 months	0.5832	0.8800	0.7660	0.8911
12 months	0.5924	0.8703	0.7734	0.9246

[a]Significant differences in adherence between groups (p=0.005)
[b]Significant differences between groups (p=0.002)
[c]Significant difference between groups at 6 months (p=0.012)
[d]Significant difference between groups at 12 months (p=0.031)
[e]Significant difference between groups at 12 months (p=0.001)
[f]Significant difference between groups at 6, 9, and 12 months (p<0.05)
[g]Significant difference between groups at 6, 9, and 12 months (p<0.05)

Table 4: Comparison of HbA1c Scores Within and Across Groups

HbA1c (%) ± (SD)	PB Mean (N=14)[cd]	BP Mean (N=15)[§]	PB+MTM Mean (N=16)[c*§]	BP+MTM Mean (N=16)[d*§]
Baseline	8.7 ± (0.40)	8.5 ± (1.28)	8.8 ± (1.30)	8.5 ± (1.48)
6 months	8.5 ± (0.65)	7.6 ± (1.21)	7.3 ± (1.17)	7.2 ± (0.97)
12 months	8.4 ± (0.81)	7.1 ± (0.92)	6.8 ± (1.62)	6.2 ± (0.53)

[*]Significant change from baseline to 6 months (p<0.05)
[§]Significant change from baseline to 12 months (p<0.05)
[c]Significant differences between groups (p<0.05)
[d]Significant differences between groups (p<0.05)

Table 5: Comparison of BMI Scores Across Groups Over Time

BMI (kg/m^2) ± (SD)[*]	PB Mean (N=14)	BP Mean (N=14)	PB+MTM Mean (N=14)	BP+MTM Mean (N=13)
Baseline	36.14 ± (4.28)	38.20 ± (2.50)	38.70 ± (3.30)	38.24 ± (4.12)
6 months	36.81 ± (3.97)	37.90 ± (3.16)	37.91 ± (2.13)	37.6 ± (3.36)
12 months	37.08 ± (3.45)	37.51 ± (3.24)	37.31 ± (2.27)	36.52 ± (2.68)

[*]No statistically significant differences across groups

Table 6: Comparison of SBP and DBP Scores Across Groups

Visit	PB Mean (N=14)	BP Mean (N=15)	PB+MTM Mean (N=16)	BP+MTM Mean (N=16)
SBP (mmHg) ± (SD)[*]				
Baseline	123.31 ± (12.28)	129.87 ± (11.0)	121.56 ± (9.62)	124.62 ± (8.73)
6 months	126.18 ± (11.22)	104.40 ± (7.85)	126.79 ± (11.31)	107.40 ± (10.45)
12 months	129.33 ± (7.45)	121.82 ± (5.24)	128.55 ± (9.27)	119.93 ± (7.48)
DBP (mmHg) ± (SD)[*]				
Baseline	89.79 ± (8.28)	77.02 ± (4.18)	82.64 ± (5.78)	89.13 ± (7.24)
6 months	72.91 ± (5.75)	75.15 ± (7.59)	74.00 ± (8.95)	65.62 ± (5.68)
12 months	79.56 ± (3.43)	74.73 ± (9.00)	66.64 ± (3.81)	74.22 ± (10.36)

n=17 patients were hypertensive at baseline
[*]No statistically significant differences across groups

Appendix 1: CONSORT Flow