

2012

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### Recommended Citation

McKenzie MC, Lenz TL, Gillespie ND, Skradski JJ. Medication Adherence Improvements in Employees Participating in a Pharmacist-Run Risk Reduction Program. *Inov Pharm*. 2012;3(4): Article 92. <http://pubs.lib.umn.edu/innovations/vol3/iss4/3>

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## Medication Adherence Improvements in Employees Participating in a Pharmacist-Run Risk Reduction Program

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**Disclosures:** The authors have no conflicts of interest to disclose

**Keywords:** medication adherence, pharmacist, employee health

### Abstract

**Objective:** To evaluate the medication adherence of individuals participating in a pharmacist-run employee health Cardiovascular and Diabetes Risk Reduction Program. **Design:** Retrospective analysis of medication adherence using pharmacy refill data. **Setting:** A medium sized university located in the Midwest United States and the organization's outpatient pharmacy. **Participants:** 38 participants  $\geq$  18 years of age, employed and receiving their health insurance through the organization, and have a diagnosis of hypertension, hyperlipidemia, diabetes mellitus, or a combination thereof. **Intervention:** Participation in the risk reduction program that emphasizes medication therapy management (MTM), lifestyle medicine and care coordination. **Main Outcome Measures:** The Proportion of Days Covered (PDC) and the Medication Possession Ratio (MPR). **Results:** PDC and MPR analysis showed a statistically significant improvement in medication adherence for 180 days and 360 days post enrollment versus the 180 days prior to enrollment ( $P < 0.01$ ). The PDC analysis demonstrated a statistically significant improvement in the number of medications that achieved a PDC  $\geq$  80% (high adherence) for the 180 days post enrollment versus the 180 days prior to enrollment (+30%,  $P < 0.01$ ). The MPR analysis showed a non-statistically significant improvement in the number of medications that achieved an MPR  $\geq$  80% (high adherence) pre enrollment versus post enrollment (+10%,  $P = 0.086$ ). The percentage of participants in the program that reached a PDC and MPR adherence rate  $\geq$  80% at 180 days post enrollment was 78.9% and 94.4%, respectively which exceeds that of a matched cohort that reached a PDC and MPR adherence rate  $\geq$  80% of 66.4% and 82.8%, respectively. **Conclusion:** Pharmacists can improve medication adherence as measured by PDC and MPR when working with employees enrolled in a novel pharmacist-run employee health risk reduction program. Medication adherence was shown to be sustainable for at least one year and was shown to be better when compared to a matched cohort of similar age, condition and region.

### Introduction

The World Health Organization defines adherence as "the extent to which a person's behavior – taking medication, following a diet, and/or executing lifestyle changes – corresponds with agreed recommendations from a healthcare provider."<sup>1</sup> The term adherence implies active participation by the patient whereas compliance refers to a passive role. With adherence, the patient is collaborating with their healthcare provider and not simply following "doctor's orders."

Medication non-adherence is considered to be our nation's "other drug problem."<sup>2</sup> It is estimated that 50% percent of patients with chronic conditions are non-adherent to their medication therapy.<sup>3</sup> Adherence to chronic medications is often lower than adherence to acute medications.<sup>4</sup>

Medication non-adherence can lead to substantial health and economic consequences. According to an estimate from the Office of the Inspector General, 10% of hospital admissions are due to medication non-adherence, and approximately 125,000 deaths from cardiovascular disease per year in the United States are due to medication non-adherence.<sup>1</sup> Medication non-adherence leads to an estimated \$100 billion dollars per year in medication related hospital admissions in the U.S.<sup>4</sup>

The proportion of days covered (PDC) and the medication possession ratio (MPR) are two methods of measuring medication adherence using pharmacy refill or claims data.<sup>5</sup> A PDC and MPR  $\geq$  80% is considered high adherence and is the benchmark most commonly reported in the literature.<sup>5</sup>

The primary objective of this analysis was to evaluate the change in medication adherence of individuals participating in a pharmacist-run risk reduction program using both the proportion of days covered (PDC) and the medication possession ratio (MPR). The project was submitted to the local Institutional Review Board for approval and oversight. The project was considered to be a continuous quality

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improvement measure of the risk reduction program and therefore, oversight was deemed unnecessary.

## Methods

### *Risk Reduction Program*

In 2008, a medium sized university in the Midwestern section of the United States initiated a pharmacist-run employee health Cardiovascular and Diabetes Risk Reduction Program. Employees were eligible to volunteer for the program if they had an existing diagnosis of hypertension, hypercholesterolemia, diabetes mellitus, or a combination thereof. Employees could participate in the program for as long as they remained employed with the university and obtained their health care benefits from the employer. The primary outcomes of the program were to (1) reduce the risk of experiencing a cardiovascular event within the next 10 years; (2) improve the lifestyle habits of physical activity, healthy eating, stress management, sleeping, alcohol consumption, and tobacco use; (3) improve medication adherence; (4) improve quality of life; and (5) improve presenteeism rates.

Participants in the risk reduction program attended one-on-one appointments with the pharmacist at least one time per month. Monthly visits consisted of medication therapy management activities, implementation and adherence to seven personalized lifestyle medicine programs (physical activity, healthy eating, stress management, restorative sleep, moderate alcohol consumption, tobacco abstinence/cessation, and weight control), and chronic disease education and care coordination practices.<sup>6</sup> Information regarding the care coordination practices within the program has been previously published.<sup>7</sup>

In order to achieve the highest level of program adherence and success, each participant was provided with educational materials, a home blood pressure monitor, a pedometer, lifestyle behavior tracking tools, free access to the employer's exercise facilities, monthly support group meetings, and access to a licensed mental health care provider.

Individual participant data was collected at baseline and annually thereafter. Collected data consisted of medication refill records, cholesterol, blood pressure, and blood glucose lab values, body weight, lifestyle behavior activities, health related quality of life questionnaires, and work productivity questionnaires. With the permission of the participant, additional health information was also obtained from the annual health risk appraisal data collected by the employer and/or from the participants other health care professionals (i.e. physician).

### *Medication Adherence Analysis*

Medication-related data were collected for each participant for six months prior to enrollment in the program and for one year after enrollment in the program. The medication related data for each oral medication used to treat hypertension, hyperlipidemia and diabetes included: name, strength, quantity, dosage unit per day, national drug code (NDC), date of first fill and date of subsequent refills. Days' supply was calculated based on quantity dispensed and dosage unit per day. Medications were excluded if they were non-oral or if they did not have a quantifiable days supply. The proportion of days covered (PDC) and the medication possession ratio (MPR) were used to measure adherence for each participant.

The PDC was calculated as the number of days during the analysis period on which medication was available to the participant (total days supplied) divided by the total number of days in the analysis period. The PDC was truncated at 1.00 by removing any days of therapy extending beyond the analysis period, resulting in a ratio ranging between 0 and 1.

MPR was calculated as the total days supplied of medication between the first prescription and the end of days supplied associated with the participant's final prescription in the follow-up period (regardless of gaps in therapy), divided by the total number of days between the participant's first fill date and the end of days supplied for the participant's final prescription in the analysis period. The MPR was truncated at 1.00 by removing any days of therapy extending beyond the analysis period. Participants with only one medication in the analysis period were not analyzed for MPR.

Participant medication adherence for 360 days after enrollment in the program was compared with their adherence for 180 days leading up to enrollment in the program. Also, adherence results were compared to benchmark data obtained from the IMS Lifelink Integrated Health Plan Claims Database within the Disease Cohort Analytic module of the Insight Data & Analytics (iDNA) tool.<sup>8</sup> The matched cohort benchmark data is comprised of commercial, self-insured and Medicare Advantage data. Individuals included in the current analysis were matched to individuals in the database using age, diagnosis, treatment time period, and region of the country. The time period chosen for the matched cohort was similar to that of the participants for year (2009) and follow-up (180 days).

### *Participants*

The individuals included in this analysis were participants in the risk reduction program enrolled between August 2008 and December 2009.

### Statistical Analysis

For each participant included in the analysis, PDC and MPR were summarized by mean, standard deviation, median, and the number (%) attaining a threshold of  $\geq 80\%$  (high adherence). The PDC was calculated at a medication class level and MPR was calculated at both the medication class and product levels, both using an intent-to-treat analysis.

A paired t-test was used to compare the PDC and MPR on a medication class level before and after enrollment in the program. A two sample t-test was used to compare the PDC and MPR for participants before and after enrollment in the program.

### Results

#### Participant population characteristics

There were 48 participants enrolled in the risk reduction program between August 2008 and December 2009. A total of 38 participants had pharmacy refill data available and were included in the PDC analysis. A total of 36 participants had pharmacy refill data available and were included in the MPR analysis. The differing methods of calculating the PDC and MPR account for differing number of participants included in each analysis. The average age of the 38 study participants for the PDC analysis was 52 years, with 27 females and 11 males. The number of participants for the PDC analysis with a diagnosis of hypertension, hyperlipidemia and diabetes mellitus were 27, 24, and 10, respectively. The average age of the 36 study participants for the MPR analysis was 52 years, with 26 females and 10 males. The number of participants for the MPR analysis with a diagnosis of hypertension, hyperlipidemia, and diabetes mellitus was 25, 22, and 10, respectively. For the PDC analysis, there were 53 medication refill occurrences that matched for participant identification and medication class and 44 matching medication refill occurrences for the MPR analysis. Again, differing methods of calculating the PDC and MPR account for the differing number of medication refill occurrences that can be counted in each analysis.

#### Adherence Analysis

Table 1 compares PDC and MPR prior to enrollment versus post enrollment. Both PDC and MPR analysis showed a statistically significant improvement in medication adherence for 180 days and 360 days post enrollment versus the 180 days prior to enrollment ( $P < 0.01$ ).

Table 2 compares the percentage of medications matched for participant identification and medication class that achieved a PDC and MPR  $\geq 80\%$  (high adherence) for 180 days prior to enrollment versus 180 days post enrollment. The PDC analysis showed a statistically significant improvement in the number

of medications that achieved high adherence for the 180 days post enrollment versus the 180 days prior to enrollment ( $+30\%$ ,  $P < 0.01$ ). The MPR analysis demonstrated a non-statistically significant improvement in medication adherence of 10% ( $P = 0.086$ ).

The matched cohort data consisted of 203,580 individuals between the ages of 30 to 64 years with the diagnosis of dyslipidemia in the Midwest region of the United States for a 180 day time period in the year 2009.<sup>8</sup> The comparison showed that more participants in the risk reduction program achieved a PDC and an MPR  $\geq 80\%$  when compared to the matched cohort. The percentage of participants in the program that reached a PDC and MPR adherence rate  $\geq 80\%$  for 180 days post enrollment was 78.9% and 94.4%, respectively. The percentage of participants in the matched cohort that attain a PDC and MPR adherence rate  $\geq 80\%$  during a 180 follow-up period was 66.4% and 82.8%, respectively.

A follow up analysis compared PDC and MPR for their ability to estimate medication adherence. The results showed that MPR overestimated adherence by 6.4% compared to PDC. The overestimation of adherence by MPR, however, was not statistically significant ( $P = 0.082$ ).

### Discussion

The results of this analysis suggest that medication adherence can be improved in individuals who participate in the pharmacist-led Cardiovascular and Diabetes Risk Reduction Program in an employee health setting. The results also suggest that participants in the program have higher adherence rates when compared to a matched cohort, and that the improved medication adherence can be sustained for at least 360 days post enrollment in the program.

Pharmacists play an important role in improving medication adherence and health outcomes. Previously published studies, such as the Asheville Project and Project IMPACT, have also demonstrated that pharmacist-led patient care services can improve medication adherence, health outcomes and decrease overall healthcare costs in patients with chronic conditions.<sup>9-12</sup>

Barriers to medication adherence can include cost, lack of perceived importance, complexity of medication regimens, undesirable side effects, forgetfulness and difficulty of administration.<sup>12</sup> The risk reduction program addresses a number of these barriers in an effort to improve medication adherence. [TABLE 3] The program has found that working individually with the participants has a significant impact on

success with implementing positive health behaviors, including taking medications. Participants in the program meet one-on-one with a pharmacist at least one time each month. The pharmacist and participant discuss the importance of taking medications as directed, work on individualized strategies to improve adherence, and conduct comprehensive medication therapy management (MTM). MTM for the program participants includes reviewing the most up-to-date medication and natural products lists for potential interactions, adverse effects, efficacy, and simplicity of the medication regimen. When possible, medication regimens are simplified to allow for once a day scheduling rather than multiple times per day scheduling. Also, unnecessary medications are discontinued whenever possible.

An effective method of modifying health behaviors can occur through the use of tracking tools, diaries and/or journaling. The program developed a comprehensive lifestyle journal that allows participants to record lifestyle behaviors on a daily basis, including medication adherence. The lifestyle journal helps remind the participants to take their medications as well as be accountable for their lifestyle behaviors as they are required to bring their lifestyle journal to each visit with the pharmacist. Additionally, the program supplies a pill box free of charge to any participant wishing to use one to help improve medication adherence.

A significant barrier to medication adherence can also be related to the cost of medication(s). An incentive program was implemented with the participants included in this analysis to receive their medications for hypertension, hyperlipidemia and diabetes at no cost for their first 18 months of participation if they met certain program adherence criteria. It should be noted that the free medication benefit may have removed the cost barrier and improved medication adherence.

Medication non-adherence has been shown to be associated with greater healthcare costs. It is estimated that a midsize employer in the U.S. with \$10 million in annual healthcare claims may be wasting approximately \$1 million per year in avoidable healthcare costs due to drug related morbidity, including non-adherence.<sup>13</sup> In 2010 the total direct national cost of non-adherence, defined as an MPR < 80%, for adults with diabetes, hypertension and dyslipidemia was estimated to be \$105.8 billion.<sup>14</sup> Additionally, this analysis showed that for every person in Nebraska (state which this current analysis took place) with hypertension, hyperlipidemia and diabetes who does not achieve an MPR  $\geq$  80%, it costs \$356.09 per year in direct medical costs.<sup>14</sup> In our analysis, a net of three CVRRP participants with an MPR below 80% prior

to enrolling in the program, reached an MPR  $\geq$  80% by 180 days post enrollment. This suggests that the program may have saved \$1068.27 in direct medical costs in the first year by improving medication adherence. It should be noted that 4 of the 36 individuals included in the MPR analysis improved their medication adherence from a level less than 80% to a level greater than 80% after beginning the program. Additionally, one individual decreased adherence from greater than 80% to less than 80% after starting the program. It should further be noted that the cost avoidance estimations stated above does not take into account indirect costs associated with medication non-adherence.

There is no consensus on an optimal method of measuring medication adherence.<sup>15</sup> The majority of studies use some form of the MPR calculation.<sup>5</sup> However, MPR does not account for gaps in therapy and is reported to often overestimate adherence.<sup>16</sup> An increasing number of studies and organizations including Center for Medicare and Medicaid Services (CMS) are currently using PDC to measure adherence with refill and claims data. The PDC method accounts for gaps in therapy and does not overestimate adherence. We used both the PDC and MPR methods to be consistent with the majority of the published literature and to account for the method used by CMS. Due to the reports that MPR has the potential to overestimate medication adherence, we did a follow up analysis of our data comparing PDC to MPR. The results showed that MPR overestimated adherence by 6.4% ( $P=0.082$ ). This non-statistically significant finding may have been due to the small sample size and we plan to continue to monitor both MPR and PDC in our program participants.

Although our medication adherence analysis was positive, it was not without a number of limitations. The sample size for this analysis was small and the analysis period ended at one year. One of the goals of the program is to achieve long-term medication adherence of  $\geq$  80% and therefore, further analyses of a larger cohort for a longer period of time is needed to show long-term achievement. Also, medication adherence was only calculated for oral hypertension, hyperlipidemia and diabetes mellitus medications. Medications used for other indications and non-oral medications (e.g. insulin) were not included. Medications were only included if they had a quantifiable days supply. It was not possible to calculate a PDC or MPR for any medication taken on an "as needed" basis or with a variable dosage unit per day. Also, adherence analysis based on refill data describes how much medication the participant had the opportunity to take, not what the participant actually ingested. This analysis only included medications filled at the organization's pharmacy which is where the participants filled

their prescriptions. It doesn't account for medication received at other pharmacies or by other means (e.g. samples). Lastly, the matched cohort for this analysis was not controlled, and the matched cohort only included individuals with the diagnosis of dyslipidemia. It is unknown if the matched cohort had a diagnosis of hypertension and/or diabetes. Future analyses of medication usage in risk reduction participants will include the cost effectiveness of the intervention so that a return on investment may be calculated.

### Conclusion

Medication non-adherence has shown to be a significant problem in healthcare, both in prevalence and in economic burden. This analysis showed that pharmacists can improve medication adherence as measured by PDC and MPR when working with employees enrolled in a novel pharmacist-run employee health risk reduction program. The medication adherence was shown to be sustainable for at least one year and was shown to be better when compared to a matched cohort. Strategies such as frequent one-on-one appointments with the pharmacists may be an effective way to improve medication adherence, but the cost effectiveness of this intervention needs to be analyzed.

**Acknowledgment:** Stephanie Maciejewski, PharmD Medical Outcome Specialist, Pfizer Medical, contributed to this study in the form of data analysis.

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**Table 1. Comparison of PDC and MPR for 180 days prior to enrollment versus a 360 day time period post enrollment in a pharmacist-run risk reduction program.**

	180 days prior to enrollment (Baseline)	180 days post enrollment	Adherence Change vs. Baseline (P value)	360 days post enrollment	Adherence Change vs. Baseline (P value)
PDC (n=53*)	0.79 ±0.25	0.96 ±0.11	+17% P<0.001	0.94±0.13	+15% P<0.001
MPR (n=44*)	0.92 ±0.11	0.96 ±0.06	+4% P=0.001	No data	No data

PDC: Proportion of Days Covered

MPR: Medication Possession Ratio

SD: Standard Deviation

\*Number of occurrences matched for participant identification and medication class

**Table 2. Percentage of medications achieving a PDC and MPR ≥ 80% (high adherence) for 180 days prior to enrollment versus the 180 days post enrollment.**

	180 days prior to enrollment	180 days post enrollment	Difference (P value)
PDC*	56% (n=62)	86% (n=86)	+30% P<0.01
MPR*	84% (n=49)	94% (n=81)	+10% P=0.086

PDC: Proportion of Days Covered

MPR: Medication Possession Ratio

\*Comparison matched for participant identification and medication class

**Table 3. Strategies used to Improve Medication Adherence.**

One-on-one appointments with a pharmacist at least 1 time/month
Comprehensive medication therapy management
Lifestyle Journal
Pill box
Incentive to provide medications for hypertension, hyperlipidemia and diabetes at no cost