EVALUATION OF AN AI-DRIVEN MULTICHANNEL PROGRAM TO INCREASE MEDICATION ADHERENCE IN A RETAIL PHARMACY SETTING

Thomas Marano, MA; Clifford Jones, BSEng, BSEcon; Kevin Leung, PharmD, MS; Linda Schultz, PharmD; Balamurugan Sivakolunthu Vel, MS; Chaoran Chen, MS; Claudio Flores, MS; Saikit Chan, BS; Peggy Wonders, MS; Alexandra Broadus, PharmD; Michael Taitel, PhD

RESEARCH PRIORITY AREAS

➤ Real world evidence to inform managed care pharmacy decision-making
➤ Value-based models in managed care pharmacy to address total cost of care
➤ Impact of direct patient care services provided by managed care pharmacy on patient outcomes

BACKGROUND

Medication adherence is a common pay-for-performance metric used to quantify the quality of services provided by pharmacies. Successful medication adherence programs can boost revenue to retail chain pharmacies, PBMs, and health insurance companies via performance contracts or improved Star Ratings. Patients may experience poor health when they are not taking medications appropriately, potentially resulting in poor health outcomes and raising the overall cost of care. Over the past decade, CMS has viewed medication adherence as a critical component in a health insurers' performance. This has resulted in opportunities for health care providers to address medication related issues[1]. Various clinical rules-driven interventions have been deployed to improve patients' medication adherence; however, Artificial Intelligence (AI) can be leveraged to focus multichannel interventions that best influence patients to promote adherence. In 2019, Walgreens (a national retail pharmacy chain) partnered with AllazoHealth (a healthcare AI company) to launch an AI-powered pharmacy-based adherence program using AI predictions to target in-person, telephonic, and digital patient interventions with the goal of improving the year-end adherence rate (proportion of days covered (PDC ≥ 80%) of patients for diabetes, hypertension, and statin medications.

AI modeling was used to predict patients' future adherence to their medications, as well to predict the impact of specific interventions that would best influence each patient to achieve adherence. The AI platform's predictions to select the optimal intervention channels, messaging, and timing was based on learnings from AllazoHealth's prior work, analysis of Walgreens's historical patient data, and ongoing learning of the AI platform. The AI platform was designed to continually learn and improve its targeting throughout the execution of the intervention program. Each week, the AI platform incorporated the AI predictions with regional labor constraints on intervention delivery to select interventions to be attempted with each patient.

Interventions included in the program are as follows:
• **Adherence Barrier Reviews** - Telephonic and in-person interventions delivered by pharmacists designed to understand an individual patient's barrier(s) to adherence and formulate and consult patients through action(s) which will lead to future adherence behavior.
• **Refill Reminders** - Telephonic and digital (SMS, Email, mobile app push notifications) interventions targeted to patients as they come due (or are past due) for medication refills.
• **90-day Supply Conversion** - Telephonic interventions targeted to patients who are not currently being dispensed 90-day supplies of adherence medications by their retail pharmacy.

The goals of implementing an AI targeting program are three-fold. First, AI targeting aims to cause non-adherent patients to become adherent; this is done via a targeting strategy that prioritizes patients who the AI identifies are both in need of intervention to become adherent and are most likely to be influenced by the intervention. Second, AI is leveraged to maintain adherence amongst the already-adherent portions of the populations by targeting only those patients who are predicted as being in need of interventions to continuously achieve adherent behavior. Third, for patients that are newly starting therapy, the AI can identify which patients are likely to need additional support to achieve adherence and to select the best interventions for those patients. In each of those circumstances, the AI attempts to select the best time, message, and channel of communications that will best support each patient. It then prioritizes interventions for execution based on these predictions and staff capacity.

OBJECTIVES

The study evaluated the impact of a retail pharmacy-based AI program on improving overall patient adherence rates. It also evaluated and quantified the difference in adherence improvement between an AI targeting program vs. a rules-based intervention program.

METHODS

A retrospective study was conducted using prescription, intervention, and AI targeting data from Walgreens and AllazoHealth. Patients were eligible for the study if they (1) received more than 1 fill of RAS antagonists, non-insulin anti-diabetic, or statin medications within the respective time periods (defined as follows) from the insurance plans that were included in the pay-for-performance metrics (the first of these fills needed to occur at least 91 days prior to the end of the calendar year) and (2) did not receive fills for medications that would exclude the members from the pay-for-performance metric.

Two time-period based comparison groups were used in the study: "Without-AI" and "With-AI." Patients were assigned to the "Without-AI" group if they were study-eligible in the time period of 1/1/2018 to 12/31/2018; the Without-AI group was targeted for adherence interventions using rules-based logic (not via AI predictions). Patients were assigned to the "With-AI" group if they qualified during the time period of 1/1/2020 to 12/31 2020. AllazoHealth AI targeting was turned on for Walgreens's patients in mid-2019; it is for this reason that the "Without-AI" group uses the study year of 2018 and the "With-AI" group uses the study year of 2020.

Comparison groups:

• **Without-AI** - This population of patients was not targeted via AI for interventions; rules-based systems were used to target this population for medication adherence interventions.
• **With-AI** - This population of patients was targeted via AI for adherence interventions.

The outcome variables are the proportion of adherent patients (PDC ≥ 80%) and the proportion of non-adherent patients (PDC < 80%).

Analysis was performed comparing the Without-AI to the With-AI population across the following adherence metrics for diabetes, hypertension, and statins:

• **Prior-year non-adherent to study-year adherent** - the proportion of patients that ended the prior-year as non-adherent who then converted to adherent in the study year.
• **Prior-year adherent to study-year non-adherent** - the proportion of patients that ended the prior-year adherent who then converted to non-adherent in the study year.
• **Adherence among new patients in the study year** - the proportion of patients who became adherent in the study year among those who either were not in the prior year's population or who did not meet qualification criteria in the prior-year. This includes patients who were newly qualified for the metric because they newly enrolled in the study's health plans, were new to Walgreens, and/or newly started the medications.
• **Study Year adherence rates among patients qualified in the prior year** - a comparison of the proportions within each group that were in the prior-year's adherence population and were adherent in the study year.
• **Study Year adherence rates regardless of patient's qualification in prior-year** - the proportion of qualified patients in the study year who achieved adherence.

Two-proportion z-tests were performed comparing the difference in portions of the population performance of the Without-AI group versus the With-AI group on each of the above metrics to determine statistical significance.

In the graphs below, differences in performance between With-AI and Without-AI group are stated as percent-difference (calculated by using the percentage-point difference between the proportion of the With-AI group minus the proportion of the Without-AI group and then divided into the proportion of the Without-AI group.)

RESULTS

Demographics
Patient distributions for the study populations remained consistent across key demographics across the study's comparison groups:

• 57% of patients are Female
• The plurality of patients are in the 65 to 74 age range (approximately 50%)
• The plurality of patients live in the south (approximately 41%)

Figure 1:

Sex	Without-AI	With-AI
F	57.2%	57.3%
M	42.8%	42.7%

Figure 2:

Geographic Region	Without-AI	With-AI
Midwest	24.1%	22.3%
Northeast	13.1%	15.1%
Pacific	10.5%	10.1%
South	40.9%	41.4%
West	11.3%	11.1%

Figure 3:

Age Group	Without-AI	With-AI
Under 35	0.19%	0.18%
35 to 44	0.76%	0.74%
45 to 54	2.48%	2.33%
55 to 64	6.97%	6.92%
65 to 74	50.36%	49.44%
75 to 84	29.51%	30.46%
85+	9.73%	9.93%

Year-end Metrics
Prior-year non-adherent to study-year adherent
AI targeting resulted in a 17.9% to 25.3% increase in non-adherent patients who became adherent in the study year. Without AI targeting, only 48.3% of prior-year non-adherent diabetes patients became adherent in the study year, compared with 59.9% of diabetes patients that were part of the group targeted with AI. 59.9% is 23.9% larger than 48.3% (an 11.6 percentage point increase); percentage increases will continue to be used throughout this study.

Without AI, only 57.8% prior year of non-adherent hypertension patients became adherent in the study year, compared to 68.1% of those in the group targeted with AI. Lastly, without AI, only 53% of the prior-year non-adherent statin patients became adherent in the study year, compared to 66.4% of those in the group targeted with AI.

Figure 4: Proportion of Non-Adherent Patients who Converted to Adherent in the Study Year
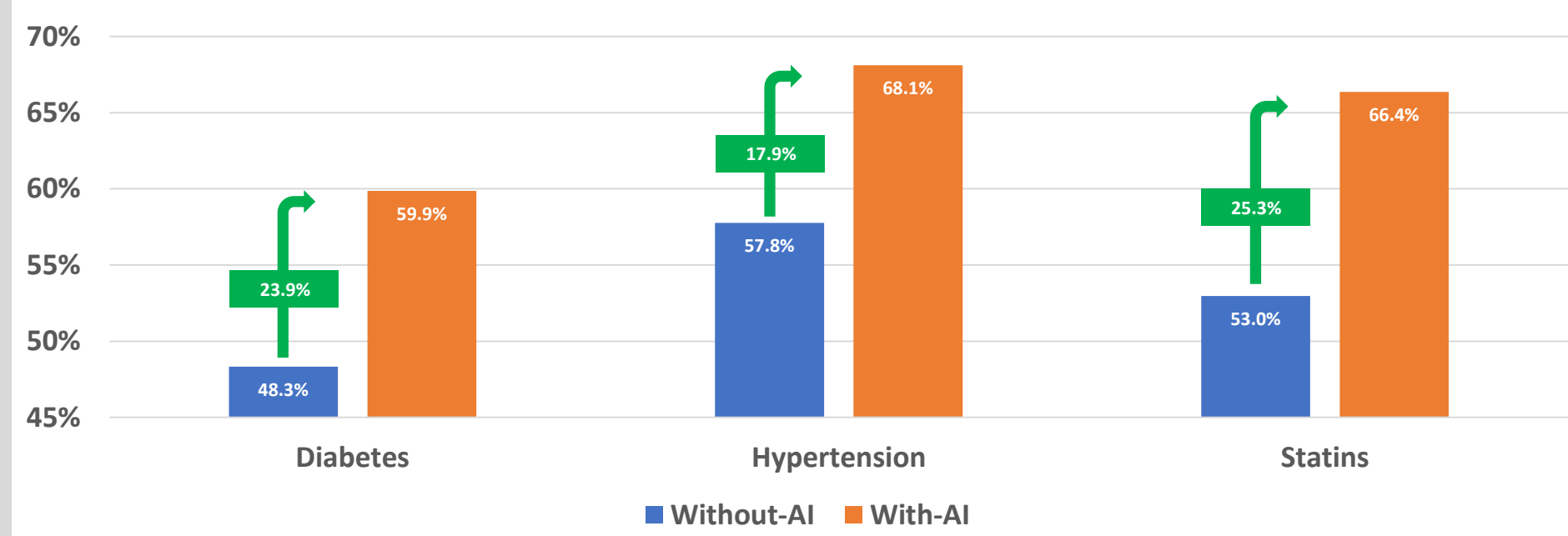
Figure 4 shows that in the group with the AI targeting program, the proportion of prior-year non-adherent patients becoming adherent in the study year improved for all conditions. In patients that were previously non-adherent, there was a 23.9% increase in the adherence rates between the Without-AI and With-AI groups for diabetes (P<.00001), 17.9% increase for hypertension (P<.00001) and 25.3% increase for statins (P<.00001).

Without-AI and With-AI sample sizes were 39,536 and 35,926 respectively for diabetes, 99,327 and 92,171 for hypertension, and 132,401 and 119,409 for statins.

Prior-year adherent to study-year non-adherent
AI targeting resulted in a 21.1% to 31.2% decrease in adherent patients that became non-adherent the following year. Without AI targeting, 18.4% of adherent diabetes patients transitioned to non-adherent behavior in the study year; conversely, only 13.6% of diabetes patients that were part of the group targeted with AI became adherent in the study year. Without AI, 15.1% of adherent hypertension patients became non-adherent in the study year, compared to only 11.9% of those in the group targeted with AI. Lastly, without AI, 16.4% of adherent statin patients became non-adherent in the study year, compared to only 11.3% of those in the group targeted with AI.

Figure 5: Proportion of Adherent Patients who Converted to Non-Adherent in the Study Year
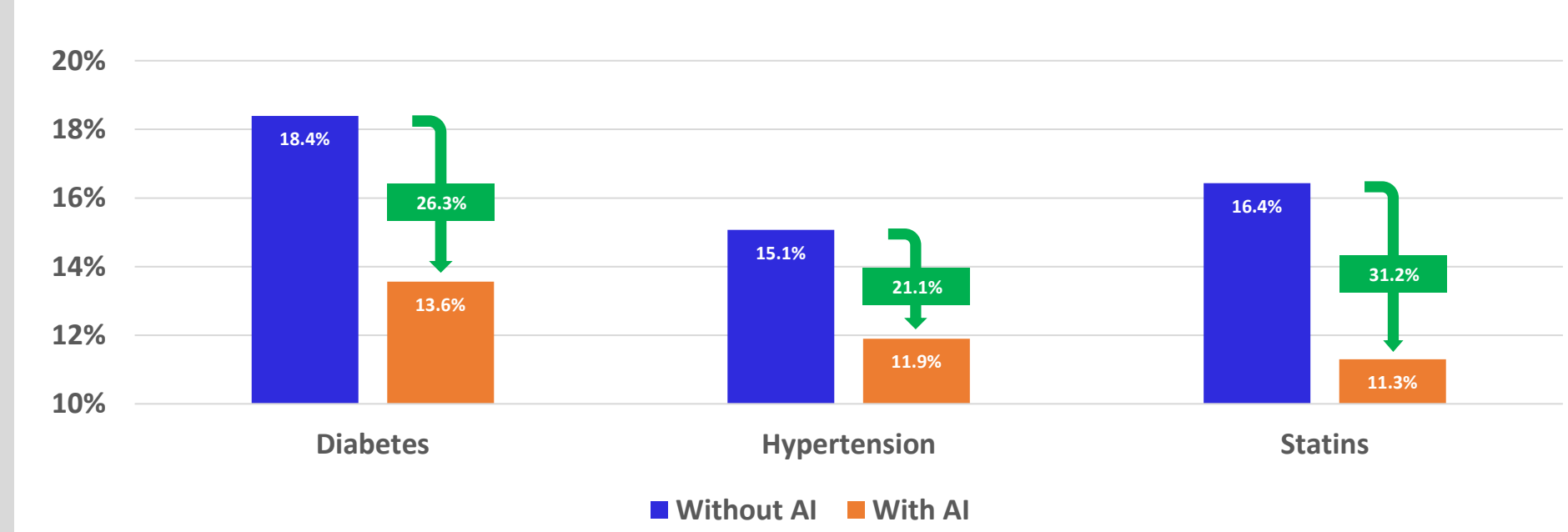
Figure 5 shows that between the Without-AI and With-AI groups and among patients who were adherent at prior-year, the proportion that transitioned to non-adherence decreased for the With-AI group by 26.3%, 21.1%, and 31.2% (diabetes P<.00001; hypertension P<.00001; statins P<.00001).

Without-AI and With-AI sample sizes were 228,198 and 245,700 respectively for diabetes, 737,107 and 787,865 for hypertension, and 775,216 and 882,718 for statins.

Adherence among new patients in the study year
AI targeting resulted in a 4.9% to 9.9% increase in newly started patients that achieved adherence by year end of the study year. Without AI targeting, only 68.3% of new diabetes patients achieved adherence in the study year; conversely, 73.5% of new diabetes patients that were part of the group targeted with AI achieved adherence. Without AI, only 75.2% of new hypertension patients achieved adherence in the study year, compared to 78.8% of those in the group targeted with AI. Lastly, without AI, only 71.8% of new statin patients achieved adherence in the study year, compared to 78.9% of those in the group targeted with AI.

Figure 6: Proportion of New Patients who Achieved Adherence by Year-End of the Study Year
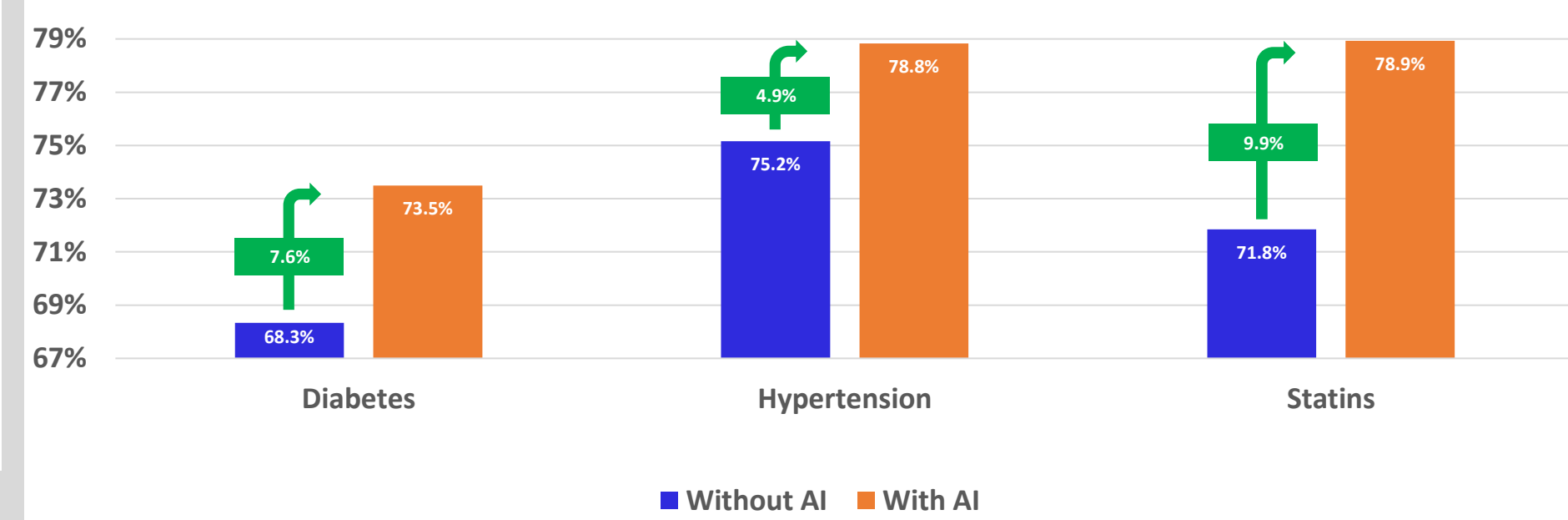
Figure 6 shows that in the group with the AI targeting program, the proportion of new patients that were adherent in the study year increased for all conditions. There was a 7.6% increase in the adherence rates between the Without-AI and With-AI groups for diabetes (P<.00001), 4.9% increase for hypertension (P<.00001) and 9.9% increase for statins (P<.00001).

Without-AI and With-AI sample sizes were 157,868 and 157,776 respectively for diabetes, 439,751 and 418,112 for hypertension, and 498,466 and 498,592 for statins.

Study Year adherence rates among patients qualified in the prior year
AI targeting resulted in a 5.5% to 9.3% increase in that in the fraction of patients eligible in the prior year who achieved adherence in the study year.

Without AI targeting, 75.8% of the prior-year's diabetes patients were adherent in the study year; however, with AI targeting, 82.6% of the prior-year's diabetes patients were adherent. Without AI, 81.3% of the prior-year's hypertension patients were adherent in the study year, compared to 85.7% of those in the group targeted with AI. Lastly, without AI, 78.3% of the prior-year's statin patients were adherent in the study year, compared to 85.6% of those in the group targeted with AI.

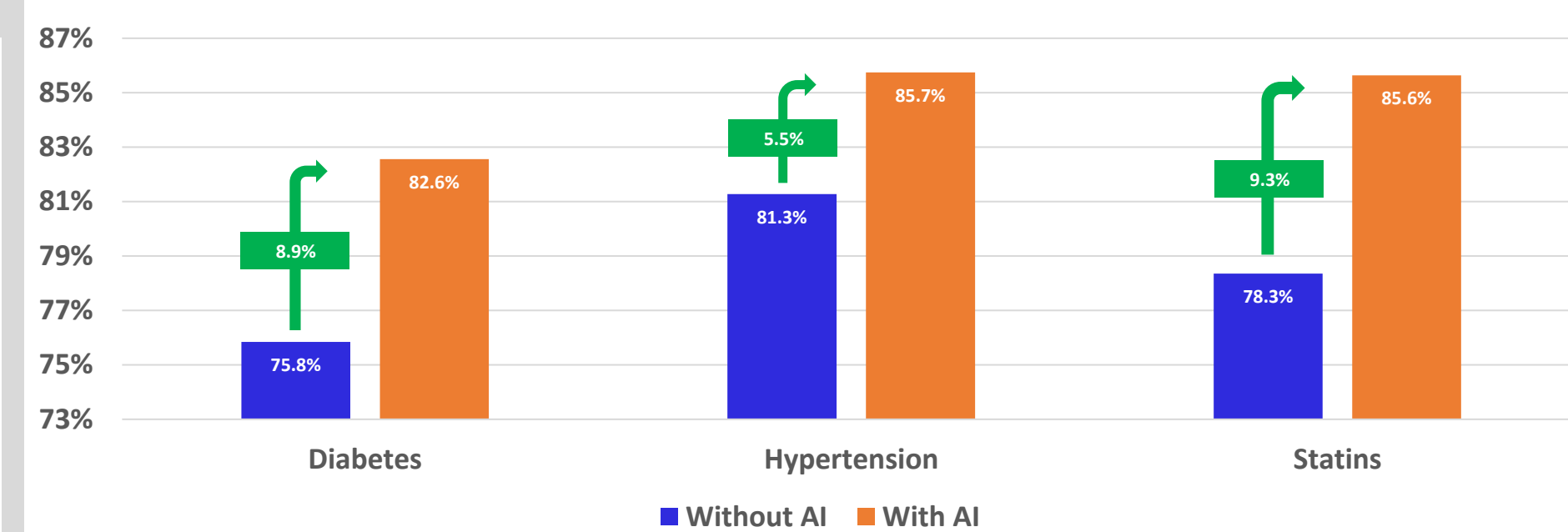Figure 7: Increase in Adherence Rates for Patients in the Prior Year

Figure 7 shows that in the group with the AI targeting program, the proportion of patients that were in the prior year and adherent the study year increased for all conditions. There was an 8.9% increase in the adherence rates between the Without-AI and With-AI groups for diabetes (P<.00001), 5.5% increase for hypertension (P<.00001) and 9.3% increase for statins (P<.00001).

Without-AI and With-AI sample sizes were 267,734 and 281,626 respectively for diabetes, 836,434 and 880,036 for hypertension, and 907,617 and 1,002,127 for statins.

Study Year adherence rates regardless of patient's qualification in prior-year
AI targeting resulted in a 4.7% to 8.9% increase in achieving adherence in the following year among prior year eligible patients and newly enrolled patients.

Without AI targeting, only 73.3% of diabetes patients were adherent in the study year; however, with AI targeting, 79.6% of diabetes patients were adherent. Without AI, only 79.3% of hypertension patients are adherent in the study year, compared to 83.7% of those in the group targeted with AI. Lastly, without AI, 76.3% of statin patients were adherent in the study year, compared to 83.6% of those in the group targeted with AI.

Figure 8: Proportion of All Prior-Year Patients + New Patients who Achieved Adherence by the Study Year-End
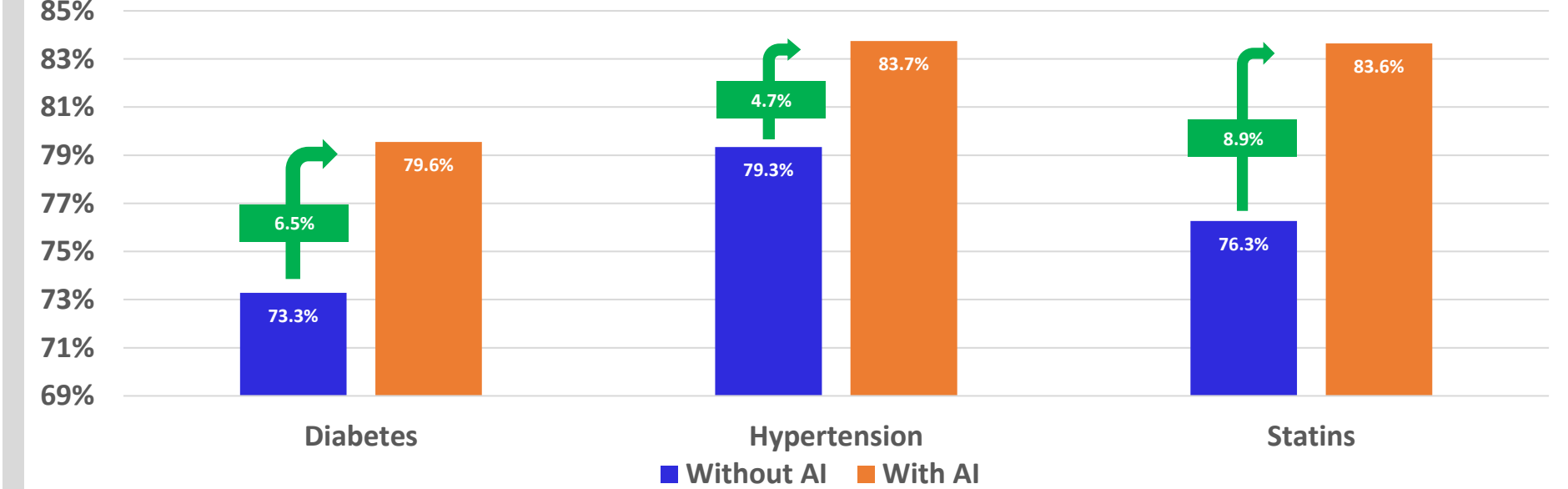
Figure 8 shows that in the group with the AI targeting program, the proportion of patients that were adherent by year-end increased for all conditions, overall. There was a 6.5% increase in the adherence rates between the Without-AI and With-AI groups for diabetes (P<.00001), 4.7% increase for hypertension (P<.00001) and 8.9% increase for statins (P<.00001). Because these adherence rates were calculated using Walgreens's data, and did not include some of the additional data utilized in calculating the pay-for-performance metrics, the overall adherence rates shown here are substantially lower than what is reported on by the PBM as performance on the pay-for-performance metrics. When examining the pay-for-performance metric scores (not reported here for confidentiality reasons), the With-AI group achieves similar uplifts in adherence rates compared to the Without-AI group.

Without-AI and With-AI sample sizes were 386,395 and 403,476 respectively for diabetes, 1,177,895 and 1,198,821 for hypertension, and 1,274,712 and 1,368,318 for statins.

Metrics as of 9/30 in Without-AI and With-AI groups
Prior-year non-adherent to study-year adherence and Prior-year adherent to study-year non-adherence
Prior to receiving data through the end of 2020, a similar analysis was performed using data through 9/30 of the study year. This analysis showed similar trends to the full year analysis shown earlier in this study and is included here for comprehensiveness. In the With-AI group, the proportion of prior-year non-adherent patients becoming adherent by 9/30 of the study year improved for all conditions. In patients that were previously non-adherent, there was a 22.5% increase in the adherence rates between the Without-AI and With-AI groups for diabetes (P<.00001), 15.6% increase for hypertension (P<.00001) and 19.9% increase for statins (P<.00001).

Among patients that were adherent at prior-year, the proportion that transitioned to non-adherence decreased by 29.7%, 21.7%, and 31.6% between the Without-AI and With-AI groups (diabetes P<.00001; hypertension P<.00001; statins P<.00001).
Without-AI and With-AI sample sizes were 222,971 and 240,734 respectively for diabetes, 718,766 and 762,039 for hypertension, and 747,169 and 842,443 for statins.

CONCLUSIONS

An AI-powered pharmacy-based adherence program can improve the adherence rate of non-adherent patients and limit the non-compliance rate of adherent patients. An AI-powered pharmacy-based adherence program can also improve the adherence of "New" patients. Leveraging AI predictions to identify the most valuable portions of the population to target and intervene across multiple channels drives significant uplift across large subpopulations of chain retail pharmacies. The With-AI population outperformed the Without-AI population at converting non-adherent patients to become adherent. Among diabetes patients, 23.9% more of the prior-year noneadherent patients converted to adherence in the study year in the With-AI than in the Without-AI group; for hypertension 17.9% more converted to adherence in the With-AI group; for statins 25.3% more converted to adherence in the With-AI group.

The With-AI group also outperformed the Without-AI group at preventing adherent patients from becoming non-adherent. The rate at which prior year adherent patients converted to non-adherence in the study year was 26.3% less in the With-AI group than the Without-AI group for diabetes; 21.1% less for hypertension, and 31.2% less for statins.

The With-AI group also outperformed the Without-AI group at promoting adherence among new patients. For patients new in the study year, the With-AI group achieved adherence by year end for 6.5% more diabetes patients than the Without-AI group, 4.7% more for hypertension, and 8.9% more for statins.

When considering all patients in the study year (combining prior year adherent, prior year non-adherent, and new patients), the AI group achieved a 6.5% higher adherence rate than the non-AI group for the diabetes patients, 4.7% higher adherence rate for hypertension patients, and 8.9% higher adherence rate for statins.

REFERENCES

1. Centers for Medicare & Medicaid Services (CMS), Fact Sheet Part C and D Star Ratings. October 2020; https://www.cms.gov/files/document/2021starratingsfactsheet-10-13-2020.pdf

SPONSORSHIP

AllazoHealth
Walgreens

This study was conducted in compliance with HIPAA's Privacy Rule regarding research.