SUPPLEMENTARY MATERIALS

Economic and utilization outcomes of medication management at a large Medicaid plan with disease management pharmacists using a novel artificial intelligence platform from 2018 to 2019: a retrospective observational study using regression methods

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Supplementary Table 1: Comparison of MTM, CMM-Wrap, and CMM

INTRODUCTION

Characteristic	MTM	CMM-Wrap	CMM
Conduct a comprehensive medication review therapy review to identify all medication-related problems	✓	✓	✓
Confirm medication-related problems including assessment, point-of-care testing, medication-related labs	✓	✓	✓
Assess ALL medications and medical conditions		✓	✓
Develop individualized medication care plan to address medication-related problems and ensure attainment of treatment goals	✓	✓	✓
Add, substitute, discontinue, or modify medication doses	✓	✓	✓
Generate complete medication record	✓	✓	✓
Document care delivered and communicate to health care team	✓	✓	✓
Ensure care is coordinated with other health care providers	✓	✓	✓
Provide follow-up care in accordance with treatment-related goals		✓	✓
Requires collaborative practice agreement between pharmacist and physician			✓
Pharmacist is embedded in care team			✓
Face-to-Face with ability to perform physical assessment			✓
Telephonic only		✓	

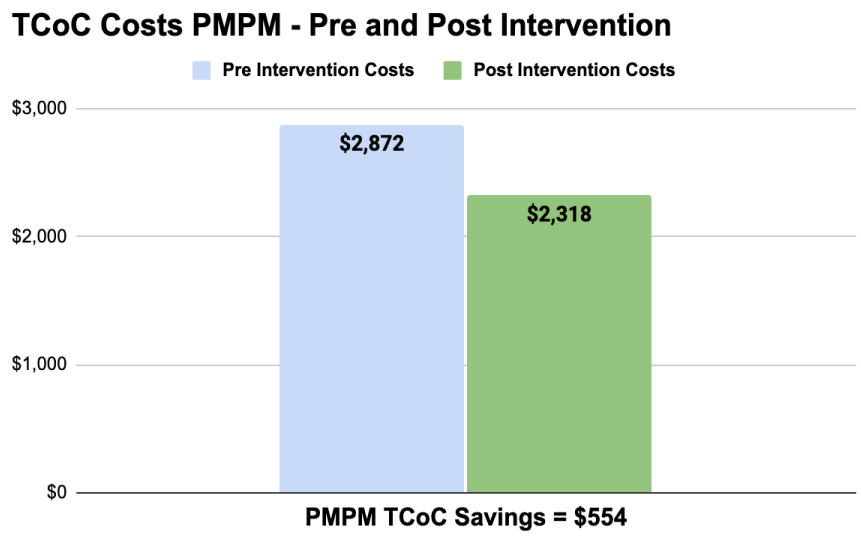
Supplementary Table 1 shows a comparison of MTM, CMM-Wrap, and CMM. This table comparing MTM and CMM is based on Steve Chen's Comprehensive Medication Management Framework[1]. We have added characteristics that further differentiate CMM from CMM-Wrap. The primary differentiators show that unlike CMM, CMM-Wrap

[1] https://www.ihs.gov/california/tasks/sites/default/assets/File/GPRA/BP2018-ComprehensiveMedicationMgmt_Chen.pdf

achieves its results without the overhead of the pharmacist fully embedded with the care team, a collaborative practice agreement or face-to-face interventions. Yellow background highlights the differences between MTM and CMM. The green background highlights the differences between CMM and CMM-Wrap. These differences make it much easier to provide interventions to a larger population without the difficulties of face-to-face meetings.

Supplementary Figure 1: Total Costs of Care

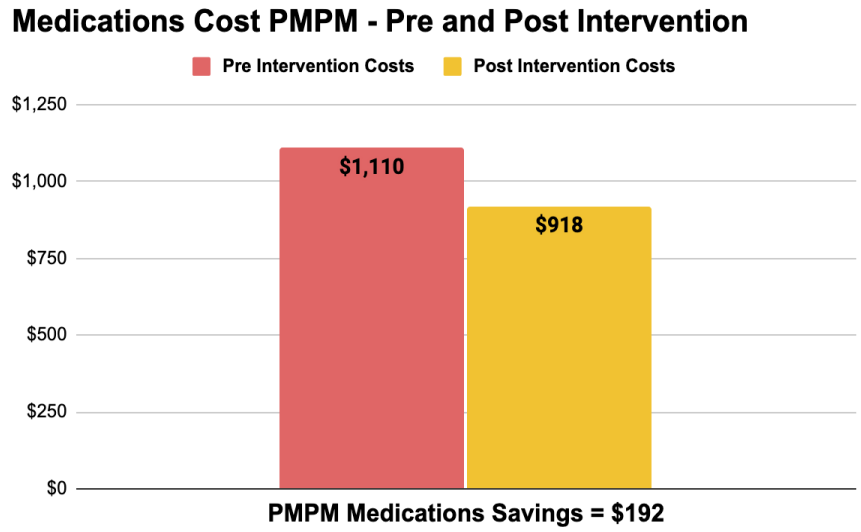
Results – REGRESSION ANALYSIS DETAILS – TCOC SAVINGS



Supplementary Figure 1 depicts the changes to the mean Total Cost of Care (TCoC) and compares the pre intervention costs to the reduced post intervention costs by applying the observed regression effect to the pre intervention costs.

Supplementary Figure 2: Cost of Medications

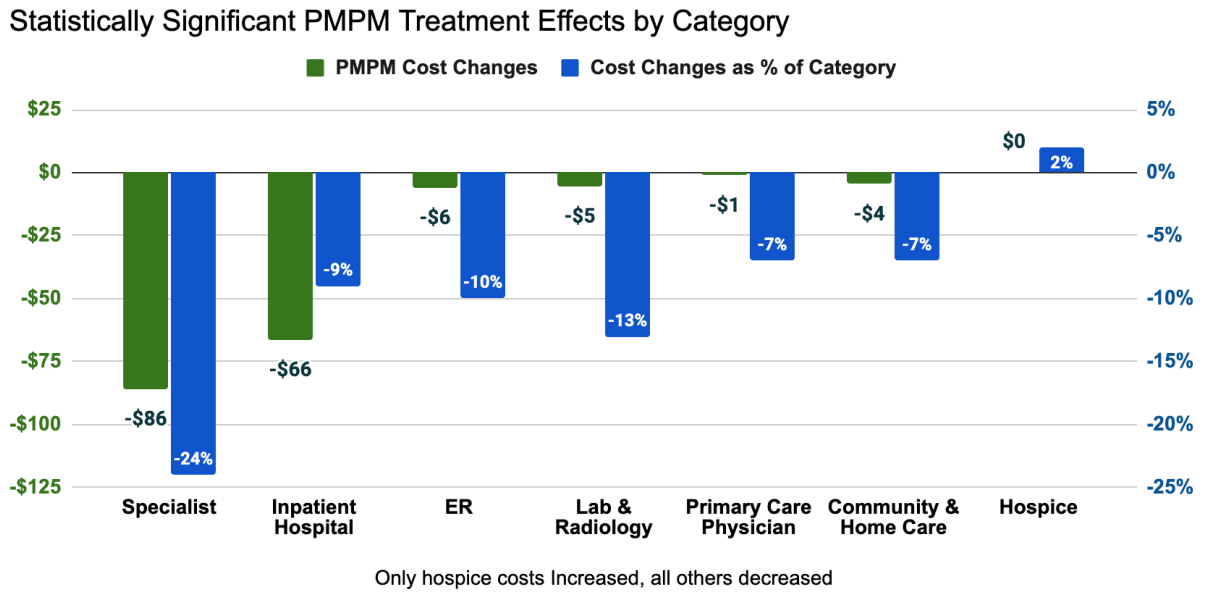
Results – REGRESSION ANALYSIS DETAILS – MEDICATION SAVINGS



Supplementary Figure 2 depicts the pre intervention mean medication cost and the result of applying the observed regression effect to the pre intervention cost.

Supplementary Figure 3: PMPM by Category

Results - EXPLORATIONS FOUND ADDITIONAL STATISTICALLY SIGNIFICANT CORRELATIONS



Supplementary Figure 3 shows an exploration which separately regressed each cost category that comprised the TCoC. Treatment effects show the % of change and the associated average PMPM cost savings. This chart depicts cost changes in green (from applying the observed regression effects to the pre mean cost for the category) and related % changes in blue. All of these results are statistically significant.

Supplementary Table 2: Potential Confounders Details

Results – EVALUATING POTENTIAL CONFOUNDERS

The potential impact of the Health Plan's other programs on changes in cost and utilization was assessed by adding patient participation in the programs as indicator variables in the regressions. Evaluating potential confounders showed that only the transition to Medicare (Med AB) reduced TCoC. This means that the savings reported for the Wrap program come from the Wrap program, not other programs, noting that the intent of the other programs was to provide additional services, not to save costs.

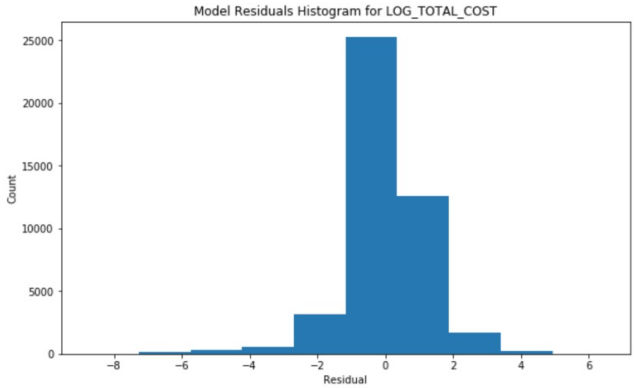
Impact of other programs - ruling out potential confounders					
Indicator Variables for participation in another Plan Program (potential confounders)*	**P-Values**	**Treatment effect as % of TCoC****	**# Members**	**# Member Util Months**	**Avg # Months Overlap**
BH - Behavioral Health Integration & Complex Care Initiative	0.001	23%	309	2,908	9
CA - Community Based Adult Services *	0.225	13%	66	805	12
HHP - Health Homes Program	0.014	13%	282	823	3
INS - In-Home Support Services	0.001	38%	762	13,678	18
Landmark - in-home medical care and education	0.001	33%	460	7,307	16
LI - Medicare Low Income Subsidy	0.002	49%	38	176	5
LTC Resident - Residing in a long-term care facility	0.001	204%	69	854	12
LTC Services - Long-term care facility *	0.218	23%	18	151	8
Med AB - Medicare Part A and Part B (costs were transitioned to Medicare)	0.001	-90%	120	594	5
MyPath - an ongoing home-based program for patients diagnosed with an advanced disease *	0.757	2%	60	455	8
PAIN - Pain Management Center of Excellence	0.001	207%	20	85	4
ToC - Transitions of Care Management	0.001	70%	35	112	3
* indicates P-Values are not statistically significant. ** TCoC = Total Cost of Care Total Members = 2,150. Total utilization months = 43,993.					

Supplementary Figure 4. Goodness of Fit

Methods – STATISTICAL METHODS

The goodness of fit for the mixed regression with respect to the source data is evidenced by a normal distribution of residuals. Supplementary Figure 4 is a histogram of residuals for TCoC, demonstrating a normal distribution.

Distribution of Residuals for TCoC in logarithmic space



Normal Distribution on the residuals implies the model is a good fit for the data. Mixed Effect Regression Models do not have R-squared values nor a consensus on a statistical calculation for goodness of fit.

An Example Intervention

Methods - CLINICAL WORKFLOW

With all available data visible and actionable, the intervention takes on the form of an investigation. The team believes this approach is a key to the observed level of success. Below a PharmD member of the Clinical Team describes a typical intervention.

“First, I selected a patient, Maria (not her real name), from the intervention pool and started a pre-assessment work-up focusing on demographics, medication fills, laboratory history and prior interventions. Next an MA phoned Maria and used motivational interviewing techniques supported by the AI Platform to conduct an initial health and adherence review in the MedRec section.

The MA transferred Maria to me and I noted that Maria’s adherence and refill history showed she had been taking Lisinopril consistently, however she recently picked up and was also taking a new combination medication that includes Lisinopril. I switched into investigator mode. It's conceivable the provider changed her to the combination to help with her hypertension and forgot to discontinue the monotherapy. I see that Maria’s labs and vitals show that she has renal issues and hyperkalemia which could be from the duplicate therapy but could also be due to other medications.

I turn my attention to the Maps & Action Plan section (seen in image above) where I see at a glance all medication regimen issues such as contraindications, precautions, additive side effects, drug-drug interactions and duplicate therapies. My search for “hyperkalemia” revealed Lisinopril to be the likely culprit, the result of additive side effects.

I checked the other maps and found that the Duplicate Therapy map visually reveals the two medications as duplicative. So informed, I confidently marked Lisinopril to be discontinued, adding it to the action plan.

The Maps & Action Plan automatically updated, showing the changes in risk in the After section. In the finalize section I mark the discontinuation for inclusion in the provider report along with the relevant labs and evidence and my reasoning to discontinue the Lisinopril. I find that this level of detail helps the provider understand and adopt my recommendations.”