Rx for Success: The Game-Changing Role of Pharmacists in Diabetes Quality Measures

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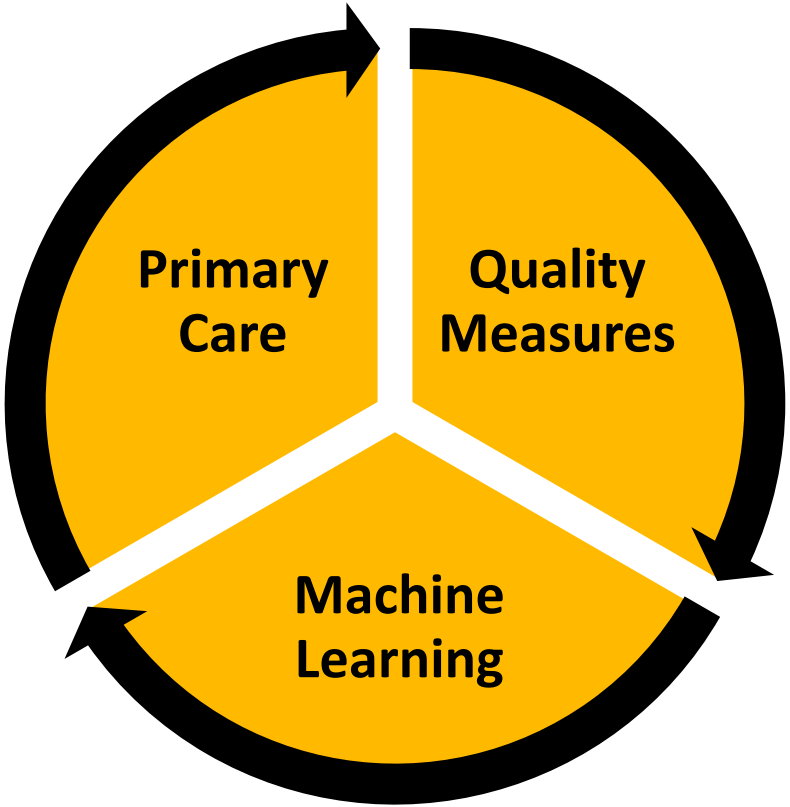
Disclosures

1. I am a person who stutters.

2. All research presented was conducted while attaining my Ph.D. at Virginia Commonwealth University and was supported in part by a **grant** from the American Foundation for Pharmacy Education (AFPE).

3. The research and findings presented in this document are solely the outcome of academic inquiry and are in no way associated with or influenced by my professional role at the National Pharmaceutical Council (NPC).

Setting the stage



Background – Primary Care in the United States

What can help alleviate this shortage?

Predicted shortage of between 17,800 and 48,000 primary care physicians

Americans made nearly 900 million office-based visits, with approximately 440 million (51.2%) being primary care visits.

Average family medicine appointment wait time for new patients was **19.5 days**

2014 — **2017** — **2018** — **2020** — **2034**

50%

Average family medicine appointment wait time for new patients was **29.3 days**

United States currently has 1 primary care physician for every **1,450 people**.

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Background – Pharmacist Role in Chronic Disease Management

Numerous randomized control trials (RCTs) have shown that through involvement of pharmacists in the patient care team for chronic disease management, physician/pharmacist collaborations have led to:

BP Control

DM Control

compared to usual care.

Simpson et al. 2011.

Carter et al. 2015.

Edelman et al. 2010.

Rothman et al. 2005.

Scott et al. 2006.

Santschi et al. 2014.

Background – Pharmacist Role in Chronic Disease Management

Collaborative Practice Agreement (CPA)

Can be **highly variable**. Logistics and scope of practice are defined in state level legislation.

August 17, 2023, Delaware became the 50th state pass legislation that allows pharmacists and physicians to enter into CPAs w/ **drug therapy management services.**

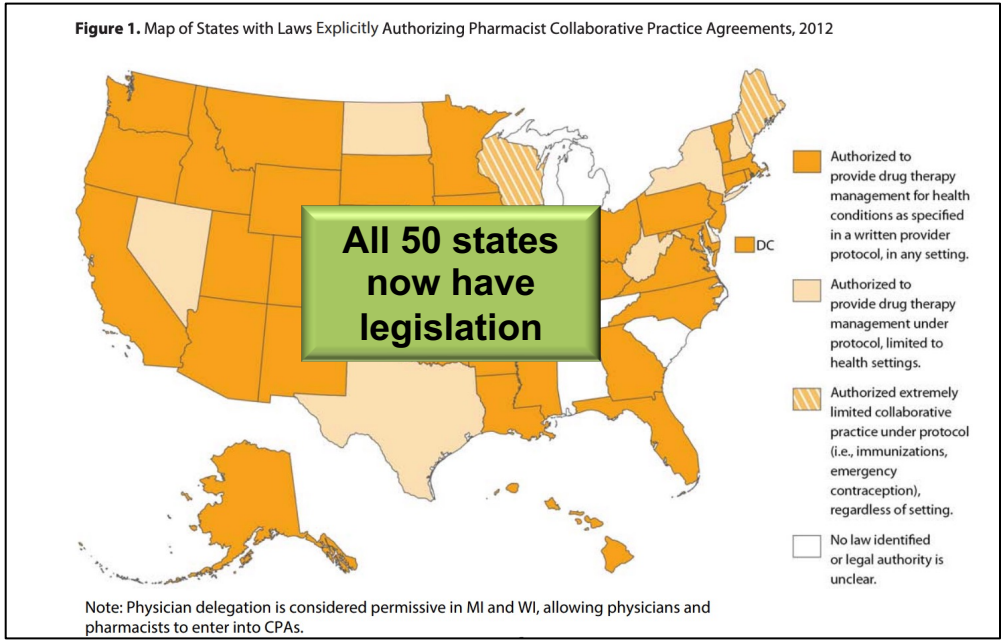


Image: 2012, CDC, Collaborative Practice Agreements and Pharmacists' Patient Care Services

Background – Pharmacist Role in Chronic Disease Management

Collaborative Practice Agreements (CPA)

Carter et al. 2015.
CAPTION Study

Goal: to improve blood pressure (BP) control.

Cluster-randomized; 9-month RPh vs. 24-month RPh vs. usual care

RPh Intervention: Care plan creation for patients, drug therapy recommendations

Edelman et al. 2010.

Goal: to improve blood pressure (BP) and blood glucose + HbA1c.

Patients at the VA, group medical clinic intervention vs. usual care

RPh Intervention: Care plan creation for patients, drug therapy changes, lifestyle modifications

Background – Quality Metrics in United States

Fee-for-service

↓ Gradual shift

Value-based payment model

!! **Quality of care**

Quality Measures?

Optimal patient and population health outcomes guide reimbursement by payers to health care systems by the achievement of pre-established performance measures.

NCQA → HEDIS → CMS

> 90 quality measures

- Effectiveness of Care
- Experience of Care
- Access and Availability of Care
- Utilization
- Health Plan Descriptive Information
- Measures reported via EHRs

Relate to many chronic conditions

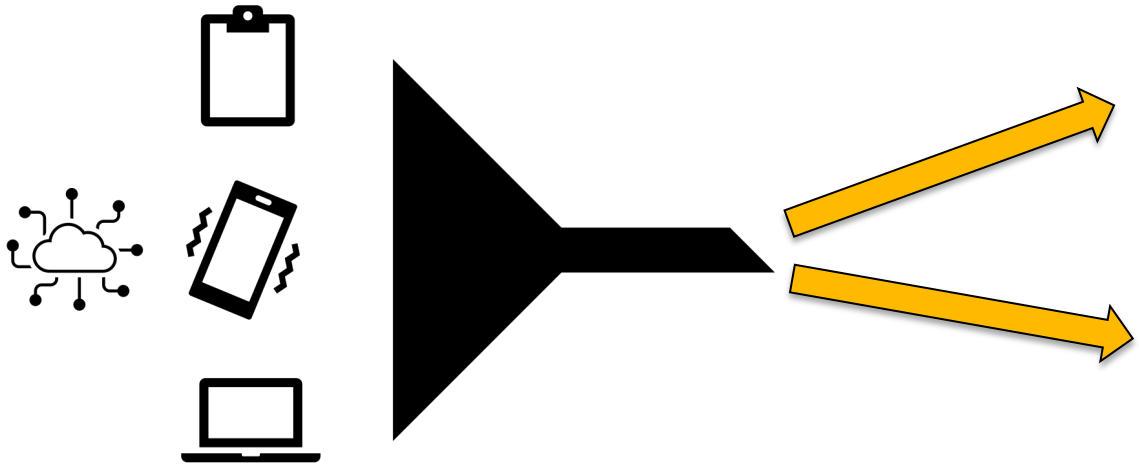
NCQA: National Committee for Quality Assurance;
HEDIS: Healthcare effectiveness data and information set;
CMS: Centers for Medicare & Medicaid Services;

Background – Quality Metrics in Virginia

Goal	Measure HEDIS: Comprehensive Diabetes Care	2016 Baseline Rate (%)	2019 Aggregate Rate* (%)
Comprehensive management of diabetes **Virginia Medicaid**	Hemoglobin A1c (HbA1c) Testing	87.37	86.33
	HbA1c Poor Control (>9.0%):	40.76	50.94
	HbA1c Control (<8.0%):	51.87	41.47
	Eye Exam (Retinal) Performed:	55.05	45.48
	Medical Attention for Nephropathy	91.52	88.15
	Blood Pressure Control (<140/90 mm Hg)	59.47	50.44

* To track the progress of achieving the goals and objectives outlined in the 2017–2019 Quality Strategy, DMAS tracked the aggregate annual results of contractual performance metrics that aligned with the performance measures included in the Quality Strategy to measure improvement.

Artificial Intelligence in Health Care



Efficiency

Acceleration and automation of repetitive tasks.

Insights

Better decision intelligence, providing data on **best** medication for the **right** patient.

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Artificial Intelligence in Health Care

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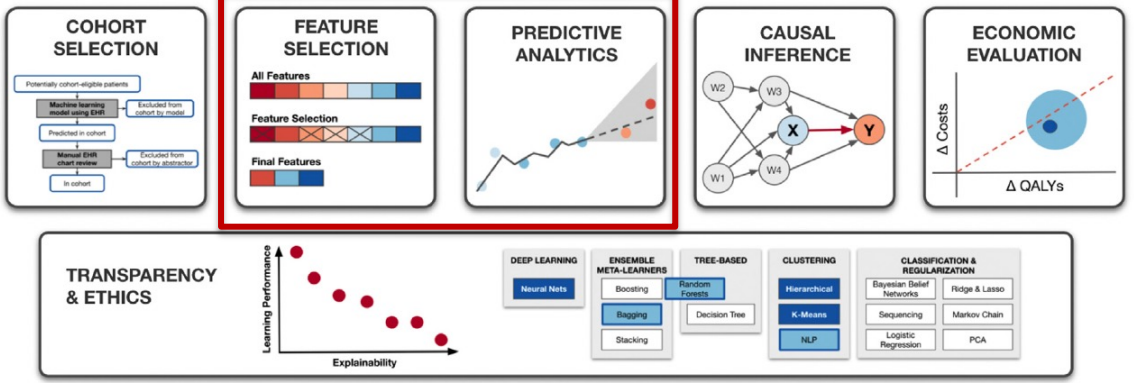
Journal homepage: www.elsevier.com/locate/jval

ISPOR Report

Machine Learning Methods in Health Economics and Outcomes Research—The PALISADE Checklist: A Good Practices Report of an ISPOR Task Force

William V. Padula, PhD, Noemi Kreif, PhD, David J. Vanness, PhD, Blythe Adan
Federico Felizzi, PhD, MBA, Pall Jonsson, PhD, Maarten J. IJzerman, PhD, Atul

Figure 1. Conceptual diagram of machine learning applications in HEOR.



HEOR indicates health economics and outcomes research; NLP, natural language processing; PCA, principal component analysis; QALY, quality-adjusted life-year.

CE Question #1

Which of the following best describes the role of a pharmacist under a Collaborative Practice Agreement (CPA) within an interprofessional health care team?

A) The pharmacist is only responsible for dispensing medications as prescribed by physicians and has no role in patient management.

B) The pharmacist can initiate, modify, or discontinue medication therapy for a patient in accordance with the CPA, allowing for a more integrated role in the patient's health care.

C) The pharmacist exclusively manages insurance claims and billing, without direct involvement in patient care.

D) The pharmacist is responsible for diagnosing medical conditions and directly treating patients without the need for a physician's approval.

Aim – To assess quality measure achievement among patients who received clinical pharmacy services and those who did not.

Retrospective, observational, cohort study

Electronic health record (EHR) data from outpatient clinics of a medical group in VA

Dataset was **Propensity Score Matched** (1:2)
CG: Standard Care
IG: Standard Care + Pharmacist

Methods – Inclusion Criteria

Intervention Group (IG)

New patients seen by a pharmacist at a local health system's primary care clinics

Time period: **Jan. 1, 2019, to Dec. 31, 2019**

Received **Disease state management (Diabetes)**

Performed under a **CPA**, Includes medication management, access, education. Patient had to receive a physician referral.

Comparator Group (CG)

New patients who received care at one of the comparator group clinics (no pharmacist)

Time period: **Jan. 1, 2019, to Dec. 31, 2019**

Recorded measurement for HbA1c ≥ 7% **at any point** during the study period.

Propensity Score Matching Results, Diabetes Subset

Variable	Intervention Group	Comparator Group	Standardized Difference	P value		Intervention Group	Comparator Group	Standardized Difference	P value
	Pre-Match					1:2 Match			
Number of Patients	464	2,200				431	832		
Age; mean (SE)	57.8 (0.63)	59.7 (0.30)	-0.14	0.0070		57.5 (0.65)	57.0 (0.47)	0.03	0.6183
Female; n (%)	257 (55.4)	1,132 (51.5)	0.08	0.1232		237 (55.0)	484 (56.2)	-0.02	0.6922
Race									
White; n (%)	221 (47.6)	1,160 (52.7)	-0.10	0.0458		195 (45.2)	391 (45.4)	0.00	0.9685
Black; n (%)	202 (43.5)	841 (38.2)	0.11	0.0333		199 (46.2)	387 (44.9)	-0.03	0.6639
Other; n (%)	41 (8.8)	199 (9.1)	-0.01	0.8862		37 (8.6)	84 (9.7)	0.04	0.4996
Medicare; n (%)	174 (37.5)	940 (42.7)	-0.11	0.0380		159 (36.9)	310 (36.0)	-0.02	0.7435
Commercial; n (%)	172 (37.1)	800 (36.4)	0.01	0.7743		160 (37.1)	327 (37.9)	-0.02	0.7763
Charlson Comorbidity Index; mean (SE)	1.4 (0.04)	1.9 (0.03)	-0.49	<.0001		1.5 (0.03)	1.4 (0.03)	0.10	0.0268
Diabetes; n (%)	431 (92.9)	2,200 (100.0)	-0.39	<.0001		431 (100.0)	862 (100.0)	0.00	-
Number of Medications; mean (SE)	9.8 (0.23)	9.1 (0.10)	0.15	0.0023		10.0 (0.24)	9.6 (0.19)	0.08	0.2217
HbA1c Baseline Value; mean (SE)	9.9 (0.09)	8.6 (0.04)	0.66	<.0001		9.9 (0.09)	9.7 (0.08)	0.11	0.0840

Dataset Overview

1,263 patients seen in 2019

Well-balanced

(i.e., age, race, sex, insurance status, disease severity)

23 variables assessed (demographics, comorbidities, lab values)

Diabetes Related Quality Measures

Diabetes Care
Criteria: Adults, 18-75 years of age, diagnosis of diabetes

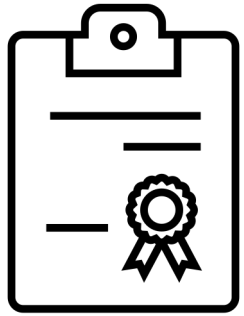
(1) HbA1c control (<9.0%) by end of the calendar year

(2) HbA1c control (<8.0%) by end of the calendar year

(3) HbA1c control (<7.0%) by end of the calendar year

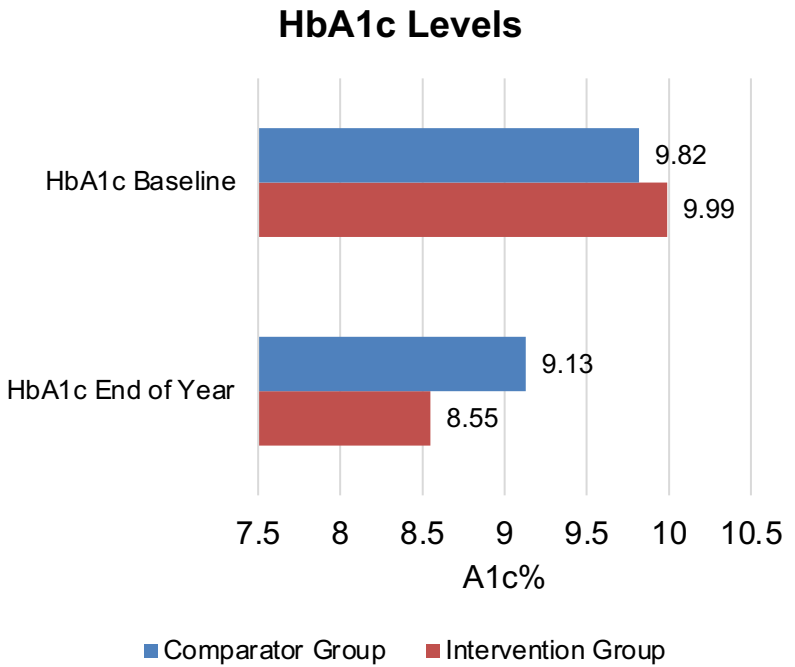
(4) HbA1c poor control (>9.0%) by end of the calendar year

(5) BP control (<140/90 mmHg) by end of the calendar year *



* Among patients with diabetes; CMS and HEDIS Quality Measures;

Results, Diabetes Quality Measures



Quality Measure	Study Group	Frequency Achieved	Percent	p-value
HbA1c Control < 9.0%	IG	250	63.13	**<.0001**
	CG	443	55.86	
HbA1c Control < 8.0%	IG	174	43.94	**<.0001**
	CG	307	38.71	
HbA1c Control < 7.0%	IG	86	18.94	**<.0001**
	CG	75	10.84	
HbA1c Poor Control > 9.0%*	IG	136	34.34	**<.0001**
	CG	336	42.37	
Blood Pressure Control <140/90 mmHg	IG	292	73.74	**0.0355**
	CG	540	68.10	

* Inverse Measure

Results, Diabetes Quality Measures

Goal	Measure HEDIS: Comprehensive Diabetes Care	2019 Aggregate Rate, VA (Medicaid) (%)	2019 Wagner et. al, VA (Medicaid, Medicare, Commercial) (%) Usual Care	2019 Wagner et. al, VA (Medicaid, Medicare, Commercial) (%) Intervention
Comprehensive management of diabetes	HbA1c Poor Control* (>9.0%):	50.94	42.37	**34.34**
	HbA1c Control (<8.0%):	41.47	38.71	**43.94**
	Blood Pressure Control (<140/90 mm Hg)	50.44	68.10	**73.74**

* Inverse Measure; VA: Virginia

Logistic Regression (+ Random Effects)

HbA1c Control (<9.0%)

ROC 0.84

Variable	aOR	95% CI
Study Group (ref. CG)	4.17	(2.46, 4.05)
Sex (ref. Females)	1.58	(1.15, 2.19)
Index Date Quarter (Q4 vs. Q1)	0.17	(0.10, 0.30)
Age	1.03	(1.01, 1.05)
# Chronic Medications	0.95	(0.92, 0.98)
Charlson Comorbidity Index	0.76	(0.59, 0.98)
Baseline HbA1c Value	0.54	(0.49, 0.60)
Baseline SBP Value	1.02	(1.00, 1.03)

Only displaying significant results.

Patients who received care with a pharmacist were **4.2 times more likely** to achieve HbA1c Control compared to patients in the comparator group.

320% higher chance

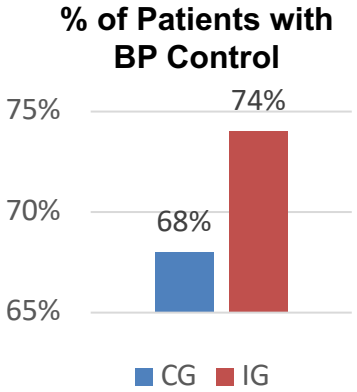
Quality Measures are assessed at the **end of the calendar year**

HbA1c: Hemoglobin A1c, aOR: Adjusted Odds Ratio, CI: Confidence Interval
SBP: Systolic Blood Pressure, CG: Comparator Group

Logistic Regression (+ Random Effects)

BP Control (<140/90 mmHg)

ROC 0.76



Variable	aOR	95% CI
Study Group (ref. CG)	1.53	(1.03, 2.27)
Race (Black vs. White)	0.66	(0.49, 0.90)
Index Date Quarter (Q4 vs. Q1)	0.49	(0.31, 0.77)
Baseline SBP Value	0.95	(0.94, 0.96)

Only displaying significant results.

Patients who received care with a pharmacist were **1.5 times more likely** to achieve BP Control compared to patients in the comparator group.

50% higher chance

Quality Measures are assessed at the **end of the calendar year**

SBP: Systolic Blood Pressure, aOR: Adjusted Odds Ratio,
CG: Comparator Group, CI: Confidence Interval

The “So What”

Novel study and scale

- One of the first studies to assess impact of pharmacists on quality measure achievement, specifically at the **end of the calendar year**, in patients with diabetes.

Pharmacist involved care = Higher rate of QM achievement

- Across all quality measures, pharmacist-involved care teams consistently **outperformed** standard care.

Quantifies impact of pharmacists

- Current literature says the same thing "Pharmacists improve diabetes and hypertension control". We assessed this with real-world data and quantified it.
- Patients seen by a pharmacist are **3.8 to 4.8 times** more likely to have HbA1c control (dependent on A1c cutoff).

Examination of other significant covariates

Index Date Quarter

- Assesses **temporal** relationship between when the patient was seen and the end of the year.
- Patients seen in Q4 were **83% less likely** to have A1c ≤9% by end of calendar year, compared to patients seen in Q1.

Should providers be penalized for patients who visit their clinic, uncontrolled, late in the year?

Baseline HbA1c level, comorbidity index, and # of chronic meds matter

- For every 1% increase in the baseline HbA1c, the odds of having HbA1c control **decrease by 46.0%.**
- For every 1 additional chronic medication and CCI score at baseline, the odds of having HbA1c control **decrease by 5% and 24%**, respectively.

Polypharmacy impacts glycemic control

Managing diabetes is complex, patients are more complex

CE Question #2

What factors have been found <u>most important</u> to a patient meeting diabetes-related quality measures?

A) Baseline HbA1c measurement

B) Month/Time in which the patient was first seen

C) The receipt of care with a physician & pharmacist (interdisciplinary care)

D) All of the above

CE Question #3

Which of the following best describes the growing role of pharmacists in the context of achieving healthcare quality measures?

A) Pharmacists primarily focus on dispensing medications and have little to no influence on healthcare quality measures.

B) Pharmacists are increasingly involved in direct patient care activities, but their impact on healthcare quality measures is yet to be proven.

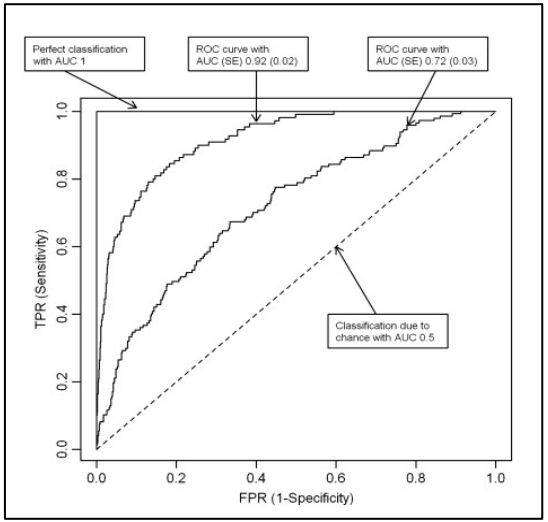
C) Pharmacists, through collaborative practice agreements, have shown significant improvements in achieving diabetes-related quality measures.

D) Pharmacists mainly contribute to healthcare quality measures by ensuring the cost-effectiveness of drug therapies.

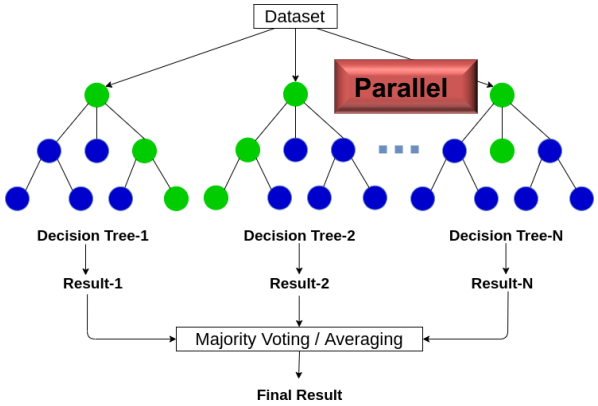
To build and compare the accuracy of predictive risk models using standard regression and machine learning algorithms.

Model Performance and Accuracy

Will split data via a 70/30 split, with 70% used to train the model and 30% used to test the model.



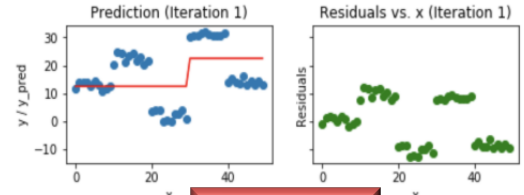
Random Forest



CARET and randomForest packages

Most highly applicable to predicting patients with high risk.

Extreme Gradient Boosting (XGBoost)



XGBOOST package

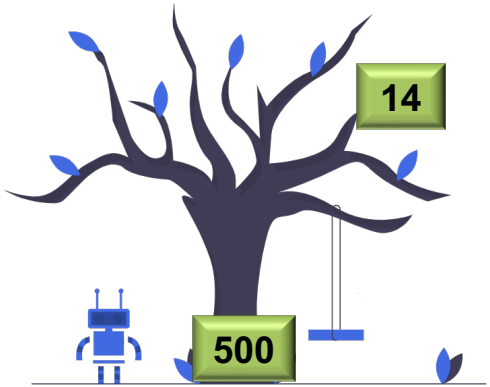
Most highly applicable with predictive tasks.

Random Forest Model

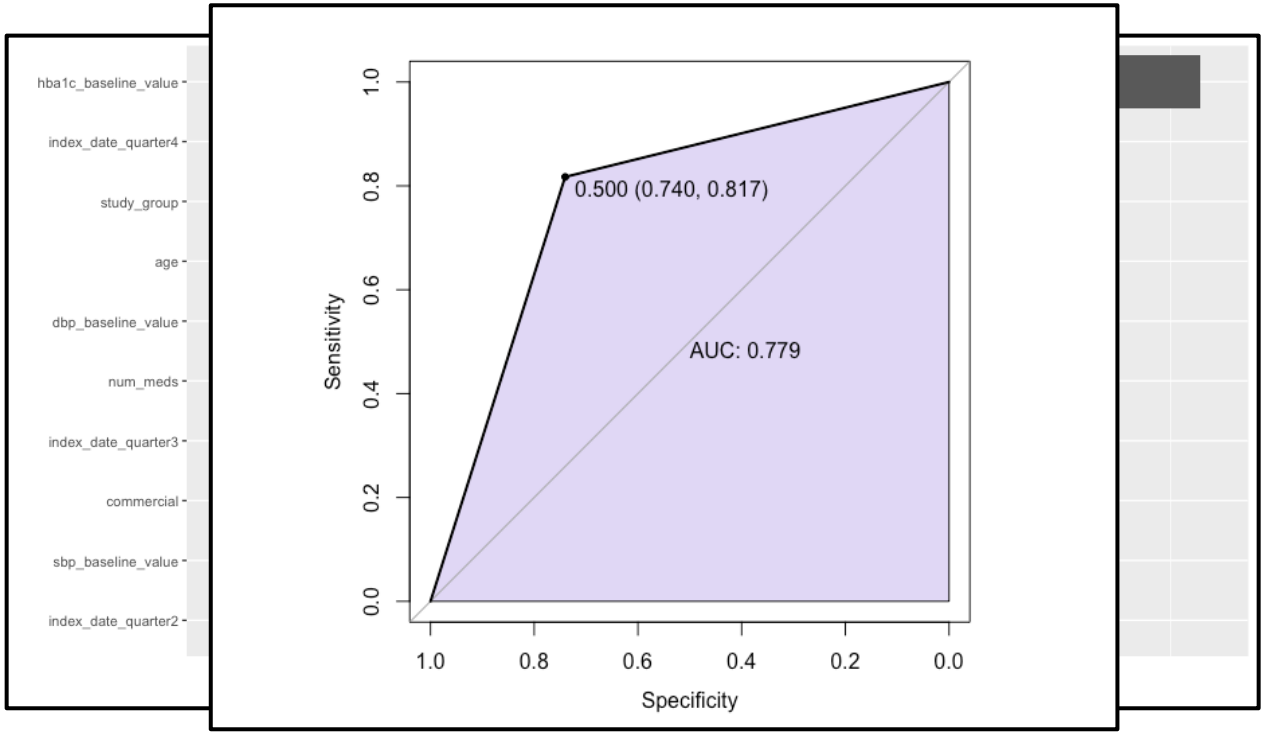
QM: HbA1c < 9%

Model Tuning

# of trees (**ntree**): 500
# of variables per tree (**mtry**): 14
Accuracy: 0.77
ROC: 0.84



Performance on test data



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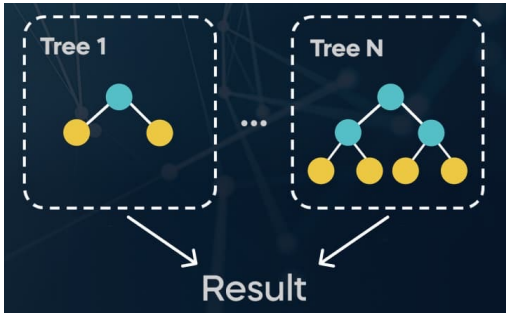
XGBoost Model

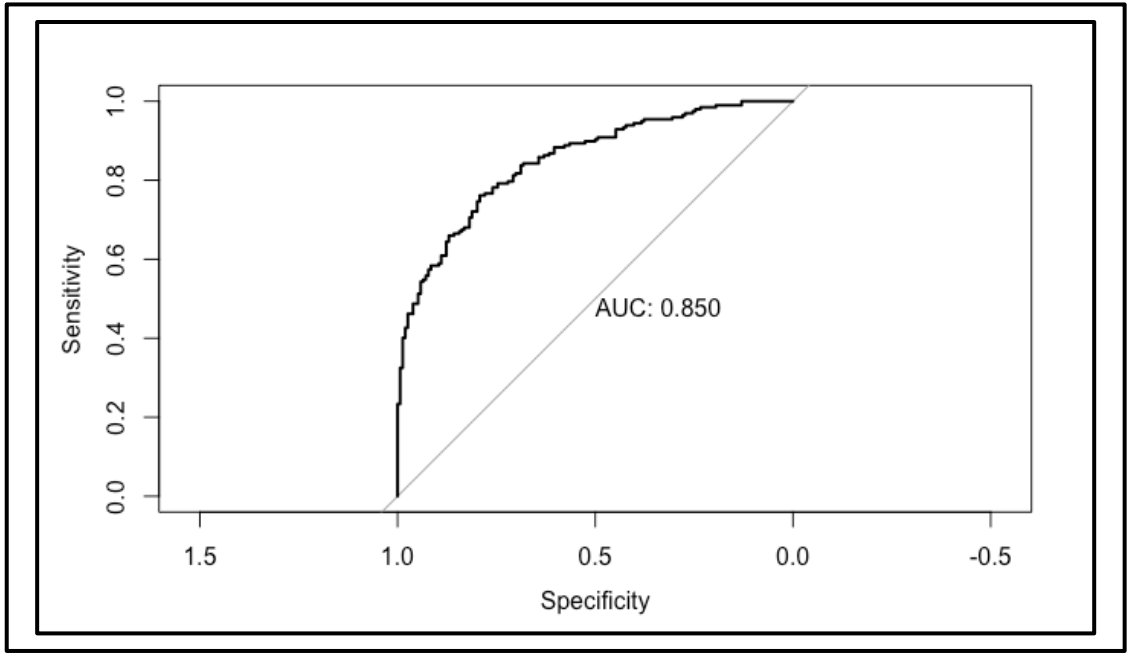
QM: HbA1c < 9%

Model Tuning

Learning Rate (**eta**): 0.15
Depth of each tree (**max depth**): 20
Number of rounds/trees (**nround**): 55
Logloss: 0.066



Performance on test data



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Random Forest Model vs. XGBoost Model

	Variable	Overall (scaled)	Overall (unscaled)
1	HbA1c_baseline_value	100	67.1486
2	index_date_quarter4	44.2072	29.3315
3	study_group	23.8452	15.5299
4	age	8.883	5.3883
5	dbp_baseline_value	5.631	3.1841
6	num_meds	5.4079	3.0329
7	index_date_quarter3	5.0884	2.8163
8	commercial	3.9303	2.0314
9	sbp_baseline_value	3.4075	1.677
10	index_date_quarter2	3.2246	1.553
11	smoking_status2	3.1711	1.5167
12	sex	2.8902	1.3263
13	cc_total	2.7512	1.2321
14	elix_obesity	2.1584	0.8303
15	race2	1.6782	0.5048
16	bp_control_2019	1.4794	0.3701
17	smoking_status3	1.4011	0.317
18	elix_depression	1.3322	0.2703
19	icd_10_chart	0.7773	-0.1058
20	medicare	0.3498	-0.3956

Feature	Gain	Cover	Frequency
HbA1c_baseline_value	0.4111	0.2682	0.1682
sbp_baseline_value	0.0892	0.1010	0.1360
dbp_baseline_value	0.0826	0.0921	0.1272
age	0.0769	0.1221	0.1316
icd_10_chart	0.0634	0.0693	0.0980
num_meds	0.0625	0.0824	0.1046
index_date_quarter4	0.0483	0.0712	0.0137
study_group	0.0416	0.0671	0.0166
sex	0.0137	0.0162	0.0218
index_date_quarter3	0.0114	0.0156	0.0144
race2	0.0114	0.0085	0.0266
commercial	0.0114	0.0067	0.0200
cc_total	0.0109	0.0116	0.0174
smoking_status3	0.0104	0.0090	0.0177
index_date_quarter2	0.0100	0.0115	0.0166
elix_obesity	0.0089	0.0099	0.0140
bp_control_2019	0.0086	0.0053	0.0129
race3	0.0086	0.0127	0.0104
smoking_status2	0.0073	0.0054	0.0107
hypertension	0.0057	0.0054	0.0115
medicare	0.0051	0.0034	0.0074
elix_depression	0.0011	0.0053	0.0026

Discussion

Model	AUC
Logistic Regression (mixed model)	0.84
Random Forest	0.78
Extreme Gradient Boosting (XGBoost)	0.85

Novel study

- 1st study to assess impact of pharmacists on quality measure achievement using **machine learning.**

Baseline HbA1c most important feature

- Found to be the **most important** variable in determining if a patient meets HbA1c quality measure.

ML Model Performance and Interpretability

- XGBoost often outperforms RF in current literature (seen here).
- XGBoost is more challenging to both visualize and tune compared to RF.
- Logistic Regression did well! Works well with EHR data.

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Conclusion

Including pharmacists in primary care clinics **significantly** improves diabetes-related quality measure achievement.

Machine learning models, notably XGBoost, affirmed these results, emphasizing the importance of baseline HbA1c and time of the patient's index date in HbA1c control.

Area of Need / Future Research

Quality measures do not always accurately reflect the quality of care provided.

Diabetes care is complex, and a snapshot measure may not wholly capture the meaningful progress a patient makes under provider care.

Example

Baseline HbA1c in Q1 2019: 12%

End of Year HbA1c 2019: 9.5%

Non-compliant with HbA1c QM <9%

There is a need for a new kind of quality measure for diabetes that accounts for patient heterogeneity.^

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^ AHRQ has been calling for this since 2013 ...

Use of AI / ML in Pharmacy Research ...

What ML method should be used?

- There are numerous ML methods that likely "fit the bill" … focus on **communication with stakeholders**.

What kind of data do you have?

- RWD: EHR vs. Claims vs. unstructured?
- Large amounts of text vs. discrete/quantitative variables?

How do we make it matter?

- 2% of ML studies that address a clinical problem are **prospective.**
- **Are clinicians going to see value in another retrospective tool?**

Future of ML Research in Health Care?

- Attain buy in from medical stakeholders.
  - Clinicians, Administrators, IT, IRB, etc.
- Communicate value of ML methods early on.
- Be patient – it takes time.

Need prospective evaluation of ML tools in health care.

- Health systems should want to improve care enough to diligently collect **AND** share more socioeconomic variables.
- With ML, more variables = more learning

There needs to be a greater willingness to focus on health disparities

CE Question #4

As the involvement of pharmacists in the direction of AI and ML in healthcare continues to evolve, which of the following statements is TRUE regarding the integration and value of ML studies?

A) There is a singular ML method that is universally recommended for all healthcare problems, and it is important to rigidly adhere to this method.

B) When determining the ML method to use, the primary emphasis should be on communication with stakeholders due to the existence of multiple ML methods that may be suitable.

C) Real-world data (RWD) sources like EHRs, claims, and unstructured data are irrelevant considerations when choosing an ML method.

D) Most ML studies addressing a clinical problem are retrospective, and clinicians universally recognize their value over prospective tools.

Rx for Success: The Game-Changing Role of Pharmacists in Diabetes Quality Measures

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