

# Quality and Cost in the True Performance Program

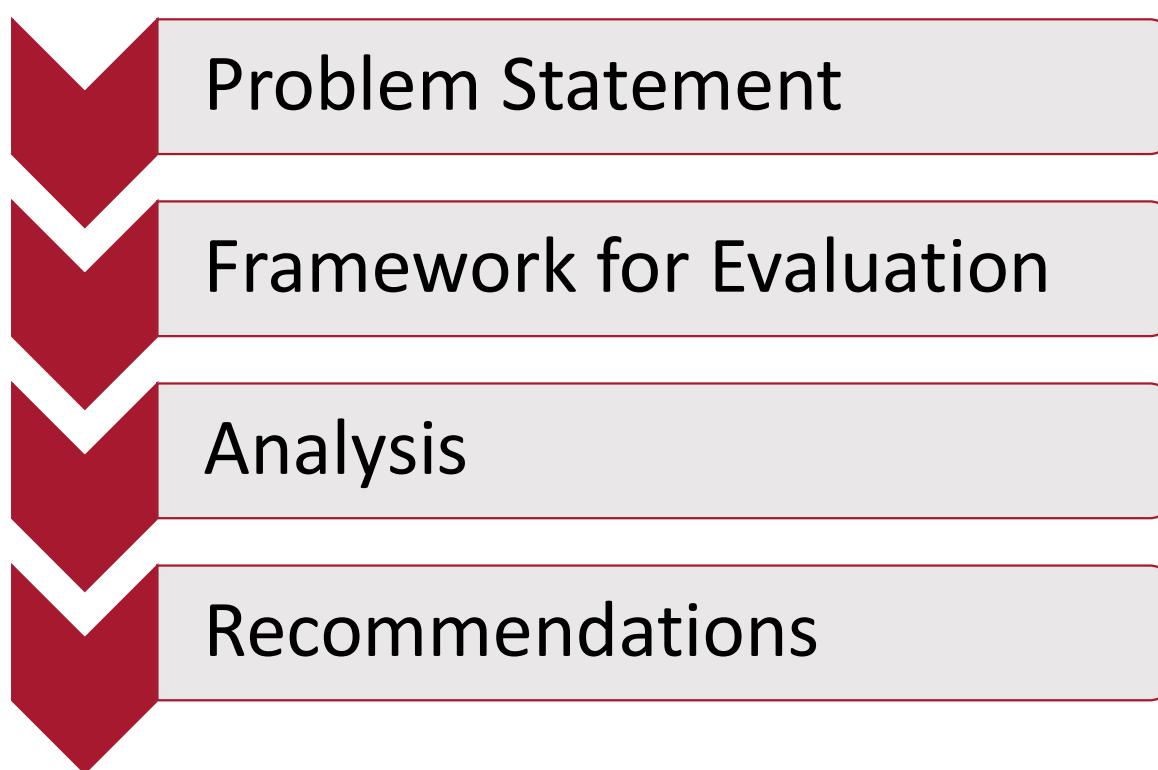
## Capstone Project 2019 – Highmark Inc

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Faculty Advisor: James F. Jordan

# Agenda

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# Objective

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Which of the quality metrics are driving the cost outcomes?



What other quality metrics could potentially be removed?



Investigate the state of value-based reimbursement programs.

# Takeaways



VBR is early in the Continuous Improvement Cycle



More closely aligned measurement



Majority of progress has been made in cost measurement



Complexity of the program inhibits physician engagement



Missing a consistent, repeatable evaluation method

# Program Evaluation Framework

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## What is it?

- Industry standard method for assessment
- Systematic approach to improve or affirm success of a program

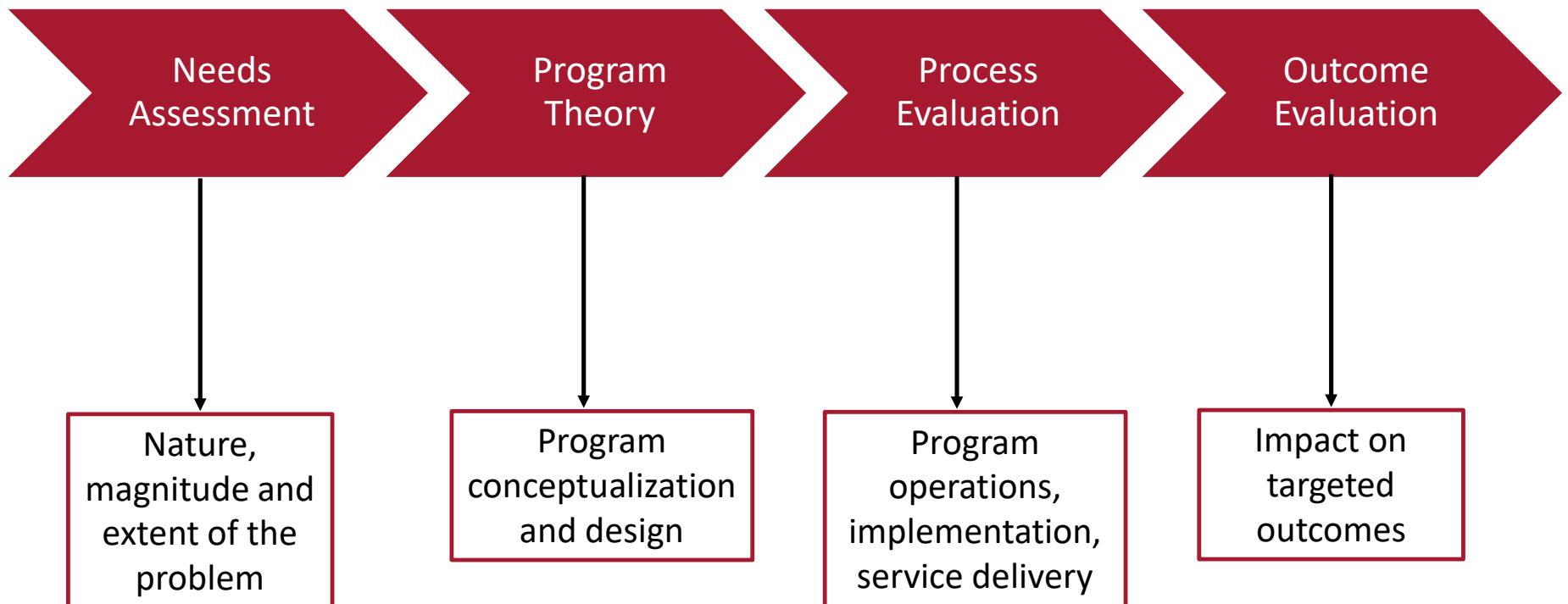


## Why did we choose it?

- Eliminate the issue of confirmation bias
- Investigate areas where a program can be improved

# Program Evaluation Framework

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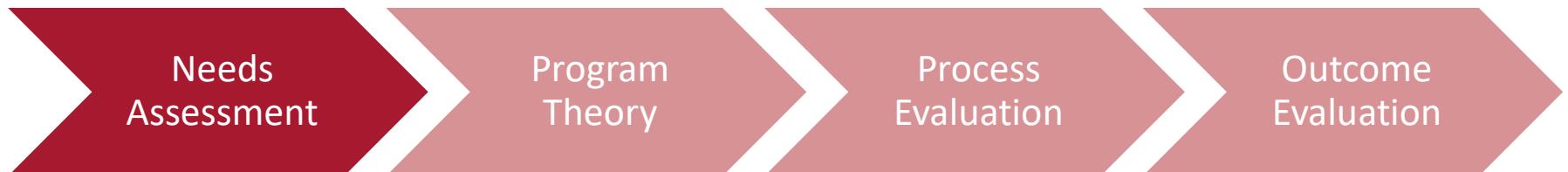
# Constraints and Limitations

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- Lack of comprehensive time series data
- Time duration of evaluation
- Lack of Provider level data who did not participate in program
- Limited access to participating providers

# Determining the Nature of the Problem

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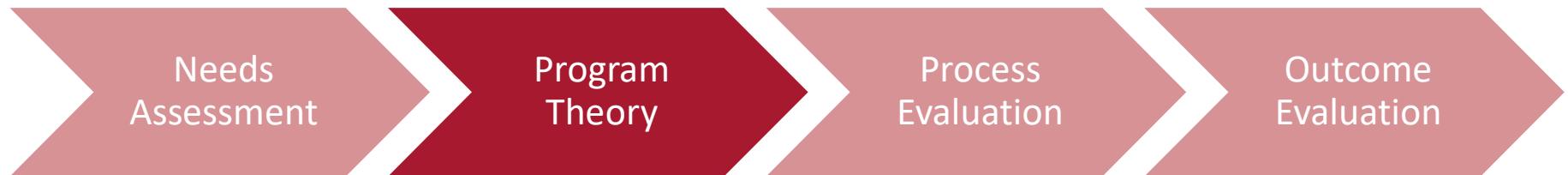
- What is the problem that the program is trying to address?
- What is the extent of the problem?
- Who is the target population?

# Problem Addressed



# Defining the Blueprint of the Program

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- Understanding the program and its components
- Intended Effect of Program
- Environmental scan

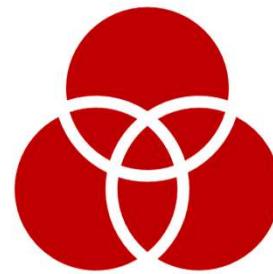
# True Performance Objectives



Supporting Primary Care Physicians (PCPs) in coordinating care, managing chronic illness, and providing preventive care.

## Improve Experience of Care

Improving Health  
of Population

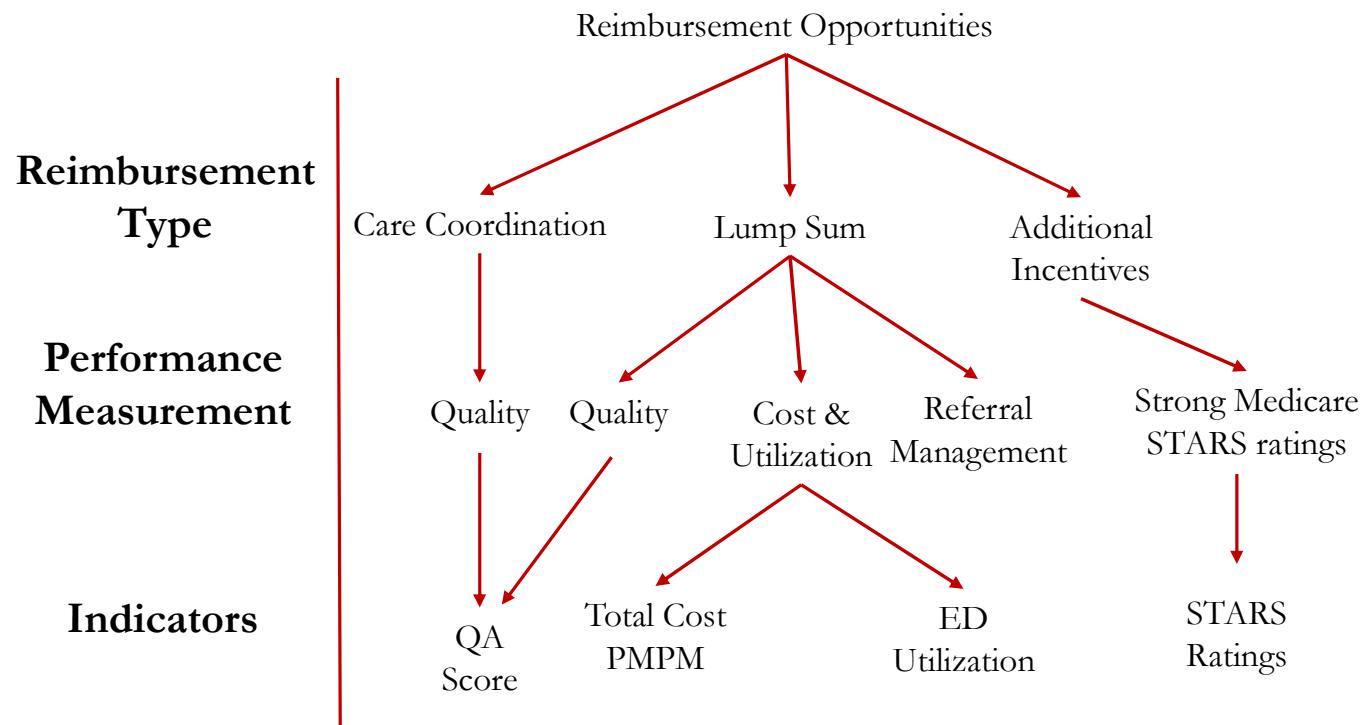


Reducing Per Capita  
Cost of Healthcare

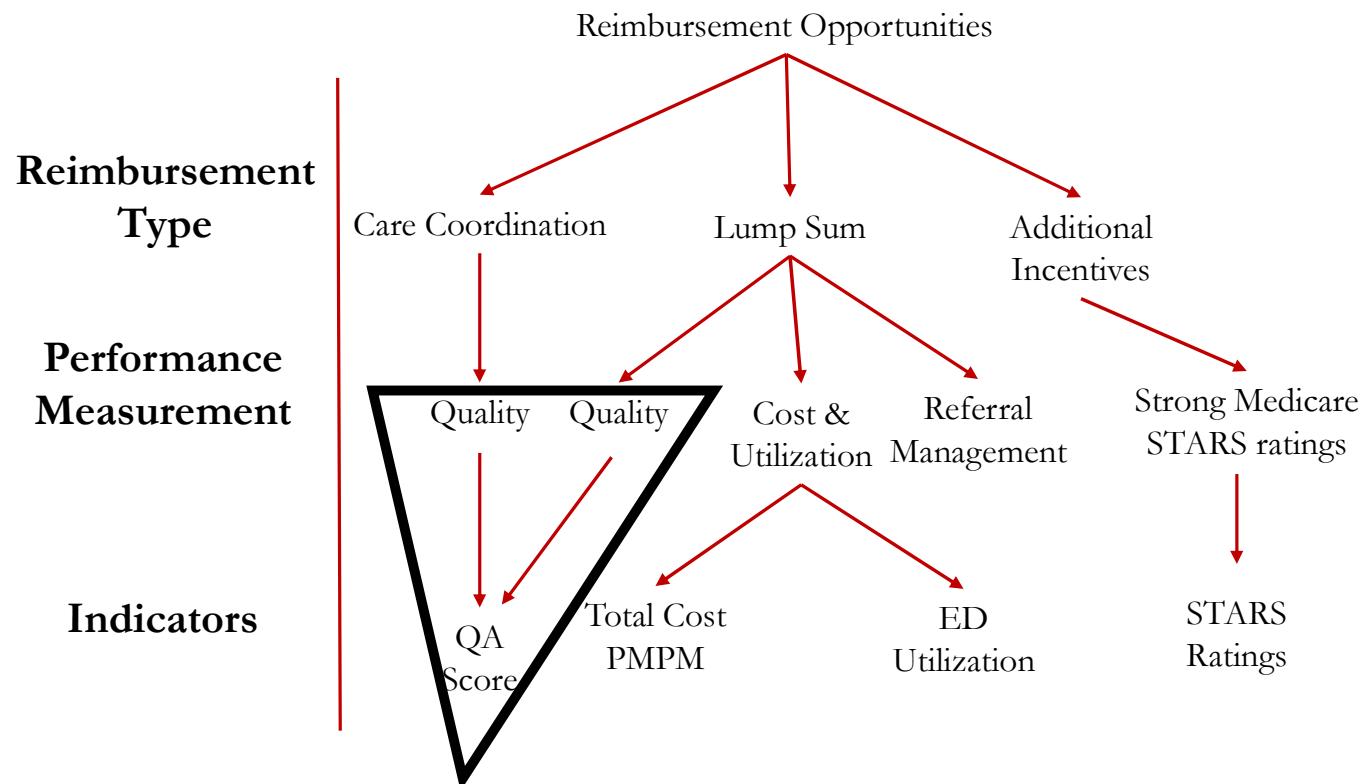
Based on IHI's (Institute of Healthcare Improvement)

“Triple Aim” of healthcare improvement

# Program Hierarchy



# Program Hierarchy



# Stakeholder Perspective



## Regulatory

Aligns with  
Medicare Plan  
STARS Ratings

## Highmark Insurance

- Reduces healthcare costs
- Reduces preventable Emergency Department visits
- Reduces readmissions and inpatient stays

## Primary Care Physicians

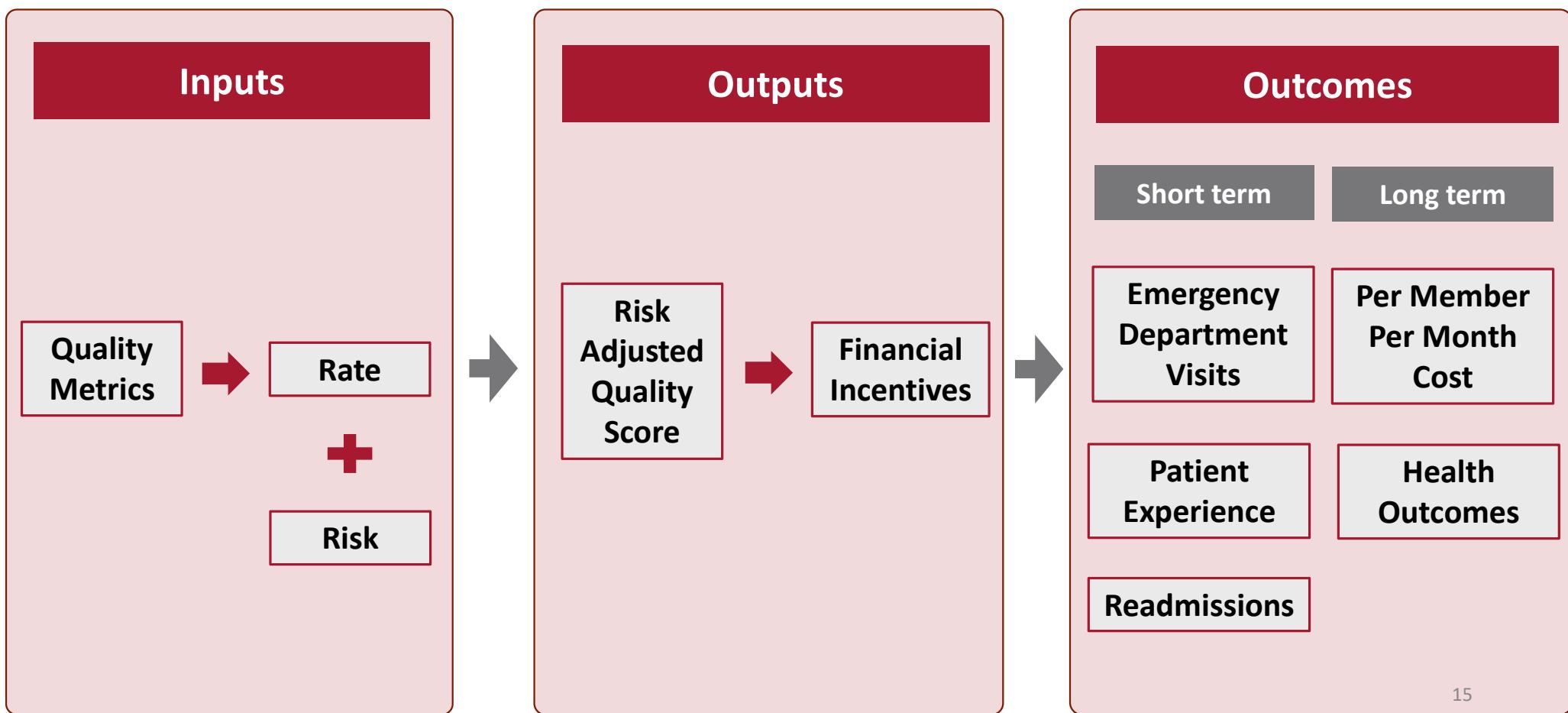
- Incentivizes focus on prevention and wellness
- Allows PCPs to improve their processes and implement best practices

## Patients

Better health outcomes especially for chronic illness patients

Improves patient experience

# Quality Component Logic Model



# Quality Metrics Overview



**No. of  
Quality CMS Meaningful Measurement Area  
Metrics**

**2** Substance Use

**2** Readmission to Hospitals

**15** Management of Chronic Conditions

**4** Appropriate Use of Healthcare

**18** Preventive Care

**1** Preventable Healthcare Harm

# Environmental Scan



The strength of evidence on the effectiveness VBR improving health delivery and patient outcomes is mixed and modest.



Many studies were over a short time frame.



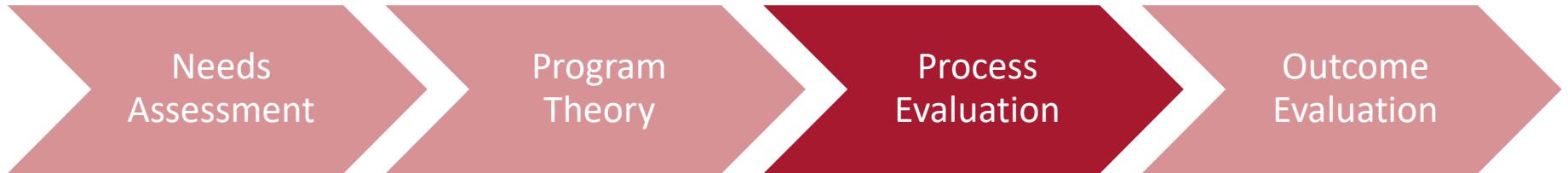
Longer study period may allow better observation of long-term outcomes.



There are mixed results regarding the success of pay for performance programs; most programs show no association with lower cost outcomes and better health outcomes

# Program Implementation

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- Reach
- Recipient Perspective of Program
- Implementation Fidelity – Dose Delivered and Received

# Reach & User Perspective



## Doctors and patients in the program

Providers in program:  
548

Patients in program:  
1.16 million



## Physician satisfaction\*

“An unreasonable number of reasonable requirements”



## Extent of engagement with the program

Many metrics = many interactions  
Large administrative burden



## Quality Metrics Details

Some metrics seem to express co-linearity  
There are some “buckets” that don’t seem to have any metrics - outcome measures, health measures

# Aligning Theory and Design



## Effectiveness of Feedback

Collect qualitative data through surveys

## Process Changes

Evaluate if there is a change in behavior or processes

## Patient Experience

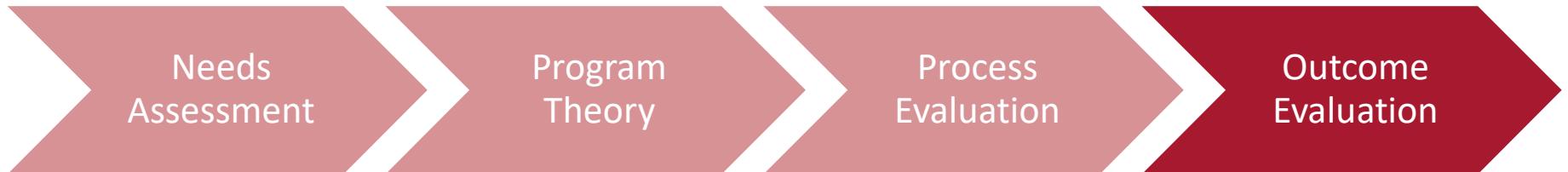
Survey patients

## Population health management

Collect healthcare quality outcomes directly

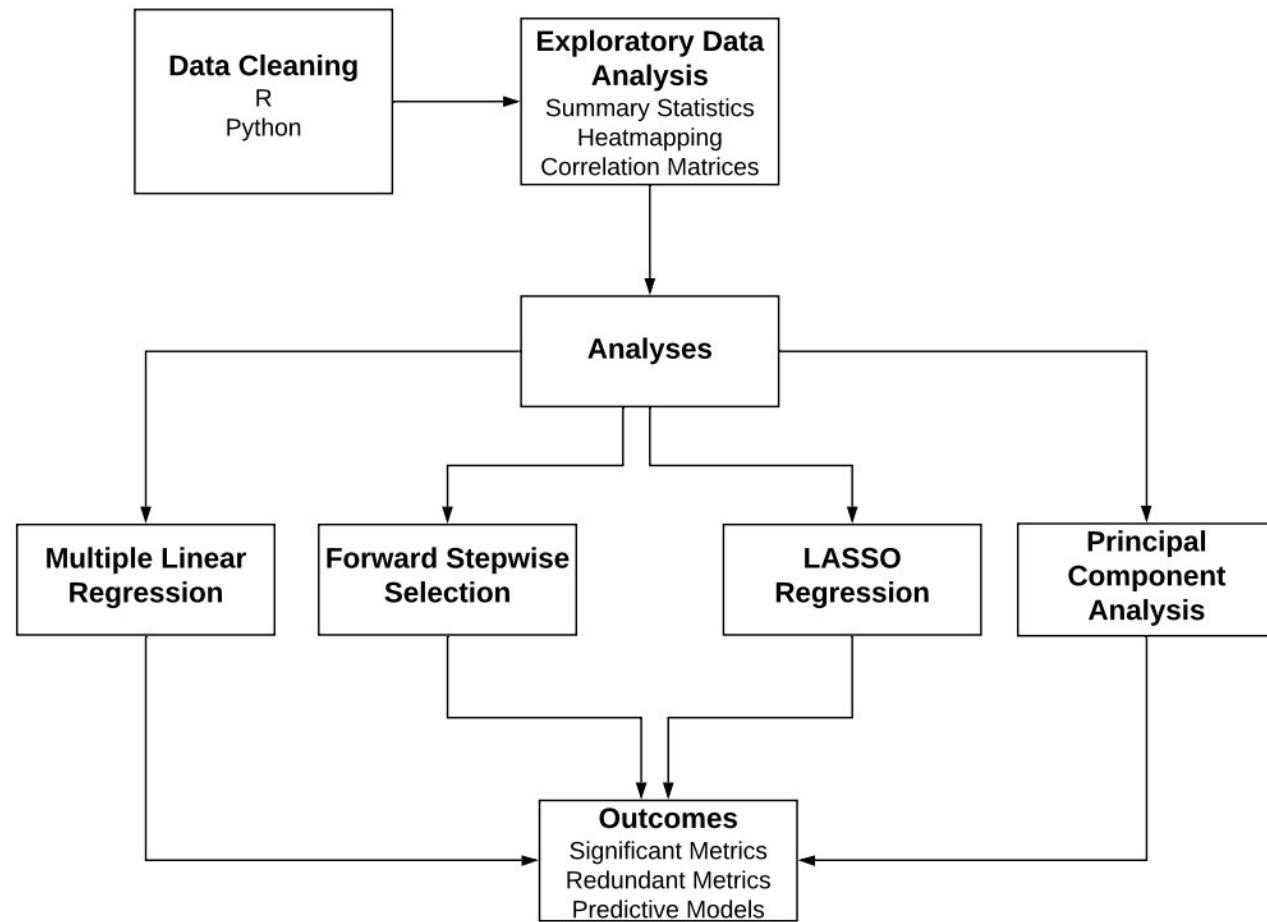
# Program Impact on Outcomes

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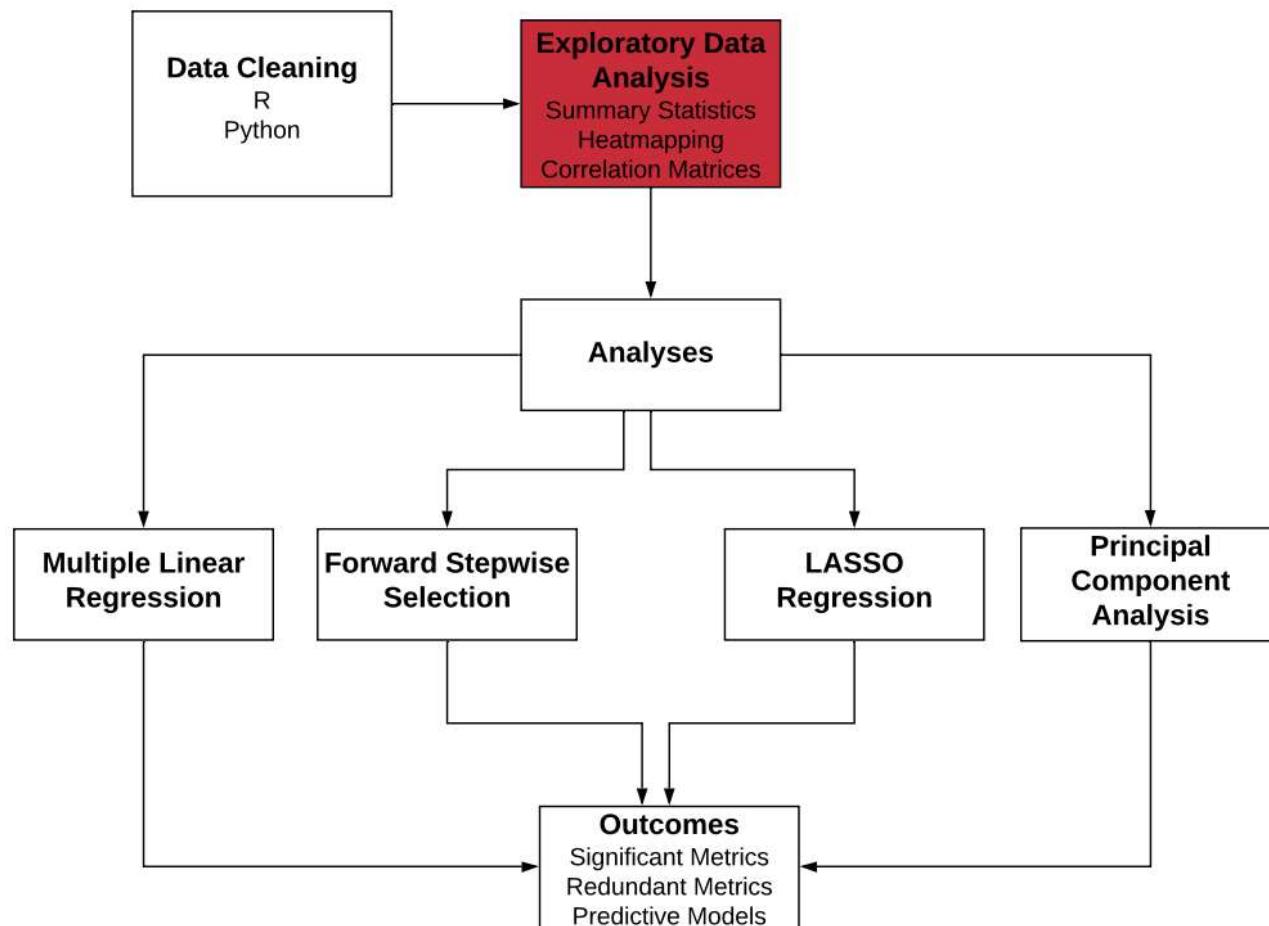


- Did the program have the intended impact?
- What were the key metrics that caused the observed effect?

# Quantitative Methods



# Quantitative Methods



# Dataset Overview

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38,000+ rows



Over 500 healthcare providers across 5 regions



~40 quality metrics per provider



3 populations: Pediatric, **Adult**, Senior



1 year, one data point per provider per population

PMPM – Per member per month cost of care



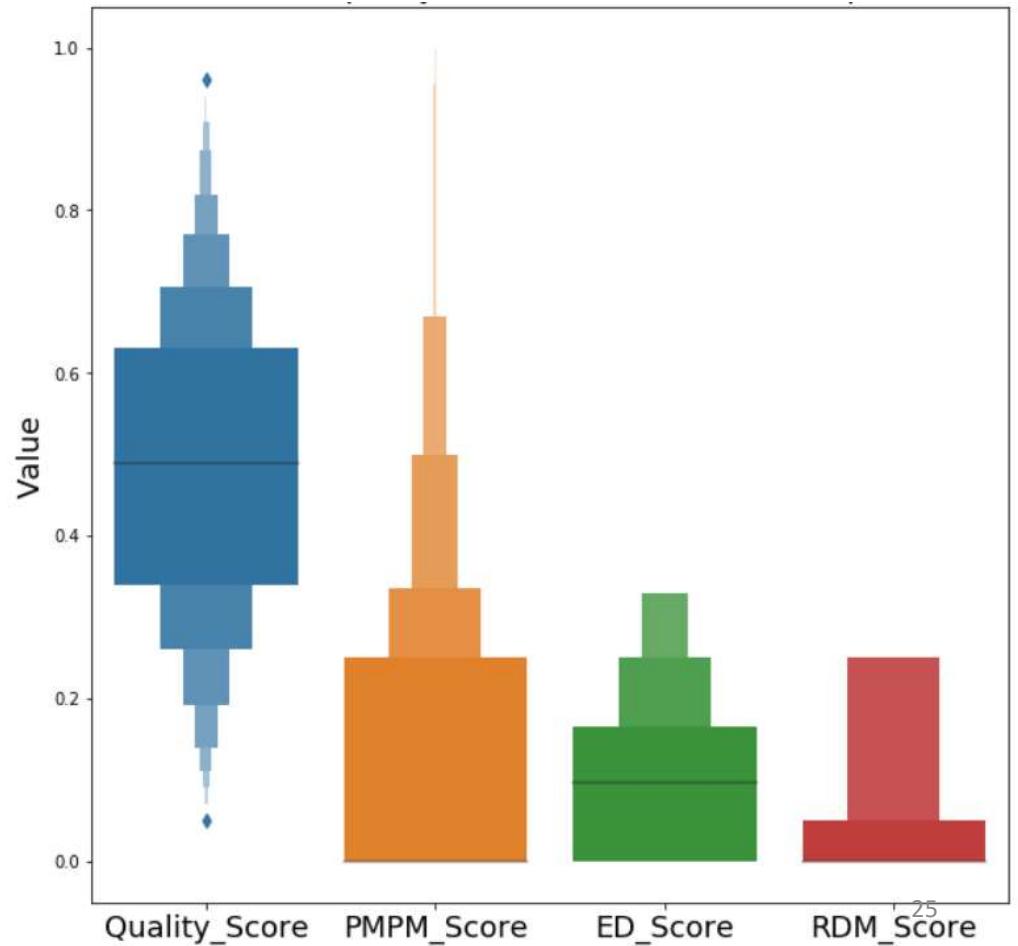
3 outcomes of interest: ED – Emergency department utilization

RDM – Readmission rates

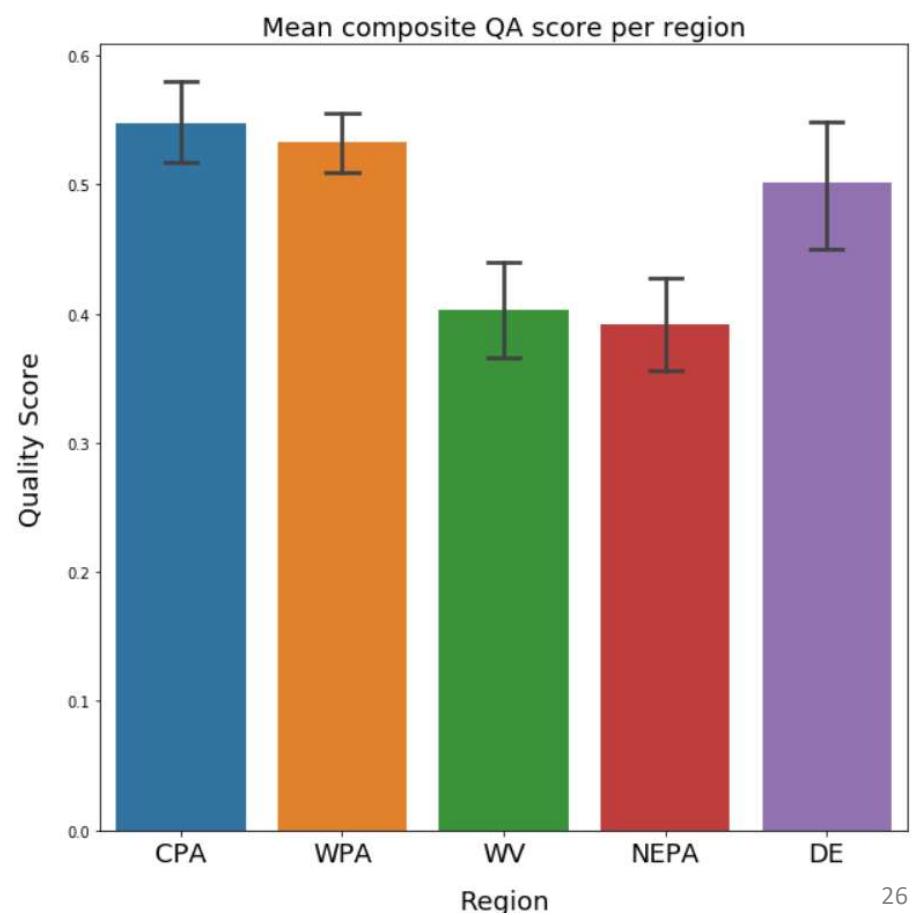
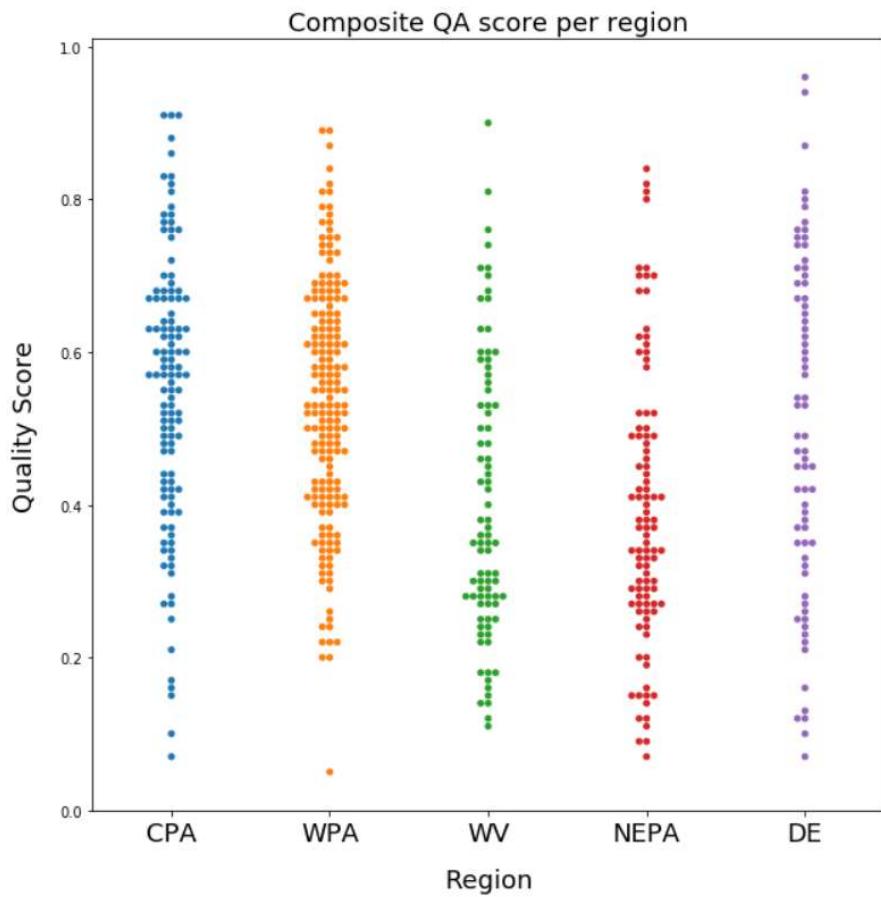
# Quality and Outcomes



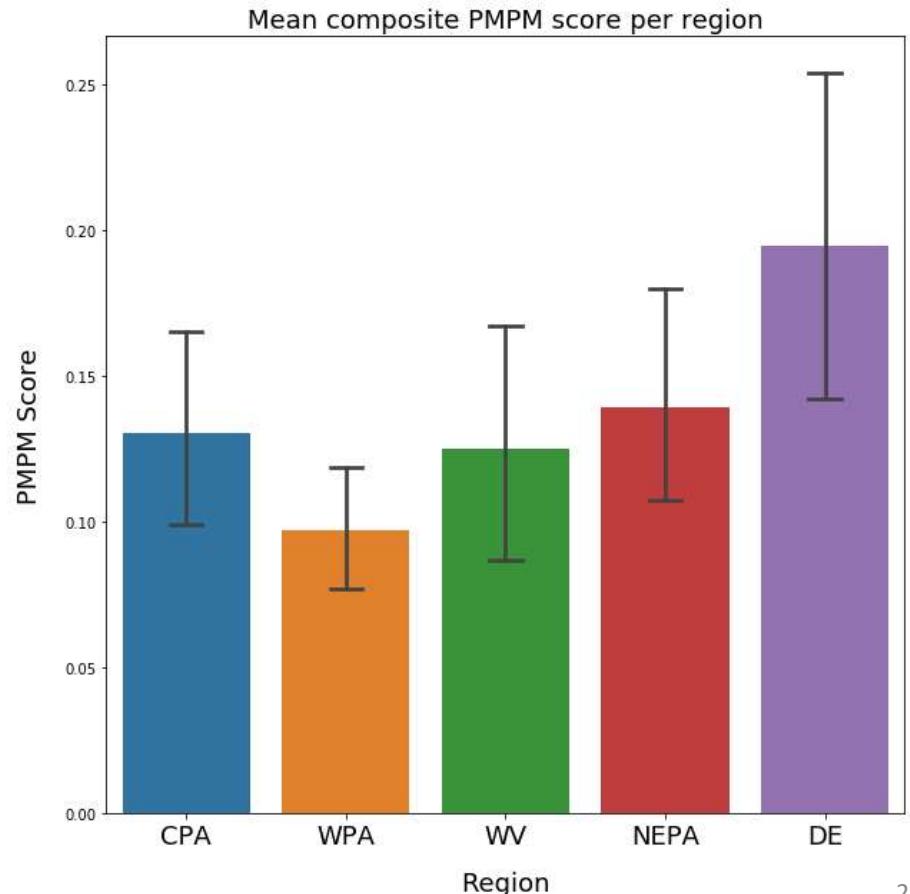
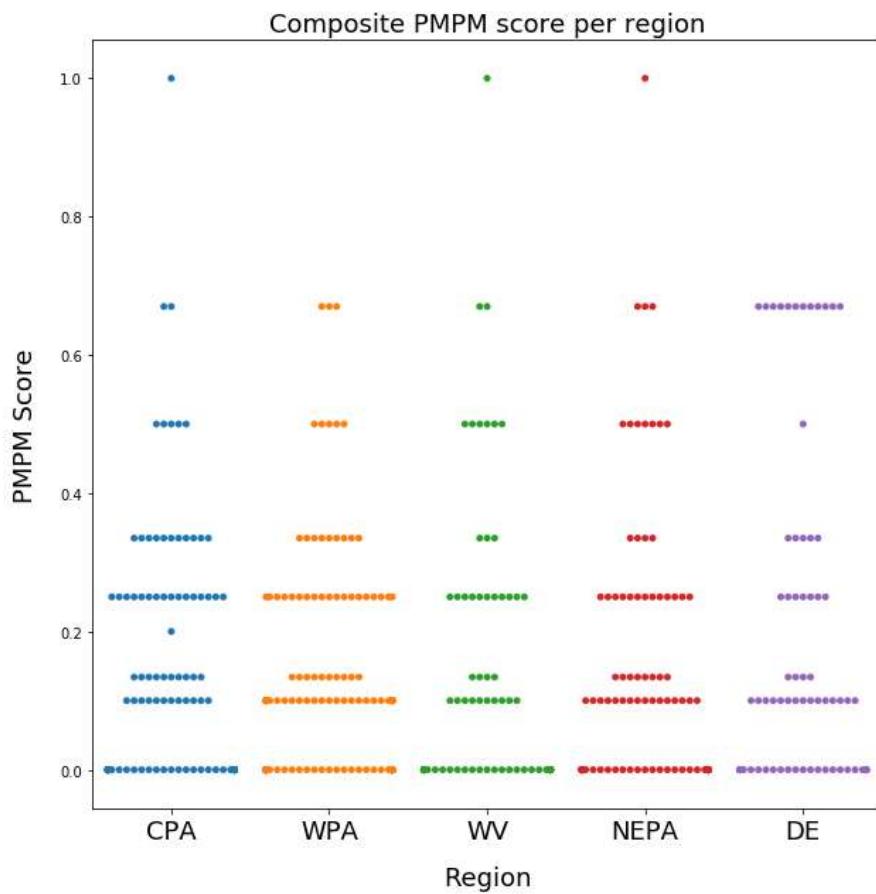
Distribution of quality vs outcome across providers



# WV and NEPA have Lower QA Scores



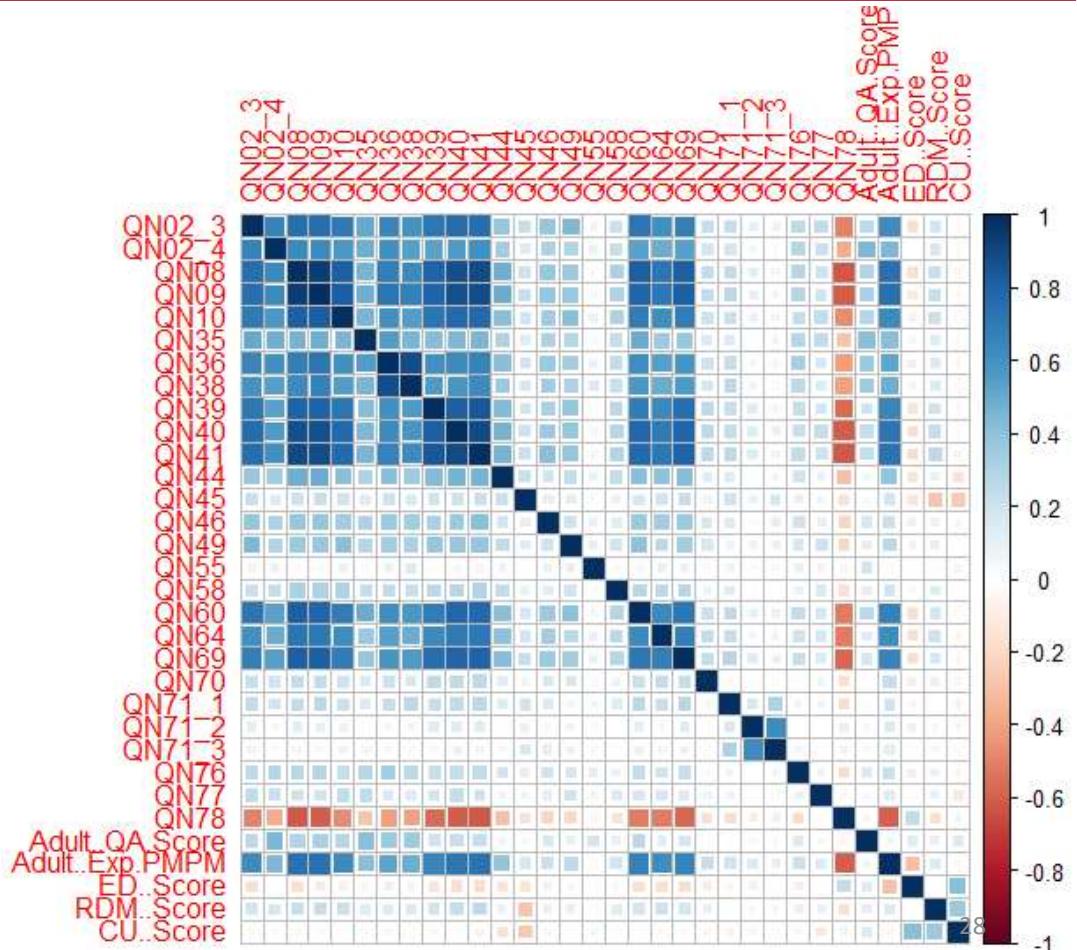
# High Variance in PMPM Score



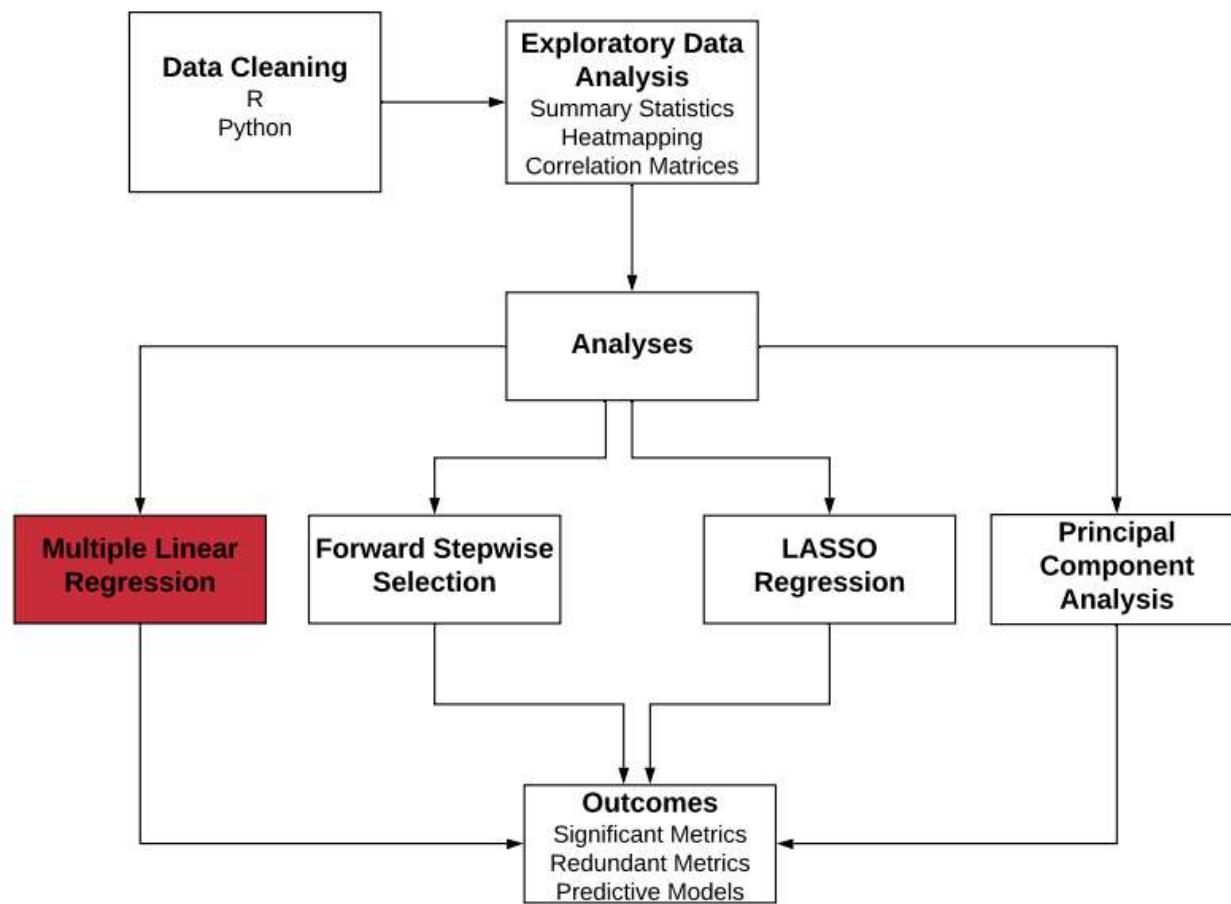
# High Collinearities between Metrics



- Most metrics were found to be highly correlated with each other
- Outcomes did not show this correlation
- This could lead to skewed results in a standard regression test
- Lasso regression and PCA can account for this problem



# Quantitative Methods



# Multiple Linear Regression



PMPM Cost	ED Score	RDM Score
Avoidance of Antibiotic treatment in Adults With Acute Bronchitis (-)	Medication Management for People With Asthma (+)	Medication Adherence for Cholesterol (Statins) (+)
Use of Imaging Studies for Low Back Pain (LBP) (-)	Annual EKGs or Cardiac Screening (+)	All-Cause Readmissions (-)
Annual EKGs or Cardiac Screening(-)	Colorectal Cancer Screening (+)	
Adult BMI Assessment (+)	Comprehensive Diabetes Care: Eye Exam (retinal) performed (+)	
Medication Adherence for Cholesterol (Statins) (+)	Use of Opioids from Multiple Providers (-)	

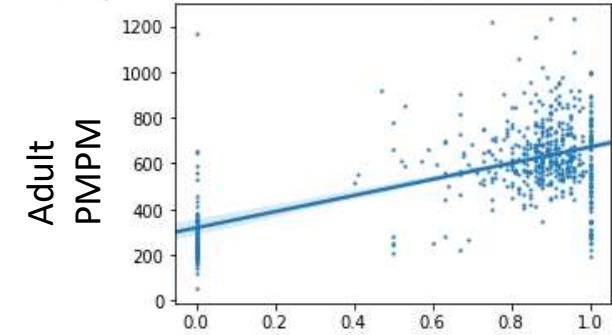


Expected/ Explainable Results

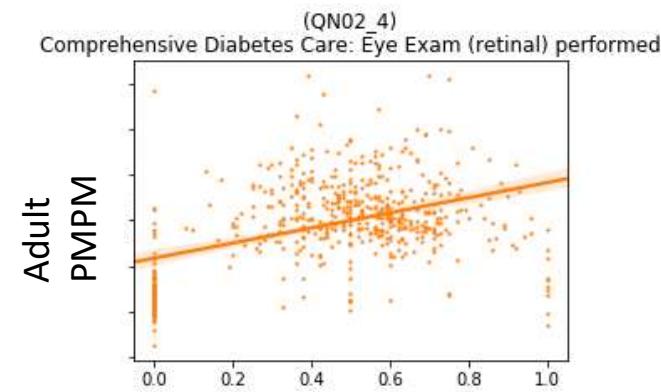
# Lack of Clear Trends



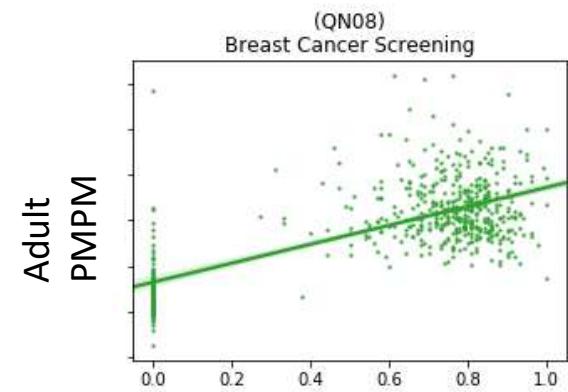
(QN02\_3)  
Comprehensive Diabetes Care: Medical Attention for Nephropathy



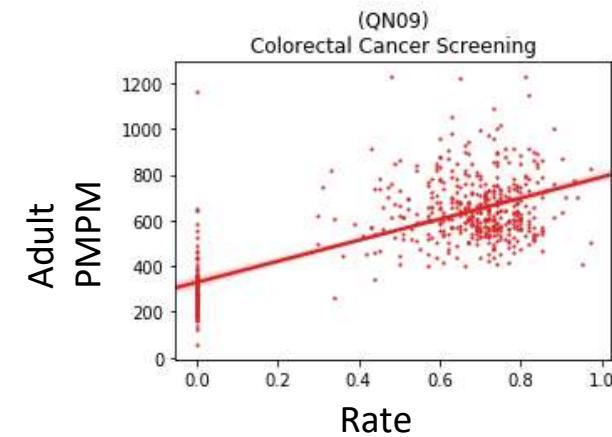
(QN02\_4)  
Comprehensive Diabetes Care: Eye Exam (retinal) performed



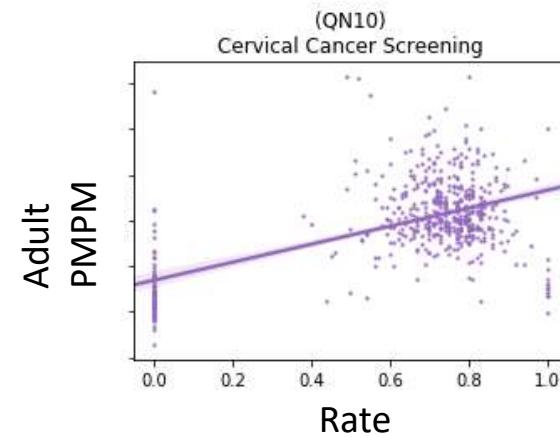
(QN08)  
Breast Cancer Screening



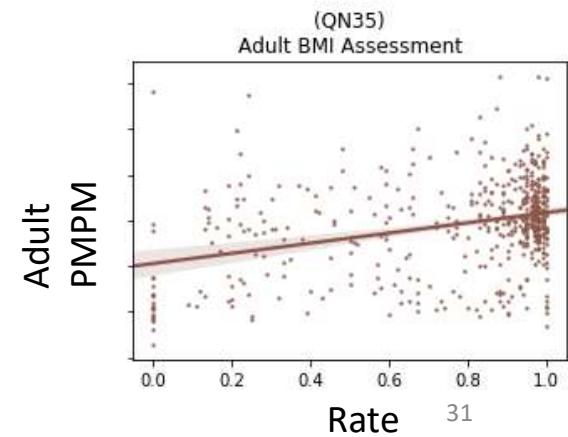
(QN09)  
Colorectal Cancer Screening



(QN10)  
Cervical Cancer Screening



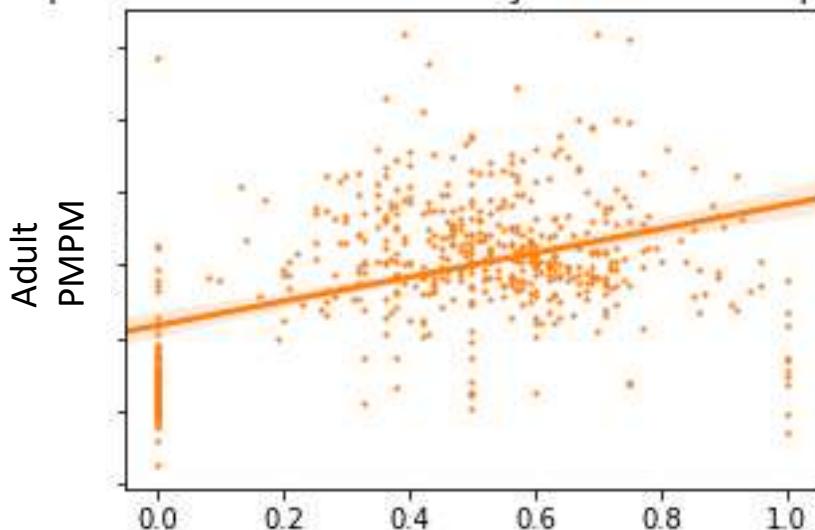
(QN35)  
Adult BMI Assessment



# Lack of Clear Trends

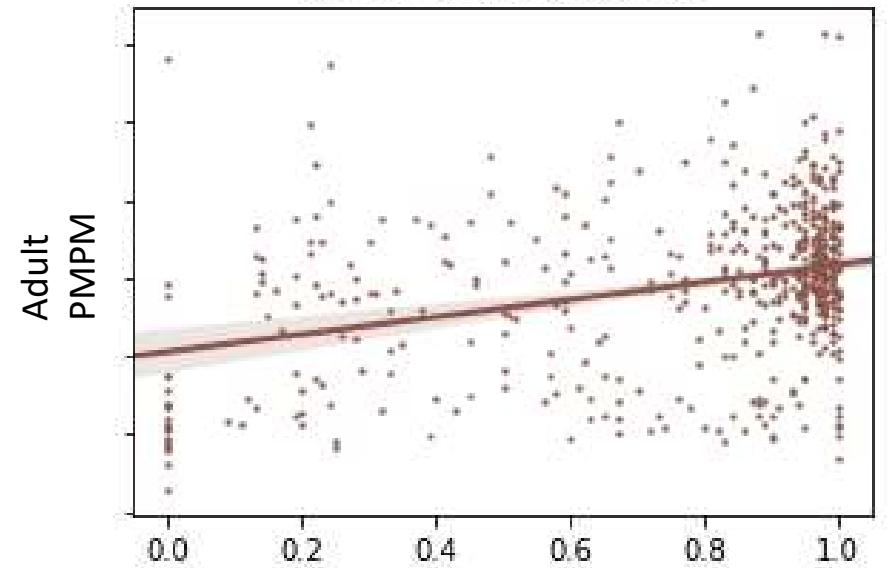


(QN02\_4)  
Comprehensive Diabetes Care: Eye Exam (retinal) performed



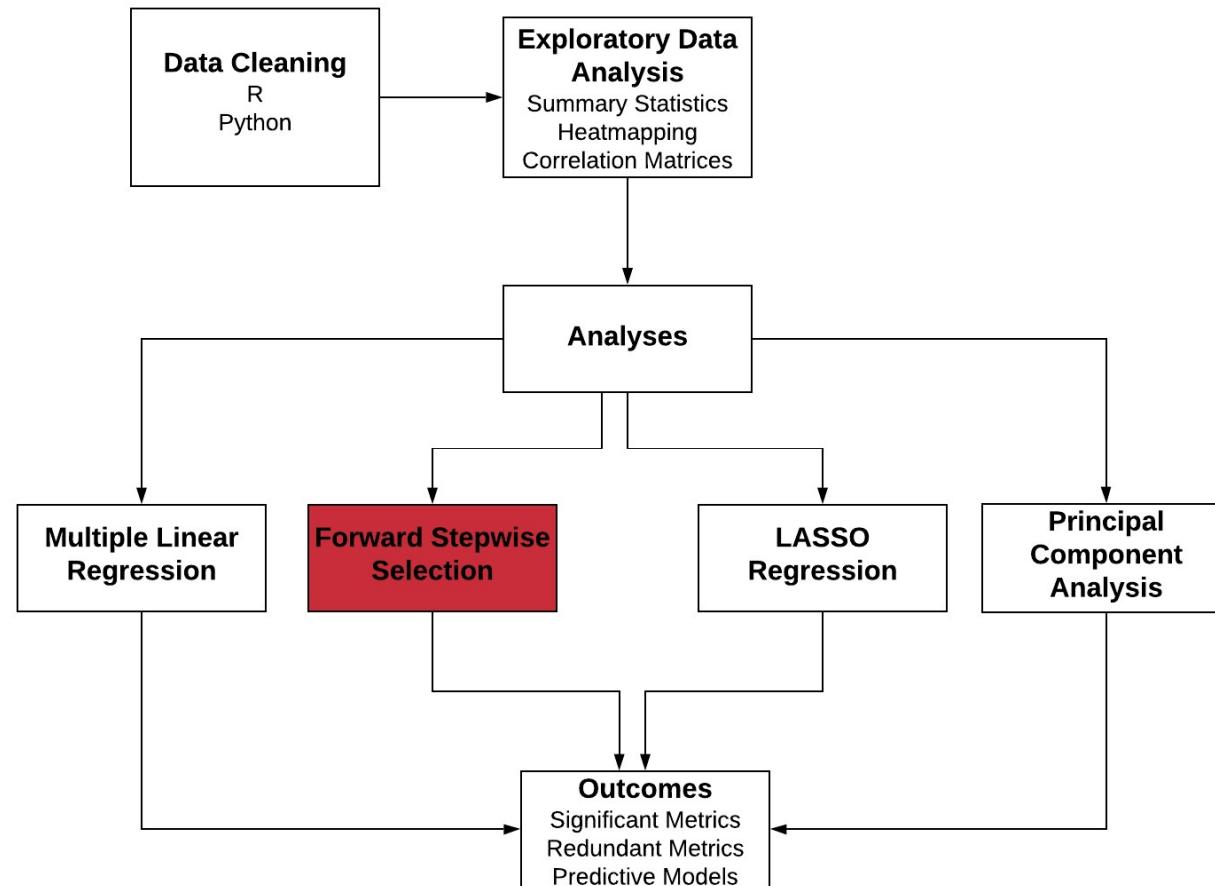
High variability

(QN35)  
Adult BMI Assessment



Low confidence

# Quantitative Methods



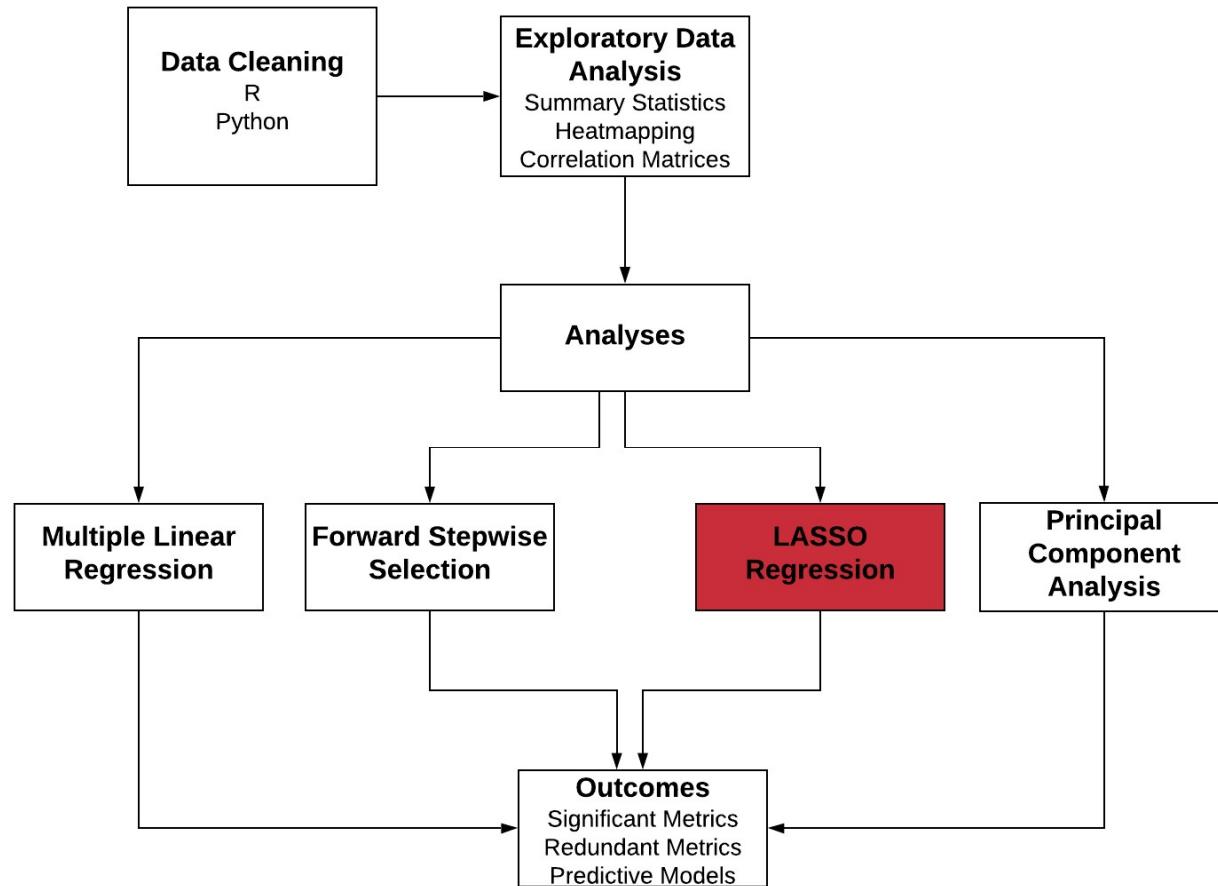
# Forward Stepwise Selection



PMPM Cost	ED Score	RDM Score
Annual EKGs or Cardiac Screening (-)	Annual EKGs or Cardiac Screening (+)	Medication Adherence for Cholesterol (Statins) (+)
Avoidance of Antibiotic Treatment in Adults with Acute Bronchitis (-)	Comprehensive Diabetes Care: Eye Exam (retinal) performed(+)	All-cause Readmissions (-)
Annual Monitoring for Patients on Persistent Medications (+)	Comprehensive Diabetes Care: Medical Attention for Nephropathy (-)	
Breast Cancer Screening (+)		
Medication Adherence for Cholesterol (Statins) (+)		

Expected/ Explainable Results

# Quantitative Methods



# Lasso Regression

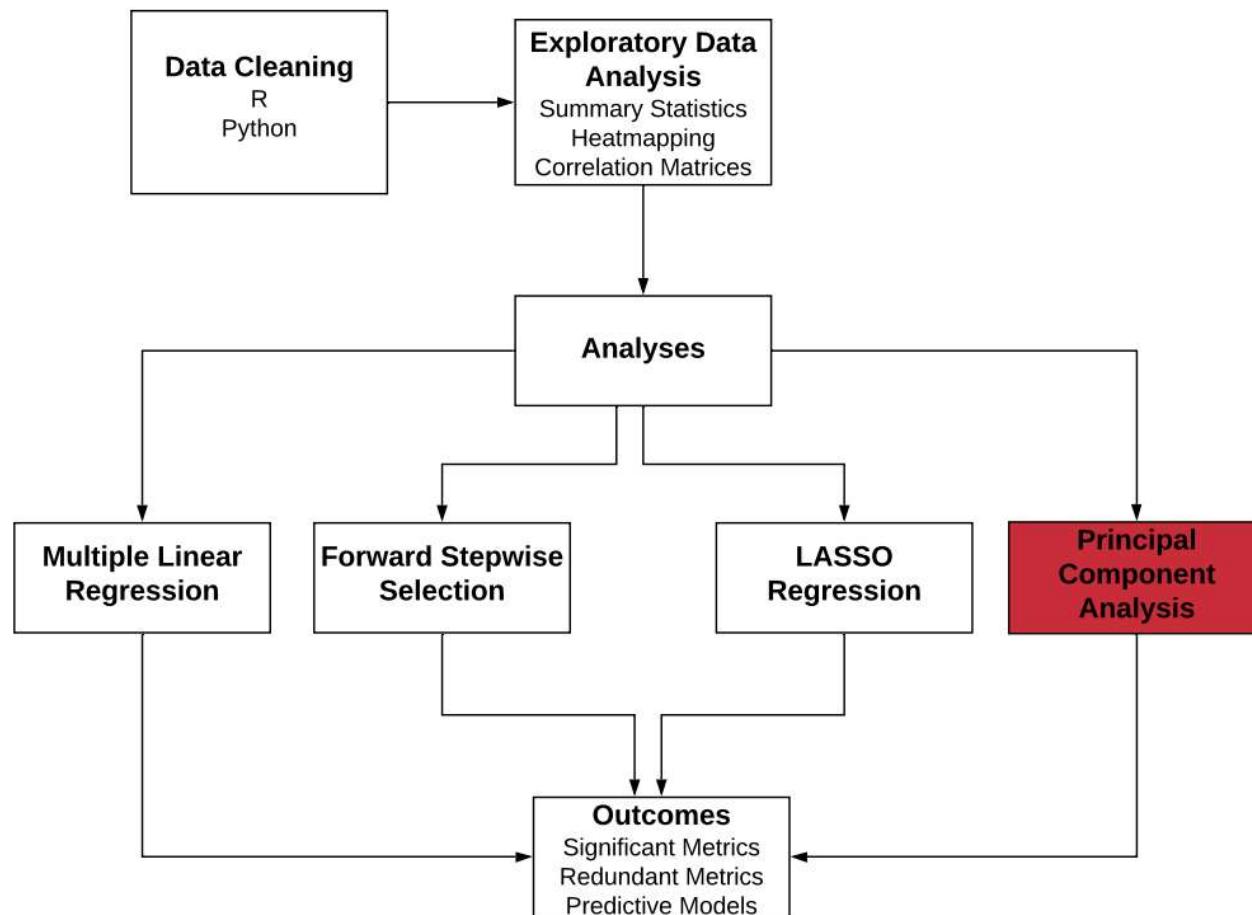


Investment in screening may yield a long-term return notwithstanding short-term cost increases

PMPM Cost	ED Score	RDM Score
Annual EKGs or Cardiac Screening (-)	Annual EKGs or Cardiac Screening (+)	Medication Adherence for Cholesterol (Statins) (+)
Colorectal Cancer Screening (+)		All-Cause Readmissions (-)
Medication Adherence for Hypertension: renin angiotensin system antagonists (+)		
Medication Adherence for Cholesterol (Statins) (+)		
Breast Cancer Screening (+)		

Expected/ Explainable Results

# Quantitative Methods



# Principal Component Analysis (PCA)

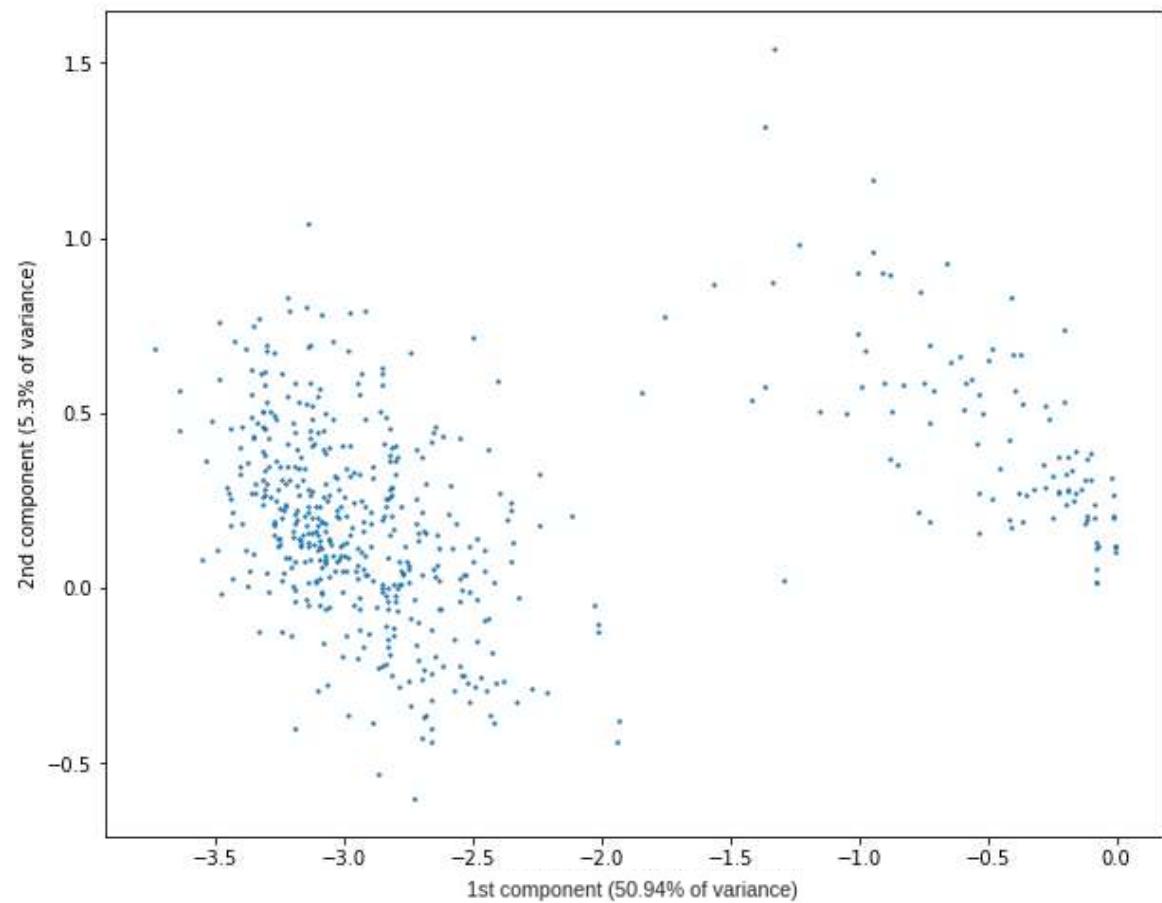


Top contributors to the first component, which explains 50.94% of the variance in the adult data:

- QN09 - Colorectal Cancer Screening
- QN08 - Breast Cancer Screening
- QN41 - Drug Therapy for Rheumatoid Arthritis
- QN40 - Medication Adherence for Cholesterol (Statins)
- QN39 - Medication Adherence for Hypertension: RASA

Top contributors to the second component, which explains 5.35% of the variance in the adult data:

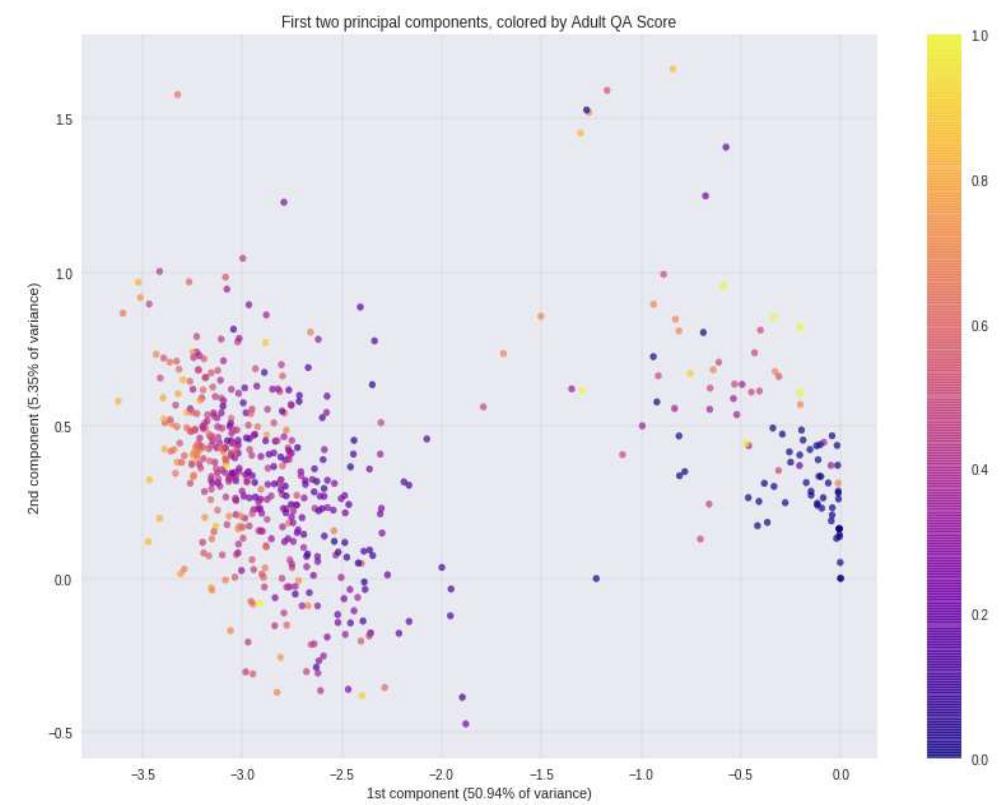
- QN76 - Controlling High Blood Pressure
- QN55 - Annual Monitoring for Patients on Persistent Medications
- QN35 - Adult BMI Assessment



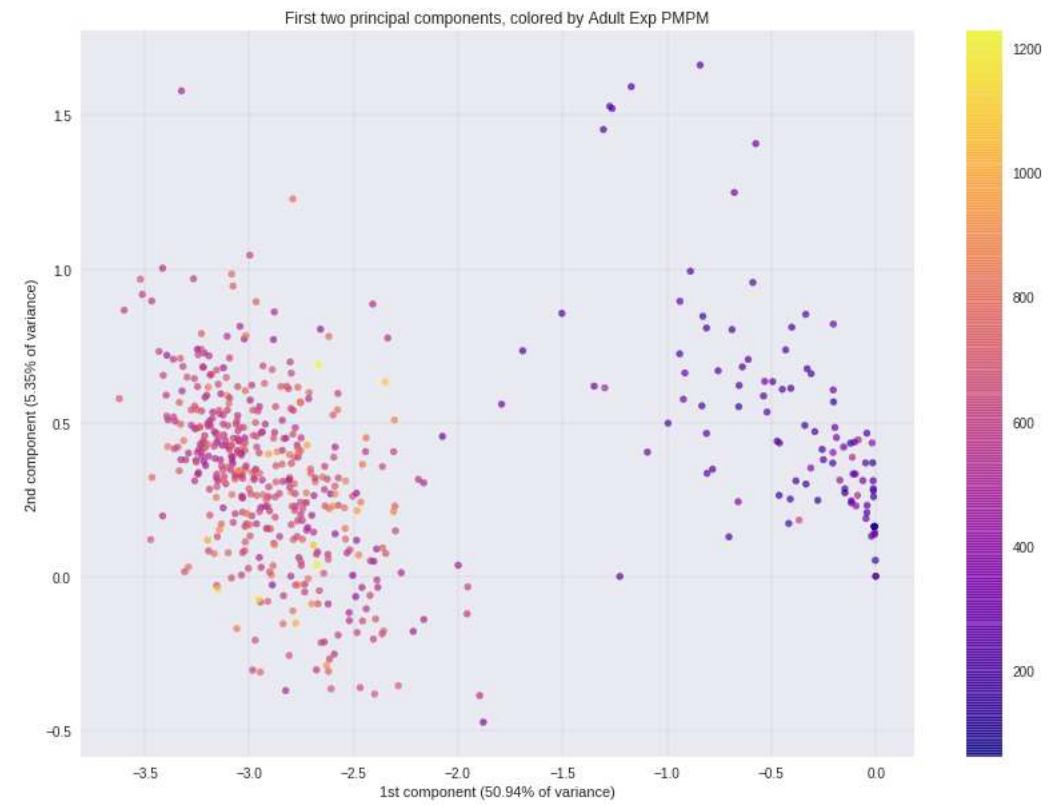
# PCA - Clusters of Similar Providers



## QA Score



## PMPM Cost



# Next Steps with Data



Collect data over time to enable time series analyses



Follow providers who are not participating in the program in order to study counterfactual



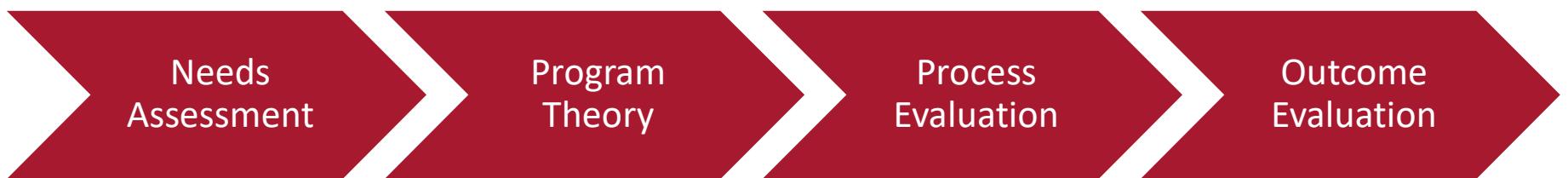
Focus on metrics that are highly colinear to identify potential candidates for removal



Diversify metrics across CMS-recommended “meaningful measures” areas of focus

# Program Evaluation Framework

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# Takeaways



VBR is early in the Continuous Improvement Cycle



More closely aligned measurement



Majority of progress has been made in cost measurement



Complexity of the program inhibits physician engagement



Missing a consistent, repeatable evaluation method

# Recommendations

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<i><b>Quality Metrics</b></i>	<i><b>Program-Specific</b></i>	<i><b>Evaluation of the Program</b></i>
<ul style="list-style-type: none"><li>• Collect more data over time to enable better time-series analysis</li><li>• Eliminate highly correlated metrics, they add no value &amp; this would reduce physician fatigue</li></ul>	<ul style="list-style-type: none"><li>• Work with providers to ensure that physicians are translating feedback into process and behavioral changes</li><li>• Structure incentives to elicit desirable changes</li></ul>	<ul style="list-style-type: none"><li>• Measure outcomes related to health and patient experience</li><li>• Assess the causal effect of the program using a control group</li><li>• Gather patient-level data in order to understand how the program is affecting patients, not just providers and payor</li></ul>

*Questions?*

# References

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- United Healthcare Report - <https://www.uhc.com/content/dam/uhcdotcom/en/ValueBasedCare/PDFs/VBC-Nov2016-Online-Report.pdf>
- Miller, H. (2017) Why Value Based Purchasing Isn't Working and How to Fix it
- Peter Rossi, Mark Lipsey, Gary Henry. *Evaluation – A Systematic Approach*. 8<sup>th</sup> Edition.
- Eijkenaar, Frank, Martin Emmert, Manfred Scheppach, and Oliver Schöffski. "Effects of pay for performance in health care: a systematic review of systematic reviews." *Health policy* 110, no. 2-3 (2013): 115-130.
- Damberg CL, Sorbero ME, Lovejoy SL, et al. Measuring Success in Health Care Value-Based Purchasing Programs: Findings from an Environmental Scan, Literature Review, and Expert Panel Discussions. *Rand Health Q* 2014;4:9
- CMS Meaningful Measures guide - <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/QualityInitiativesGenInfo/MMF/General-info-Sub-Page>

# Appendix

# Program Evaluation Framework

## Context for Evaluation (Stage 0)

- What is the purpose of the evaluation?
  - Formative evaluation (primary purpose is to analyze the program to improve and strengthen it). To some extent outcome evaluation.
  - Since the True performance program has been implemented only for about 2 years now, we cannot really say for sure if it has achieved its outcome or not.
  - The main purpose of the evaluation is to evaluate the cost outcomes (impact evaluation)
- Who are the stakeholders involved?
  - Highmark Inc Data Science team
  - Highmark Inc Value Based Reimbursement team
  - Highmark Inc Providers in their network (PCPs)
  - Patients
- What are the limitations and constraints of this evaluation?
  - Limitations: Lack of comprehensive time-series data, lack of a mechanism to collect health outcomes and patient experience outcomes.
  - Constraints: Time duration for evaluation

## Needs Assessment (Stage 1) ( will focus on the issue of over utilization and low quality)

- What is the problem that the program is trying to address?
  - Misalignment of incentives between payer, provider, patients
  - Healthcare incentives not aligned with healthcare value
  - Issues with primary care within the United States
- What is the extent of the problem?
  - Increased amount of spending on healthcare is not reflecting in the health or quality outcomes
  - Add details about the numbers related to healthcare spending and outcomes compared to other countries
- Who or what is the target population?
  - Physicians, patients (to a lesser extent)

## Program Theory (Stage 2) ( structure of the program, research on other VBR programs)

- What is the True Performance Program? (create a logic model)
- How are the outcomes measured? (impact theory)
- How were the quality metrics in the program selected?

- How should the quality metrics be measured?
- How does the program engage providers/ physicians in improving their quality scores?
- Do the measurement of quality metrics improve the outcomes? (In theory)

## Process Evaluation (Stage 3) (qualitative analysis of interviews with physicians)

- Are participants satisfied with the program? (Satisfaction)
- How many providers/ persons are part of the program? (Reach)
- Extent to which the program was implemented consistently with underlying theory/ design/ philosophy. (fidelity of program)
- Extent to which participants actively engage with program (dose received)
- Amount of each component delivered/ details about quality metrics? (dose delivered)

## Outcome Evaluation (Stage 4) (data analysis of the quality metrics)

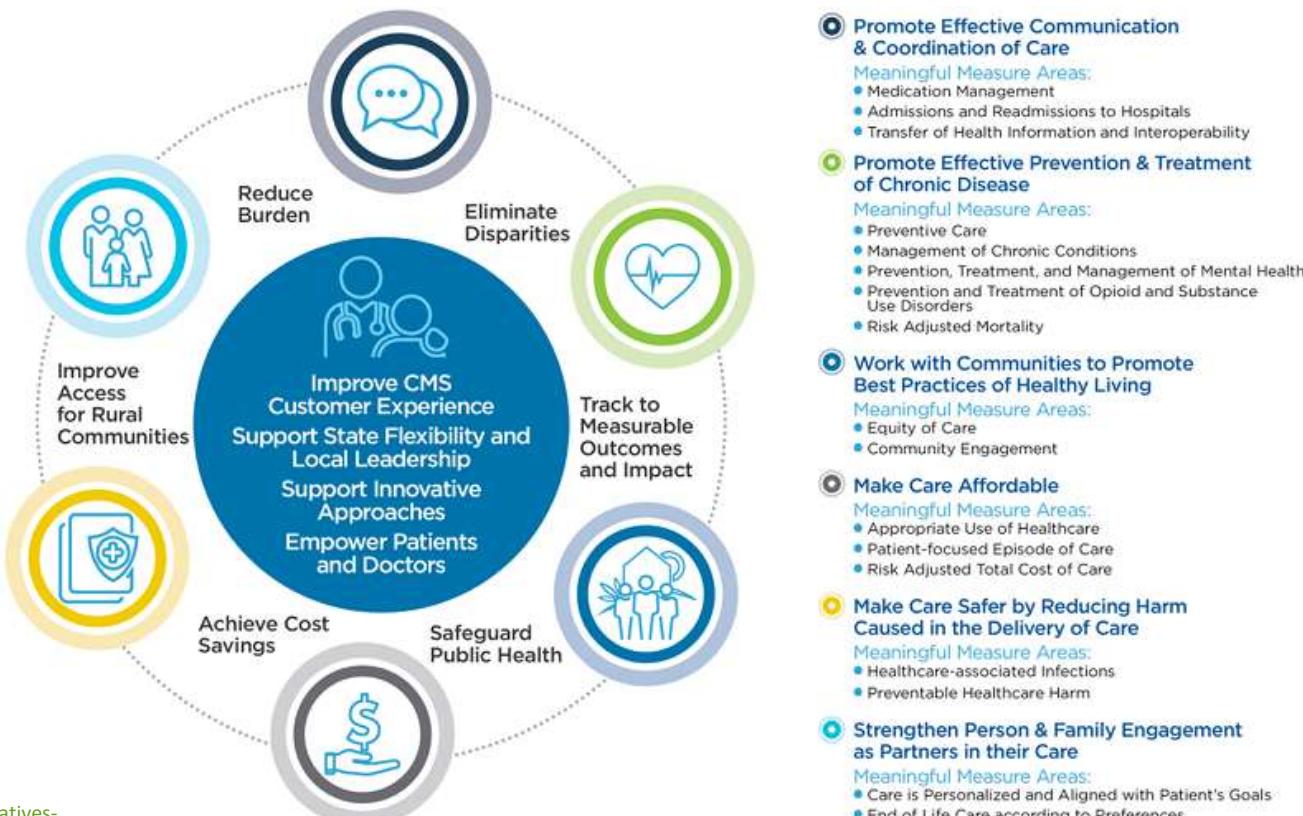
- Define the counterfactual (outcomes in the absence of the program)
- What could be the potential confounders/selection bias?
- Program effects (Quantitative results)
- Difference in outcomes between regions, patient groups, providers
- Which measures contribute most to the cost outcome?

## Recommendations (Stage 5)

### Spending + quality + infrastructure support

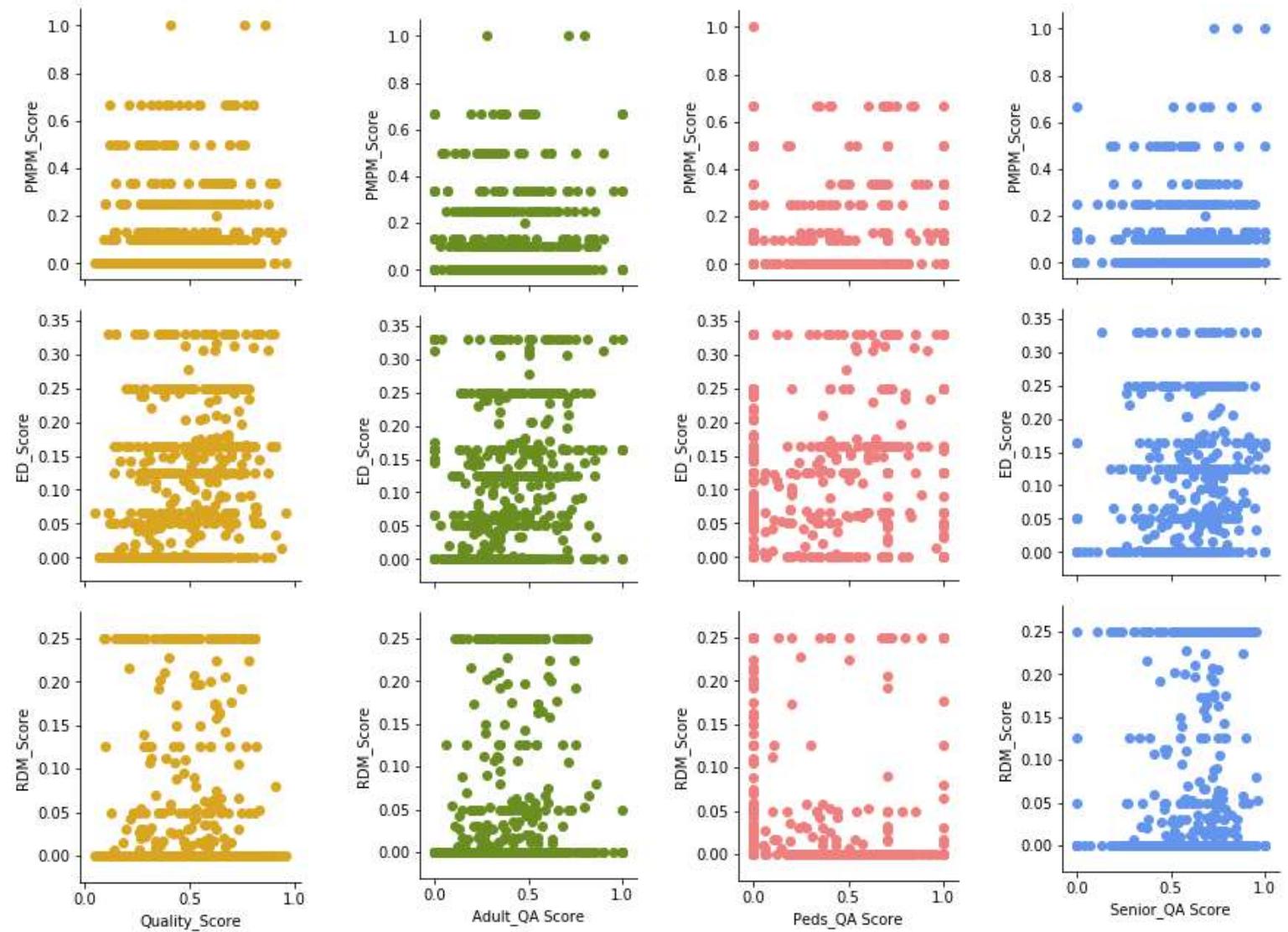
- Increase the share of provider reimbursements tied to VBR to incentivize organizational changes
- Build stronger payer + provider relationships
- Align measures across different payer contracts (to reduce the burden of data collection)
- Better align individual physician incentives with VBR contract incentives

# CMS Meaningful Measurement Areas

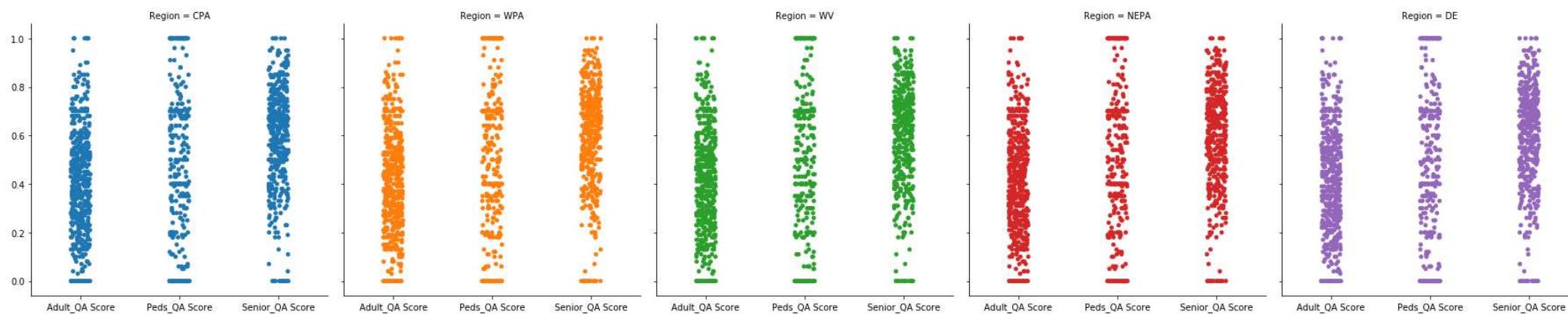


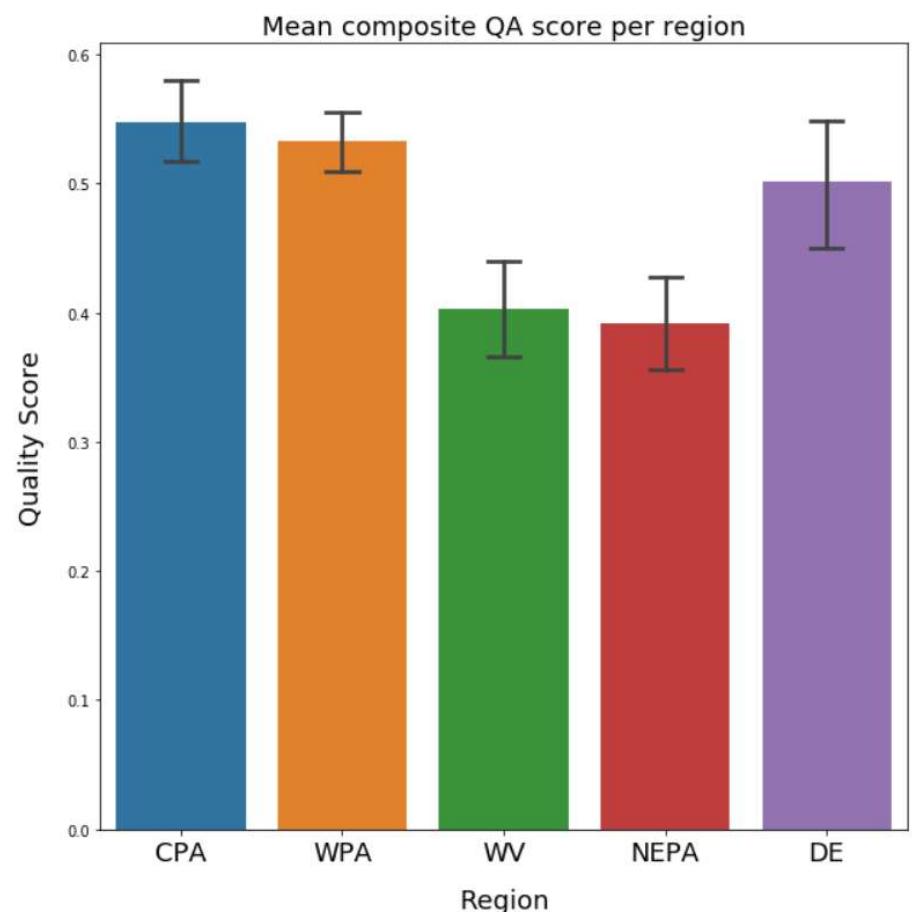
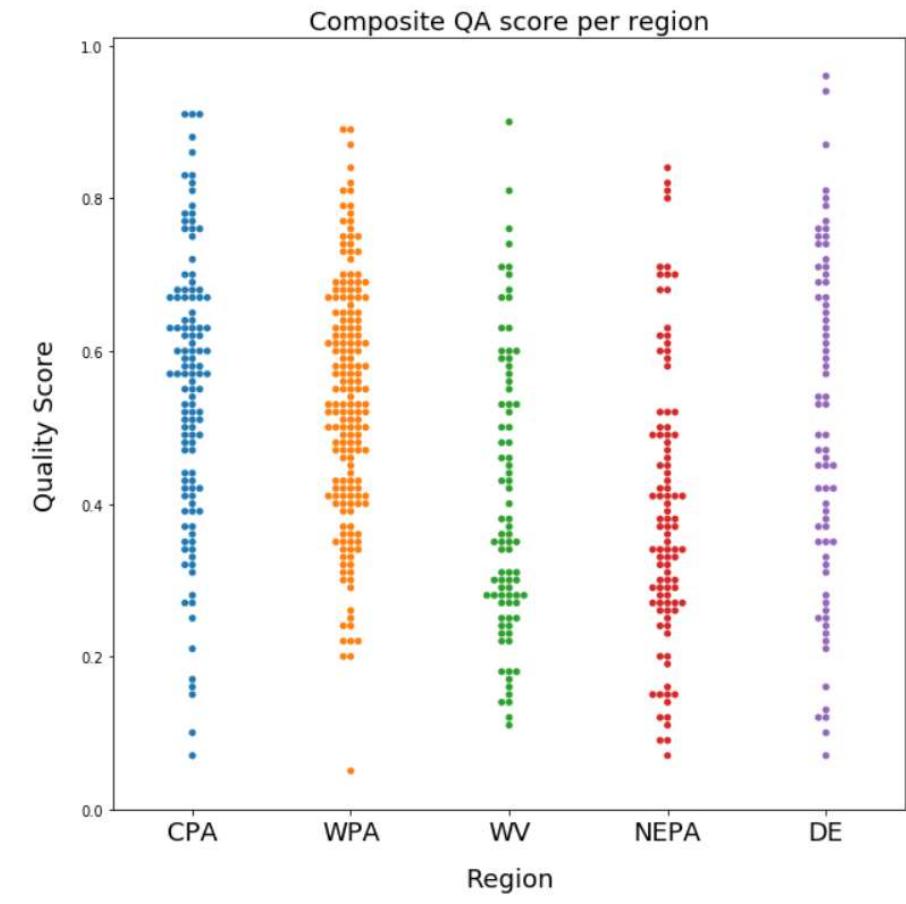
Source: <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/QualityInitiativesGenInfo/MMF/General-info-Sub-Page>

# Quality vs Outcomes

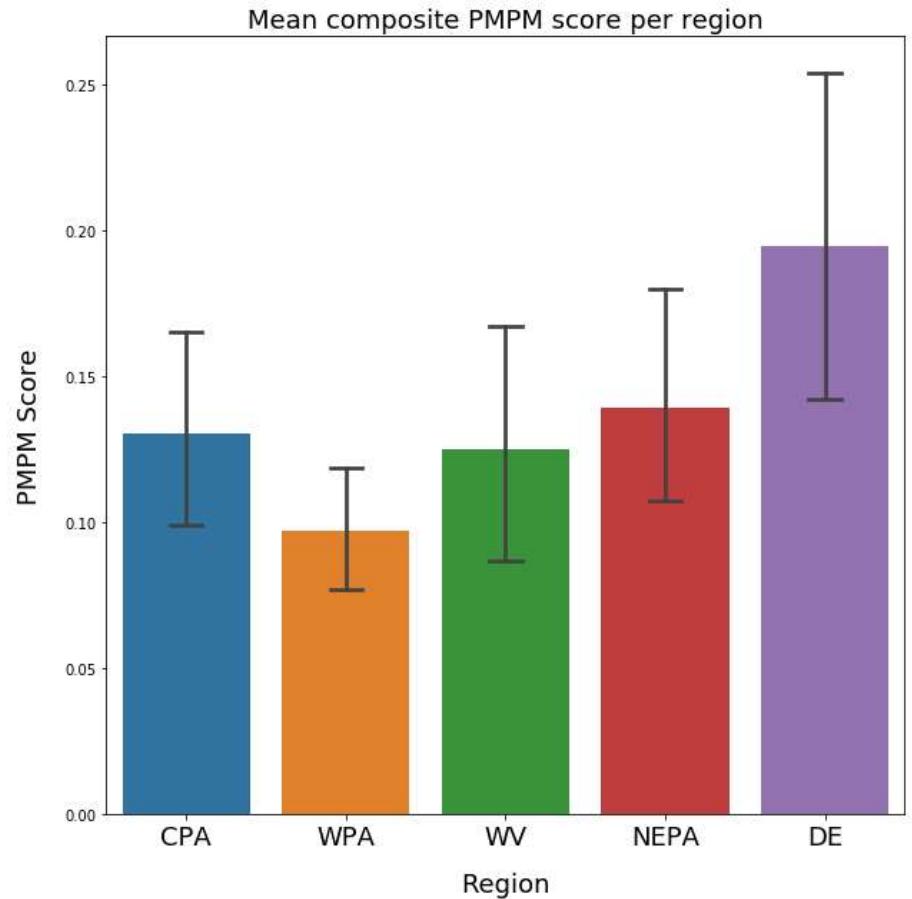
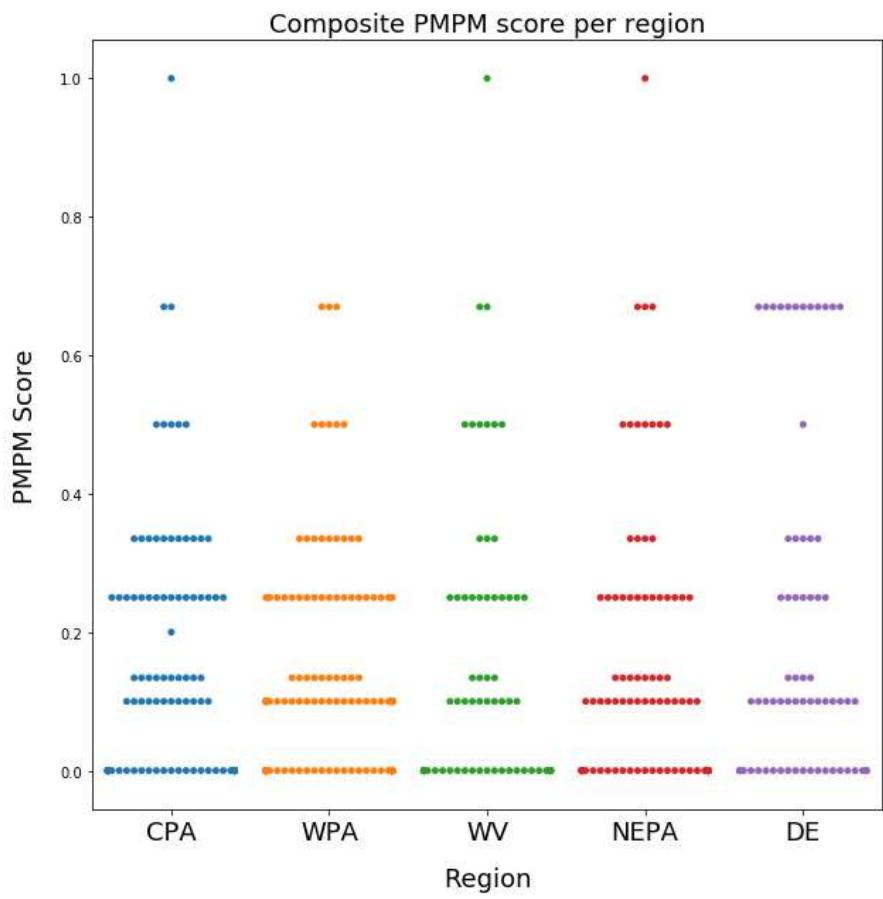


# QA Score per Region – by pop





# QA Score per Region

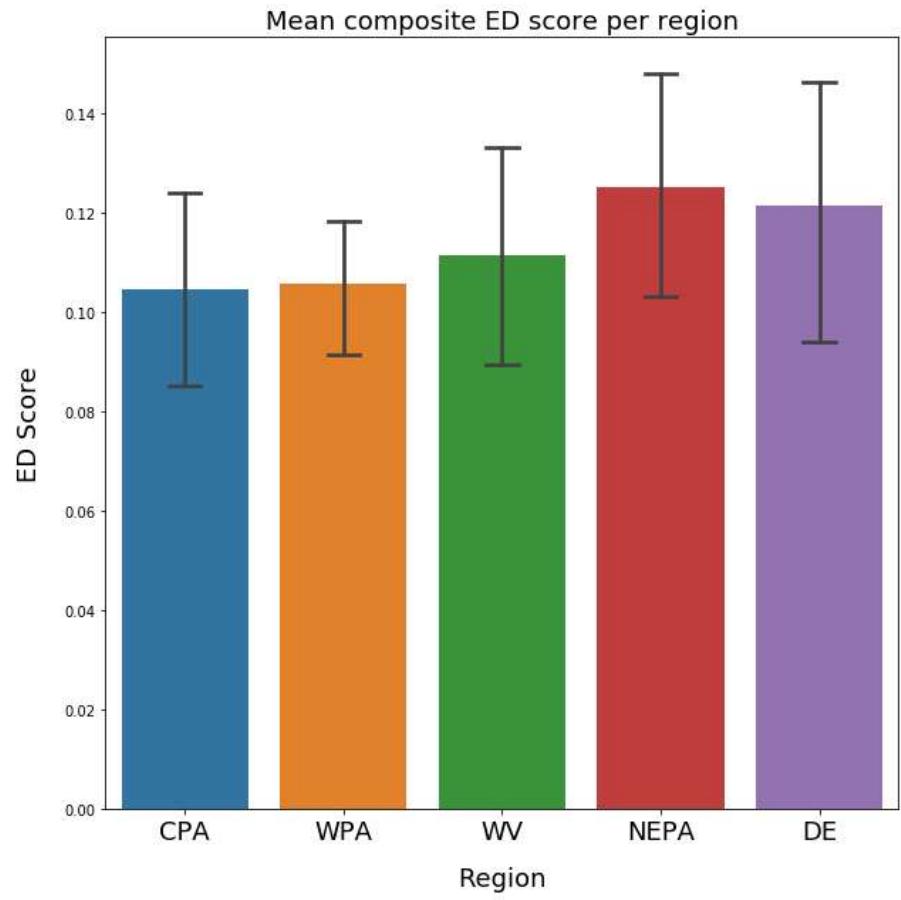
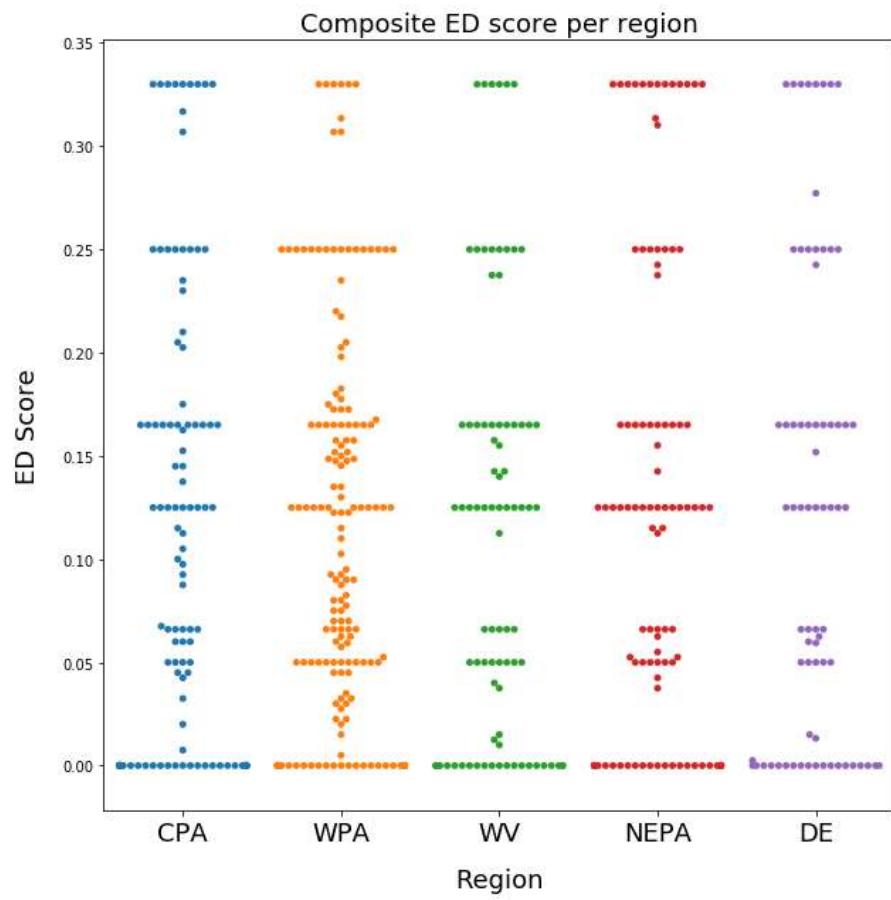


# PMPM Score per Region

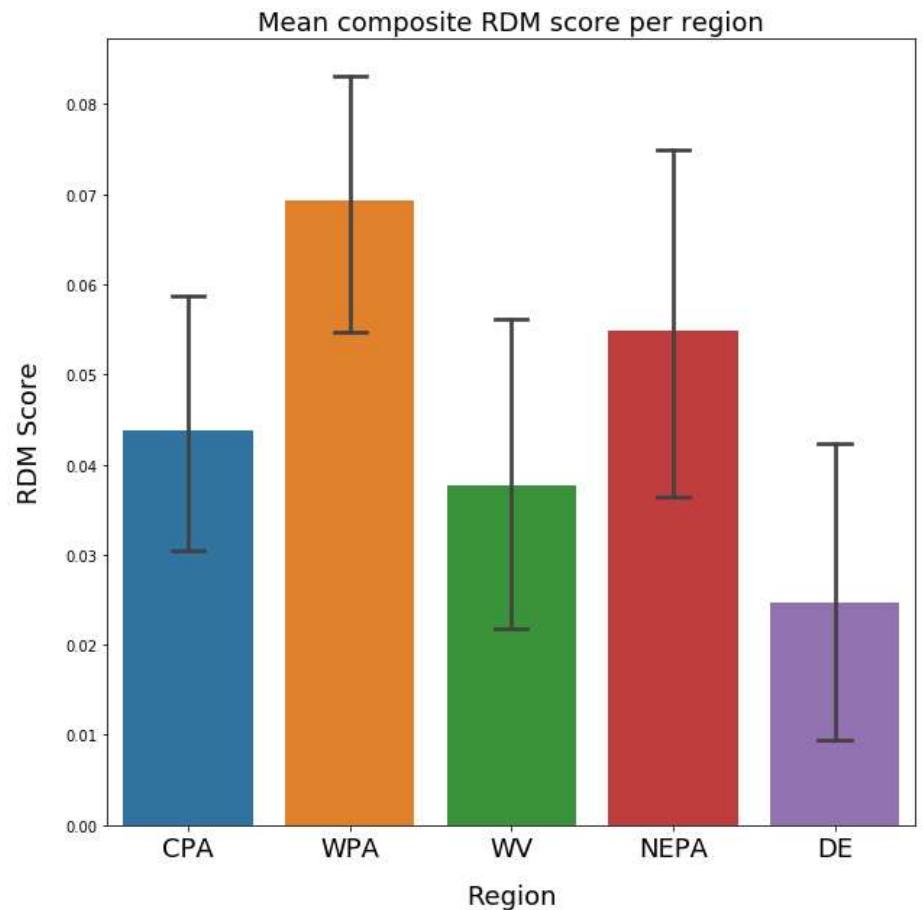
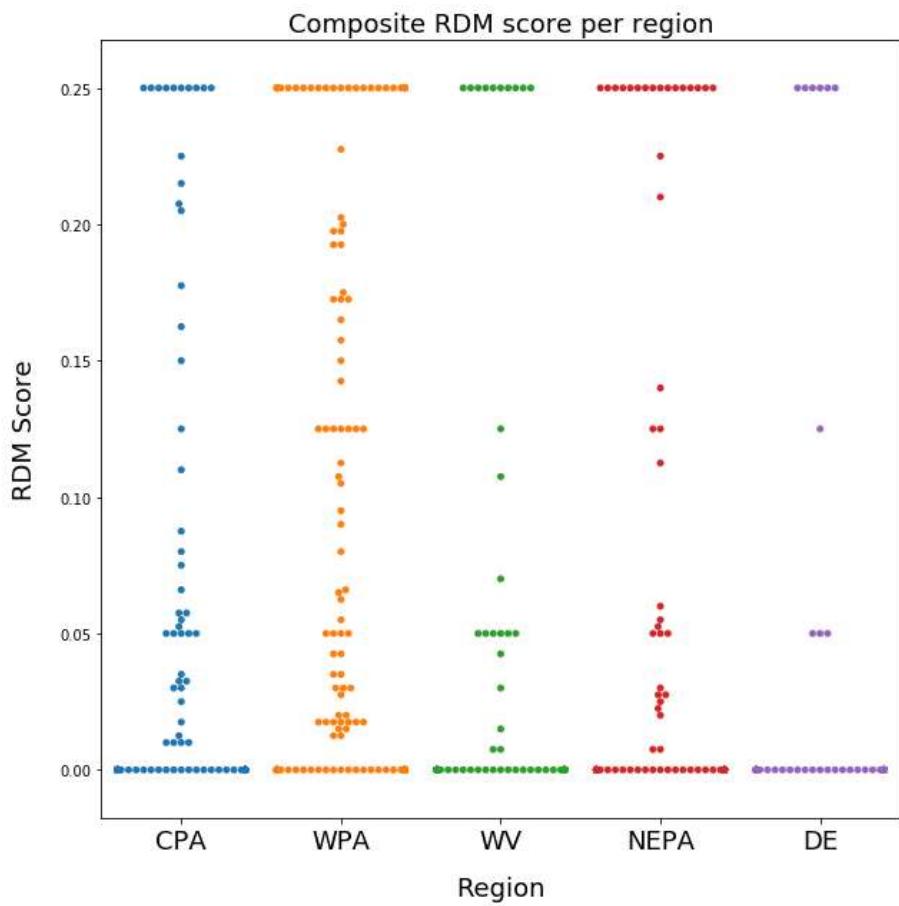
# T-test Results by Region ( $\alpha = 0.05$ )

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- PMPM Score
  - PA regions had lower scores than all other regions
  - WPA had higher scores than NEPA
  
- QA Score
  - PA had a much higher score than all other regions
  - WPA greatly outperformed NEPA and WV



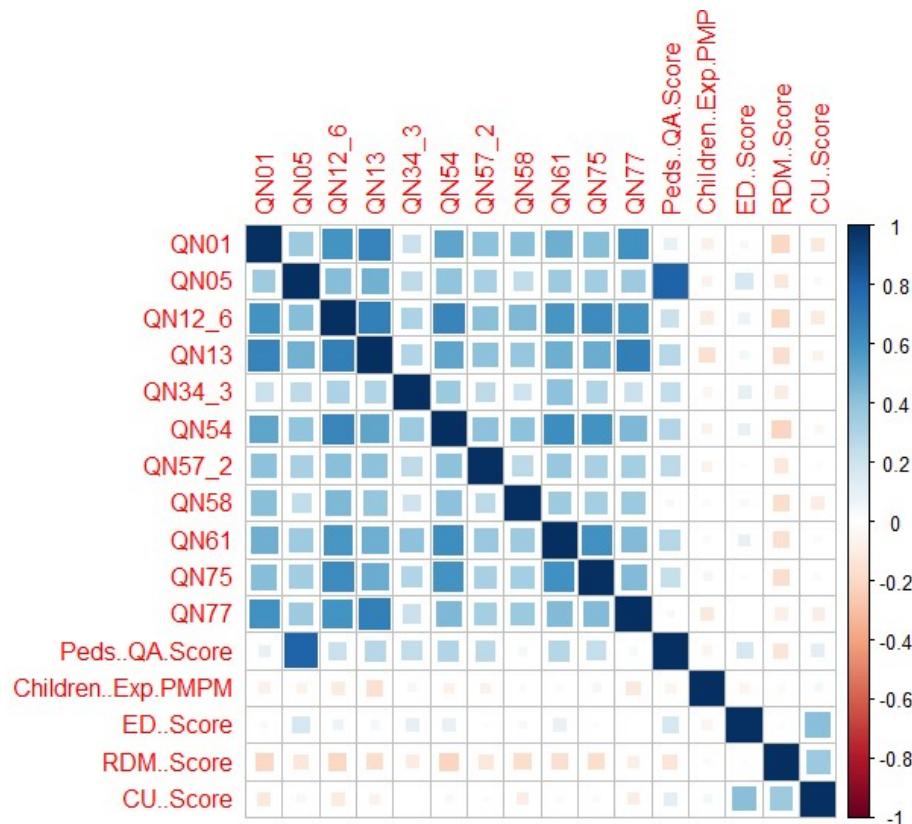
# ED Score per Region



# RDM Score per Region

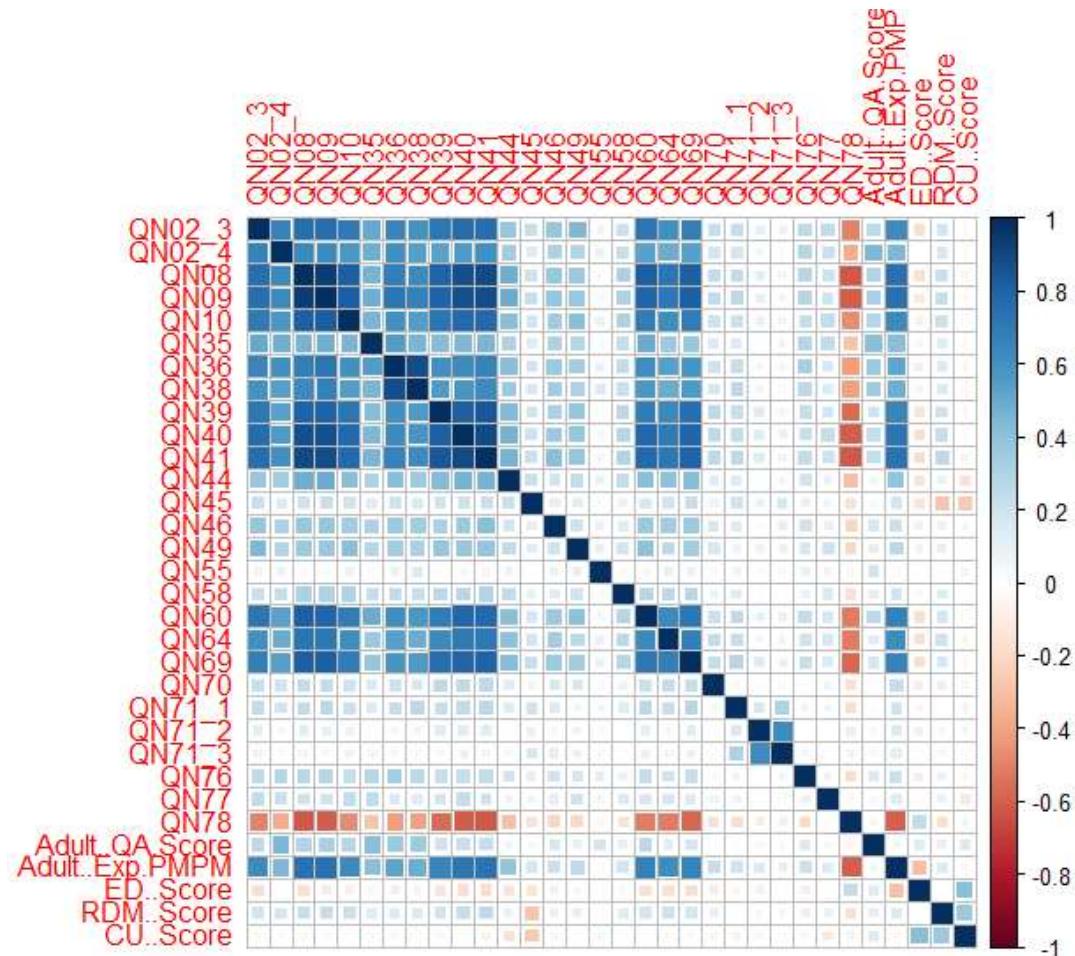
# Pediatric Correlation

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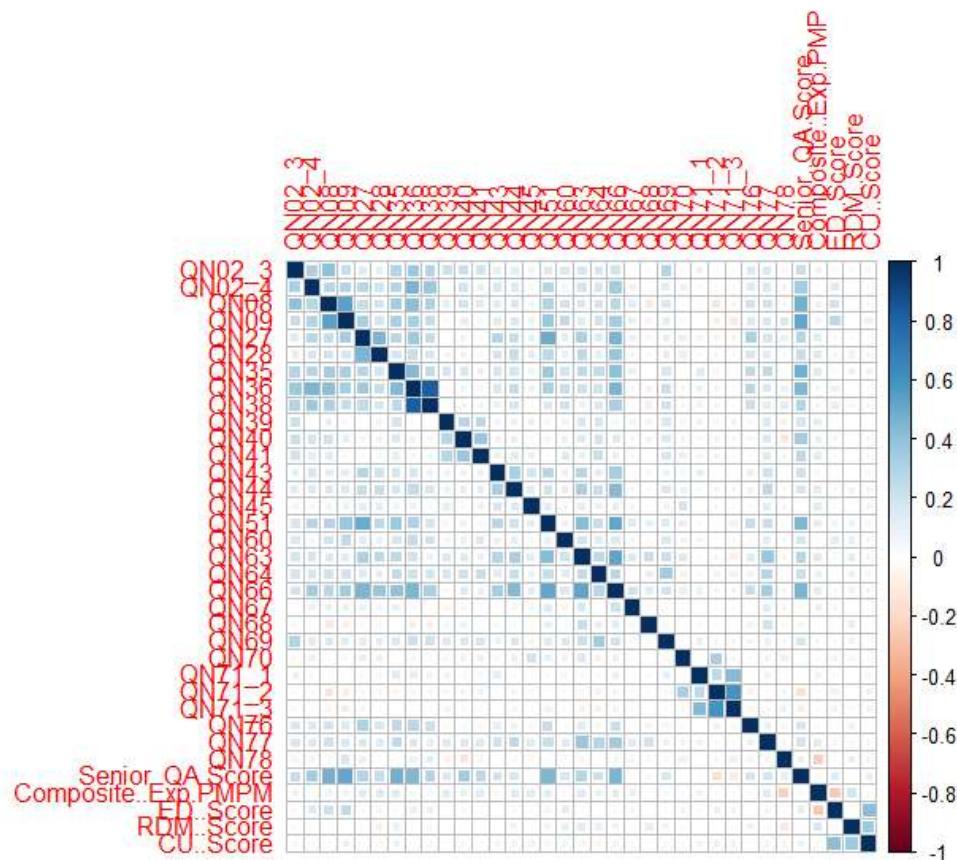
# Adult Correlation

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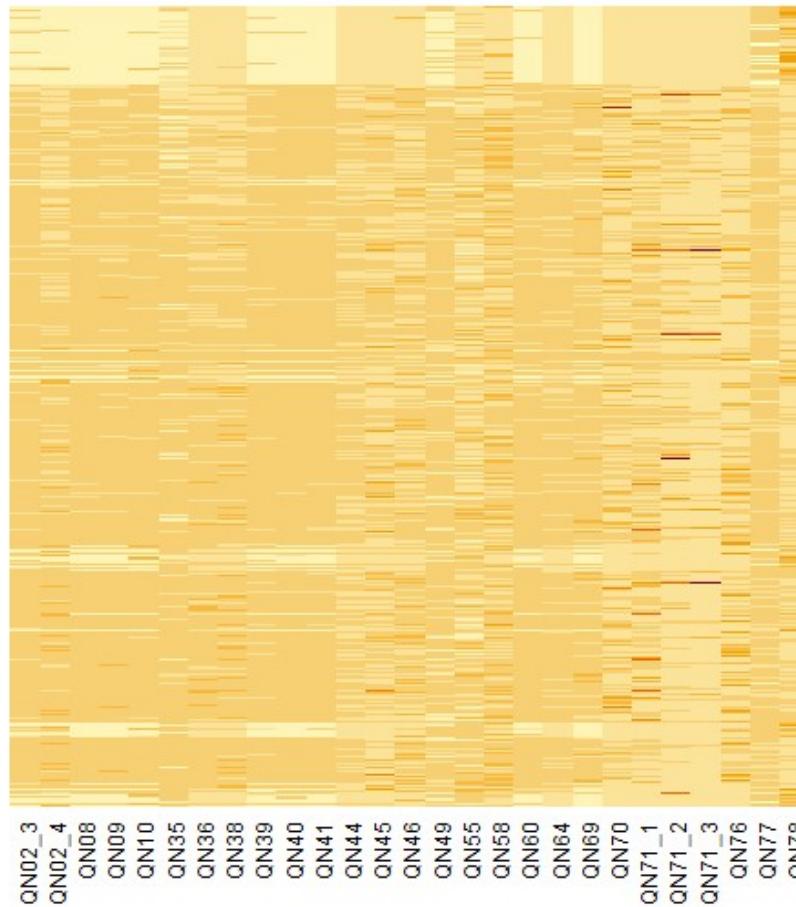
# Senior Correlation

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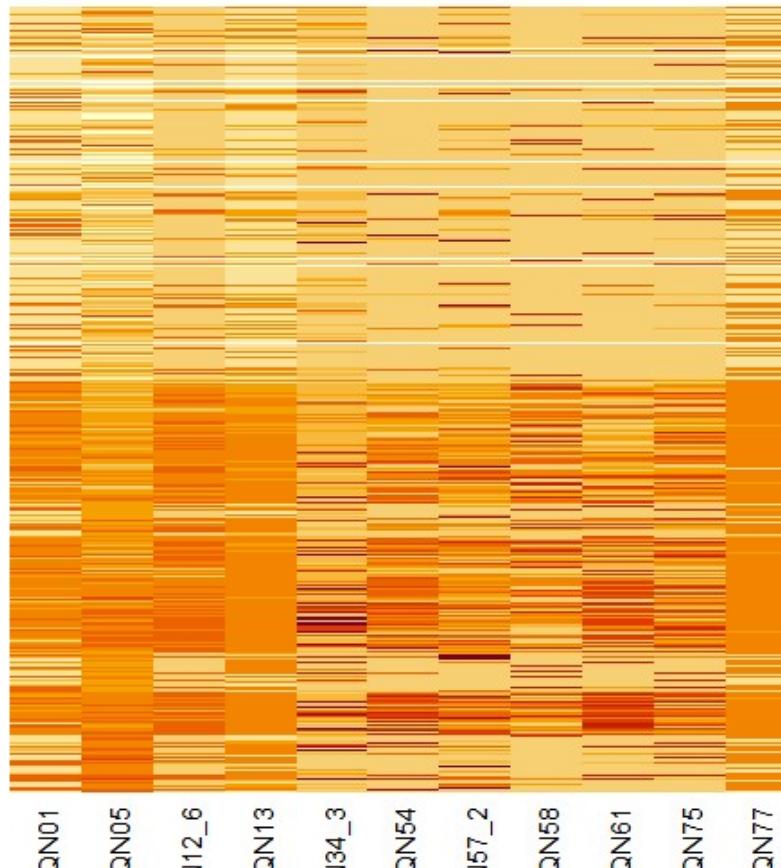
# Adult Heatmap

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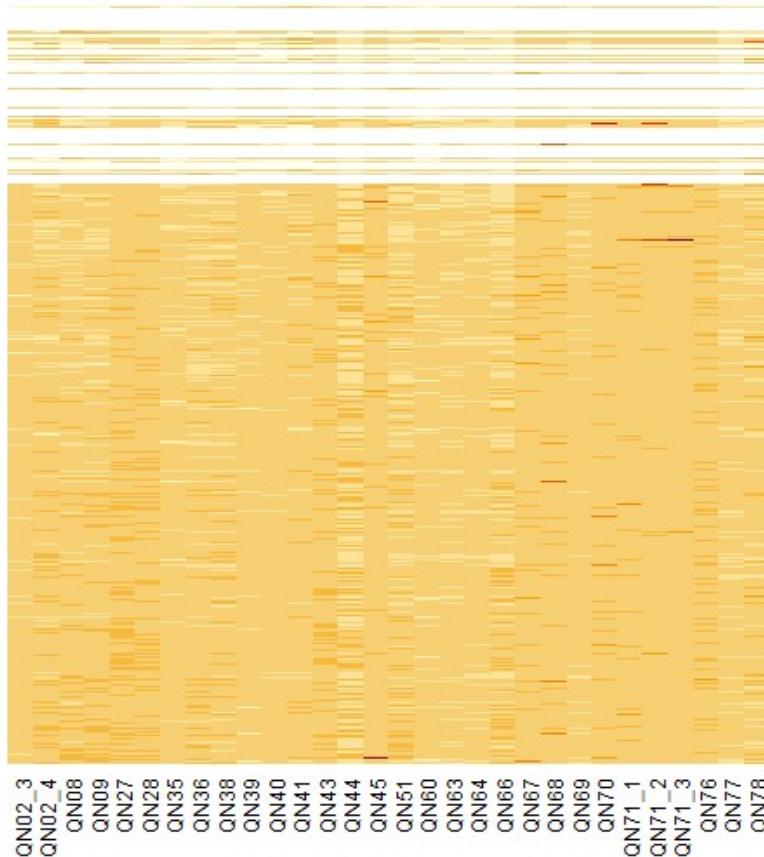
# Pediatric Heatmap

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# Senior Heatmap

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Dep. Variable:	PMPM_Score	R-squared:	0.131			
Model:	OLS	Adj. R-squared:	0.086			
PMPM_Score	coef	std err	t	P> t	[0.025	0.975]
QN02_3	0.0559	0.046	1.207	0.228	-0.035	0.147
QN02_4	-0.0984	0.045	-2.187	0.029	-0.187	-0.01
QN08	0.0902	0.096	0.942	0.347	-0.098	0.278
QN09	-0.1516	0.106	-1.428	0.154	-0.36	0.057
QN10	0.0161	0.051	0.315	0.753	-0.084	0.117
QN35	0.0958	0.035	2.739	0.006	0.027	0.165
QN36	-0.1078	0.062	-1.735	0.083	-0.23	0.014
QN38	0.1302	0.077	1.683	0.093	-0.022	0.282
QN39	-0.0044	0.049	-0.09	0.929	-0.102	0.093
QN40	0.1031	0.065	1.575	0.116	-0.025	0.232
QN41	-0.1307	0.074	-1.776	0.076	-0.275	0.014
QN44	-0.0589	0.02	-2.988	0.003	-0.098	-0.02
QN45	-0.02	0.011	-1.782	0.075	-0.042	0.002
QN46	-0.0312	0.029	-1.073	0.284	-0.088	0.026
QN49	0.022	0.028	0.795	0.427	-0.032	0.076
QN55	0.0249	0.035	0.706	0.48	-0.044	0.094
QN58	-0.017	0.021	-0.811	0.417	-0.058	0.024
QN60	0.0654	0.046	1.412	0.159	-0.026	0.156
QN64	0.0032	0.03	0.108	0.914	-0.055	0.061
QN69	0.0451	0.049	0.919	0.358	-0.051	0.142
QN70	-0.062	0.098	-0.636	0.525	-0.254	0.13
QN71_1	-0.0669	0.058	-1.159	0.247	-0.18	0.047
QN71_2	-0.1251	0.131	-0.952	0.342	-0.383	0.133
QN71_3	0.4677	0.262	1.783	0.075	-0.048	0.983
QN76	-0.0053	0.039	-0.135	0.893	-0.082	0.072
QN77	-0.2173	0.043	-5.02	0	-0.302	-0.132
QN78	0.0031	0.05	0.061	0.951	-0.095	0.101

<b>Dep. Variable:</b>	ED_Score	<b>R-squared:</b>	0.175			
<b>Model:</b>	OLS	<b>Adj. R-squared:</b>	0.132			
<b>ED_Score</b>	<b>coef</b>	<b>std err</b>	<b>t</b>	<b>P&gt; t </b>	<b>[0.025</b>	<b>0.975]</b>
QN02_3	-0.0507	0.025	-2.008	0.045	-0.1	-0.001
QN02_4	0.0874	0.025	3.564	0	0.039	0.136
QN08	-0.1648	0.052	-3.156	0.002	-0.267	-0.062
QN09	0.2495	0.058	4.312	0	0.136	0.363
QN10	0.0411	0.028	1.475	0.141	-0.014	0.096
QN35	-0.0108	0.019	-0.564	0.573	-0.048	0.027
QN36	-0.0255	0.034	-0.754	0.451	-0.092	0.041
QN38	0.0498	0.042	1.182	0.238	-0.033	0.133
QN39	0.0362	0.027	1.344	0.18	-0.017	0.089
QN40	-0.0091	0.036	-0.255	0.799	-0.079	0.061
QN41	-0.0533	0.04	-1.327	0.185	-0.132	0.026
QN44	-0.0225	0.011	-2.093	0.037	-0.044	-0.001
QN45	-0.0131	0.006	-2.145	0.002	-0.025	-0.001
QN46	-0.0097	0.016	-0.615	0.539	-0.041	0.021
QN49	-0.0017	0.015	-0.114	0.909	-0.031	0.028
QN55	0.0116	0.019	0.604	0.546	-0.026	0.049
QN58	0.0244	0.011	2.138	0.033	0.002	0.047
QN60	-0.0222	0.025	-0.881	0.379	-0.072	0.027
QN64	-0.0145	0.016	-0.899	0.369	-0.046	0.017
QN69	-0.0238	0.027	-0.889	0.374	-0.076	0.029
QN70	-0.084	0.053	-1.58	0.115	-0.188	0.02
QN71_1	-0.0285	0.031	-0.905	0.366	-0.09	0.033
QN71_2	-0.1693	0.072	-2.364	0.018	-0.31	-0.029
QN71_3	0.4033	0.143	2.821	0.005	0.122	0.684
QN76	-0.0365	0.021	-1.711	0.088	-0.078	0.005
QN77	0.0193	0.024	0.819	0.413	-0.027	0.066
QN78	0.0971	0.027	3.557	0	0.043	0.151

Dep. Variable:	RDM_Score	R-squared:	0.208			
Model:	OLS	Adj. R-squared:	0.167			
RDM_Score	coef	std err	t	P> t	[0.025	0.975]
QN02_3	0.0117	0.021	0.555	0.579	-0.03	0.053
QN02_4	-0.0012	0.02	-0.058	0.953	-0.041	0.039
QN08	-0.0636	0.043	-1.466	0.143	-0.149	0.022
QN09	0.0728	0.048	1.515	0.13	-0.022	0.167
QN10	0.0208	0.023	0.899	0.369	-0.025	0.066
QN35	0.0062	0.016	0.39	0.696	-0.025	0.037
QN36	-0.0321	0.028	-1.142	0.254	-0.087	0.023
QN38	0.0142	0.035	0.407	0.684	-0.055	0.083
QN39	-0.0303	0.022	-1.355	0.176	-0.074	0.014
QN40	0.0095	0.03	0.321	0.748	-0.049	0.068
QN41	0.1057	0.033	3.169	0.002	0.04	0.171
QN44	9.53E-05	0.009	0.011	0.991	-0.017	0.018
QN45	-0.043	0.005	-8.444	0	-0.053	-0.033
QN46	-0.0064	0.013	-0.484	0.629	-0.032	0.019
QN49	0.0057	0.013	0.452	0.651	-0.019	0.03
QN55	-0.003	0.016	-0.185	0.853	-0.034	0.028
QN58	0.0154	0.009	1.63	0.104	-0.003	0.034
QN60	-0.0203	0.021	-0.967	0.334	-0.061	0.021
QN64	0.011	0.013	0.818	0.414	-0.015	0.037
QN69	-0.0189	0.022	-0.852	0.395	-0.063	0.025
QN70	0.048	0.044	1.088	0.277	-0.039	0.135
QN71_1	0.0001	0.026	0.005	0.996	-0.051	0.052
QN71_2	-0.0947	0.06	-1.591	0.112	-0.212	0.022
QN71_3	0.0764	0.119	0.644	0.52	-0.157	0.31
QN76	0.019	0.018	1.076	0.283	-0.016	0.054
QN77	0.0161	0.02	0.819	0.413	-0.022	0.055
QN78	-0.0113	0.023	-0.499	0.618	-0.056	0.033

Dep. Variable:	Adult_Exp_PMPM	R-squared:	0.647			
Model:	OLS	Adj. R-squared:	0.629			
	coef	std err	t	P> t	[0.025	0.975]
QN02_3	57.7512	31.116	1.856	0.064	-3.377	118.879
QN02_4	-74.0502	30.218	-2.451	0.016	-133.415	-14.686
QN08	68.5893	64.322	1.066	0.287	-57.774	194.953
QN09	92.3411	71.265	1.296	0.196	-47.661	232.343
QN10	32.3073	34.305	0.942	0.347	-35.085	99.7
QN35	67.3615	23.496	2.867	0.004	21.204	113.519
QN36	-47.7641	41.722	-1.145	0.253	-129.729	34.201
QN38	23.5804	51.92	0.454	0.65	-78.419	125.579
QN39	-21.2743	33.187	-0.641	0.522	-86.47	43.922
QN40	21.044	43.925	0.479	0.632	-65.248	107.337
QN41	126.9595	49.417	2.569	0.001	29.878	224.041
QN44	11.8993	13.232	0.899	0.369	-14.095	37.893
QN45	1.3894	7.549	0.184	0.854	-13.44	16.219
QN46	-83.1641	19.503	-4.264	0	-121.477	-44.851
QN49	-39.5729	18.603	-2.127	0.034	-76.119	-3.027
QN55	-26.8744	23.652	-1.136	0.256	-73.34	19.591
QN58	-25.9798	14.048	-1.849	0.065	-53.578	1.618
QN60	83.1696	31.083	2.676	0.008	22.105	144.234
QN64	40.1564	19.885	2.019	0.044	1.091	79.221
QN69	48.0693	32.942	1.459	0.145	-16.646	112.785
QN70	116.1668	65.462	1.775	0.077	-12.436	244.769
QN71_1	-46.1358	38.779	-1.19	0.235	-122.318	30.046
QN71_2	32.1435	88.202	0.364	0.716	-141.132	205.42
QN71_3	258.4641	176.071	1.468	0.143	-87.434	604.362
QN76	14.7462	26.241	0.562	0.574	-36.806	66.298
QN77	-5.7906	29.063	-0.199	0.842	-62.886	51.305
QN78	-148.5417	33.609	-4.42	0	-214.567	-82.516

Dep. Variable:	Children_Exp_PMPM	R-squared:	0.046			
Model:	OLS	Adj. R-squared:	0.027			
	coef	std err	t	P> t	[0.025	0.975]
const	106.2732	17.573	6.047	0	71.752	140.794
QN01	27.8745	22.063	1.263	0.207	-15.466	71.216
QN05	100.3934	33.328	3.012	0.003	34.924	165.863
QN12_6	-26.5991	24.24	-1.097	0.273	-74.216	21.018
QN13	-30.8996	26.064	-1.186	0.236	-82.099	20.3
QN34_3	2.0853	31.873	0.065	0.948	-60.525	64.696
QN54	-28.0441	35.53	-0.789	0.43	-97.84	41.752
QN57_2	0.1652	34.301	0.005	0.996	-67.216	67.546
QN58	13.508	23.96	0.564	0.573	-33.56	60.576
QN61	12.6747	27.421	0.462	0.644	-41.191	66.541
QN75	9.8902	28.23	0.35	0.726	-45.565	65.345
QN77	45.1241	20.56	2.195	0.029	4.736	85.512

<b>Dep. Variable:</b>	Peds_QA_Score	<b>R-squared:</b>	0.511			
<b>Model:</b>	DLS	<b>Adj. R-squared:</b>	0.501			
	coef	std err	t	P> t	[0.025	0.975]
const	-0.2355	0.028	-8.434	0	-0.29	-0.181
QN01	-0.0459	0.035	-1.308	0.191	-0.115	0.023
QN05	0.809	0.053	15.278	0	0.705	0.913
QN12_6	-0.0492	0.039	-1.276	0.202	-0.125	0.027
QN13	0.1504	0.041	3.632	0	0.069	0.232
QN34_3	0.0637	0.051	1.258	0.209	-0.036	0.163
QN54	0.1032	0.056	1.829	0.068	-0.008	0.214
QN57_2	0.1295	0.054	2.377	0.018	0.022	0.237
QN58	-0.0892	0.038	-2.343	0.02	-0.164	-0.014
QN61	0.0871	0.044	1.999	0.046	0.001	0.173
QN75	0.0329	0.045	0.735	0.463	-0.055	0.121
QN77	-0.0402	0.033	-1.23	0.219	-0.104	0.024

<b>Dep. Variable:</b>	Senior_QA_Score	<b>R-squared:</b>	0.716			
<b>Model:</b>	OLS	<b>Adj. R-squared:</b>	0.71			
	coef	std err	t	P> t	[0.025	0.975]
const	-0.0266	0.016	-1.649	0.1	-0.058	0.005
QN02_3	-0.1845	0.061	-3.036	0.003	-0.304	-0.065
QN02_4	0.0679	0.044	1.549	0.122	-0.018	0.154
QN08	0.1824	0.056	3.282	0.001	0.073	0.292
QN09	0.1536	0.068	2.245	0.025	0.019	0.288
QN27	0.0488	0.028	1.718	0.086	-0.007	0.105
QN28	0.0558	0.027	2.074	0.039	0.003	0.109
QN35	0.2471	0.044	5.635	0	0.161	0.333
QN36	0.1167	0.056	2.086	0.037	0.007	0.227
QN38	0.0284	0.057	0.498	0.619	-0.084	0.14
QN39	0.0553	0.042	1.326	0.185	-0.027	0.137
QN40	0.1197	0.064	1.867	0.062	-0.006	0.246

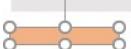
<b>Dep. Variable:</b>	MA_Exp_PMPM	<b>R-squared:</b>	0.242			
<b>Model:</b>	OLS	<b>Adj. R-squared:</b>	0.226			
	coef	std err	t	P> t	[0.025	0.975]
const	21.8623	70.697	0.309	0.757	-117.016	160.74
QN02_3	769.0564	266.062	2.891	0.004	246.404	1291.709
QN02_4	-707.0118	191.695	-3.688	0	-1083.577	-330.446
QN08	193.7423	243.228	0.797	0.426	-284.055	671.54
QN09	-35.1479	299.527	-0.117	0.907	-623.539	553.243
QN27	128.3383	124.327	1.032	0.302	-115.89	372.567
QN28	71.8075	117.787	0.61	0.542	-159.572	303.187
QN35	143.2152	191.936	0.746	0.456	-233.824	520.254
QN36	541.556	244.837	2.212	0.027	60.599	1022.513
QN38	-654.4784	249.488	-2.623	0.009	-1144.573	-164.384
QN39	-4.1078	182.515	-0.023	0.982	-362.64	354.424
QN40	447.4924	280.494	1.595	0.111	-103.509	998.494

<b>Dep. Variable:</b>	Senior_ED_Rate	<b>R-squared:</b>	0.443			
<b>Model:</b>	OLS	<b>Adj. R-squared:</b>	0.431			
	coef	std err	t	P> t	[0.025	0.975]
const	9.6745	12.263	0.789	0.431	-14.415	33.764
QN02_3	279.4961	46.15	6.056	0	188.838	370.154
QN02_4	-45.1229	33.251	-1.357	0.175	-110.441	20.195
QN08	1.599	42.19	0.038	0.97	-81.278	84.476
QN09	-93.0188	51.955	-1.79	0.074	-195.079	9.042
QN27	30.1932	21.565	1.4	0.162	-12.17	72.556
QN28	8.2747	20.431	0.405	0.686	-31.86	48.409
QN35	130.5253	33.293	3.921	0	65.125	195.925
QN36	0.396	42.469	0.009	0.993	-83.029	83.821
QN38	-39.793	43.275	-0.92	0.358	-124.803	45.217
QN39	-19.2742	31.658	-0.609	0.543	-81.464	42.916
QN40	12.9394	48.654	0.266	0.79	-82.636	108.514

<b>Dep. Variable:</b>	Senior_RDM_Rate	<b>R-squared:</b>	0.098			
<b>Model:</b>	OLS	<b>Adj. R-squared:</b>	0.079			
	coef	std err	t	P> t	[0.025	0.975]
const	0.0088	0.089	0.099	0.921	-0.165	0.183
QN02_3	0.4097	0.333	1.229	0.22	-0.245	1.064
QN02_4	-0.5725	0.24	-2.384	0.017	-1.044	-0.101
QN08	-0.0159	0.305	-0.052	0.958	-0.614	0.583
QN09	0.4836	0.375	1.289	0.198	-0.253	1.221
QN27	0.2159	0.156	1.386	0.166	-0.09	0.522
QN28	0.2092	0.148	1.418	0.157	-0.081	0.499
QN35	-0.0047	0.24	-0.02	0.984	-0.477	0.468
QN36	0.5101	0.307	1.663	0.097	-0.092	1.113
QN38	-0.4433	0.313	-1.418	0.157	-1.057	0.171
QN39	0.6042	0.229	2.643	0.008	0.155	1.053
QN40	-0.5835	0.351	-1.661	0.097	-1.274	0.107

# Forward Stepwise Selection

PMPM Cost	ED Score	CU Score	Quality Score	RDM Score
Breast Cancer Screening (+)	Comprehensive Diabetes Care: Medical Attention for Nephropathy (-)	Adult BMI Assessment (+)	Comprehensive Diabetes Care: Eye Exam (retinal) performed(+)	Medication Adherence for Cholesterol (Statins) (+)
Avoidance of Antibiotic Treatment in Adults with Acute Bronchitis (-)	Comprehensive Diabetes Care: Eye Exam (retinal) performed(+)	Avoid Inappropriate Ambulatory Antibiotic Use (-)	Colorectal Cancer Screening (+)	All-cause Readmissions (-)
Annual Monitoring for Patients on Persistent Medications (+)	Annual EKGs or Cardiac Screening (+)	All-cause Readmissions (-)	Adult BMI Assessment (+)	
Annual EKGs or Cardiac Screening (-)		Disease-Modifying Anti-Rheumatic Drug Therapy for Rheumatoid Arthritis (-)	Annual EKG or Cardiac Screening (+)	
Medication Adherence for Cholesterol (Statins) (+)			Chlamydia Screening in Women (+)	
			Statin Therapy for Patients with Cardiovascular Disease (-)	
			Statin Use in Persons with Diabetes (-)	
			Avoid Inappropriate Ambulatory Antibiotic Use (-)	
			Disease-Modifying Anti-Rheumatic Drug Therapy for Rheumatoid Arthritis (-)	


Expected/ Explainable Results

# Adult QA Forward Stepwise

---

```
call:  
lm(formula = Adult..QA.Score ~ QN02_4 + QN09 + QN35 + QN44 +  
    QN55 + QN64 + QN69 + QN77 + QN78, data = adult_reg)  
  
Residuals:  
    Min      1Q  Median      3Q     Max  
-0.44360 -0.12099 -0.01377  0.09503  0.69575  
  
Coefficients:  
              Estimate Std. Error t value Pr(>|t|)  
(Intercept) -0.03214   0.05977 -0.538 0.590957  
QN02_4       0.29496   0.04114  7.169 2.60e-12 ***  
QN09         0.41666   0.05969  6.980 9.02e-12 ***  
QN35         0.24586   0.03345  7.349 7.79e-13 ***  
QN44        -0.08068   0.01915 -4.214 2.96e-05 ***  
QN55         0.18397   0.03421  5.378 1.14e-07 ***  
QN64        -0.07531   0.02845 -2.647 0.008356 **  
QN69        -0.12242   0.04629 -2.645 0.008422 **  
QN77        -0.19157   0.05246 -3.652 0.000287 ***  
QN78         0.33574   0.05525  6.077 2.37e-09 ***  
---  
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1  
  
Residual standard error: 0.1774 on 520 degrees of freedom  
(36 observations deleted due to missingness)  
Multiple R-squared:  0.3942,    Adjusted R-squared:  0.3837  
F-statistic: 37.6 on 9 and 520 DF,  p-value: < 2.2e-16
```

# Adult PMPM Forward Stepwise

---

```
call:  
lm(formula = Adult..Exp.PMPM ~ QN08 + QN41 + QN46 + QN60 + QN78,  
    data = adult_reg)  
  
Residuals:  
    Min      1Q  Median      3Q     Max  
-265.61  -79.49  -16.76   60.56  561.41  
  
Coefficients:  
            Estimate Std. Error t value Pr(>|t|)  
(Intercept)  362.61     22.97  15.788 < 2e-16 ***  
QN08        170.83     41.50   4.117 4.44e-05 ***  
QN41        169.19     40.70   4.157 3.74e-05 ***  
QN46        -68.84     19.31  -3.566 0.000395 ***  
QN60        120.80     28.83   4.191 3.25e-05 ***  
QN78       -174.43     33.01  -5.284 1.84e-07 ***  
---  
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1  
  
Residual standard error: 122.6 on 541 degrees of freedom  
    (19 observations deleted due to missingness)  
Multiple R-squared:  0.6151,    Adjusted R-squared:  0.6115  
F-statistic: 172.9 on 5 and 541 DF,  p-value: < 2.2e-16
```

# Adult ED Forward Stepwise

---

```
call:
lm(formula = ED..Score ~ QN02_3 + QN02_4 + QN78, data = adult_reg)

Residuals:
    Min      1Q  Median      3Q     Max 
-0.19720 -0.08143 -0.02148  0.05854  0.25698 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept) 0.08800   0.01746   5.039 6.39e-07 ***
QN02_3     -0.06958   0.01956  -3.558 0.000407 ***
QN02_4      0.09482   0.02293   4.135 4.11e-05 ***
QN78       0.10921   0.02394   4.562 6.27e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.09992 on 543 degrees of freedom
(19 observations deleted due to missingness)
Multiple R-squared:  0.08948, Adjusted R-squared:  0.08445 
F-statistic: 17.79 on 3 and 543 DF,  p-value: 5.026e-11
```

# Adult RDM Forward Stepwise

---

```
call:  
lm(formula = RDM..Score ~ QN41 + QN45, data = adult_reg)  
  
Residuals:  
    Min      1Q  Median      3Q     Max  
-0.10848 -0.05367 -0.01881  0.01968  0.26603  
  
Coefficients:  
              Estimate Std. Error t value Pr(>|t|)  
(Intercept) 0.011815  0.007813   1.512   0.131  
QN41        0.096667  0.011587   8.343   6e-16 ***  
QN45       -0.041910  0.004892  -8.568  <2e-16 ***  
---  
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1  
  
Residual standard error: 0.08045 on 544 degrees of freedom  
  (19 observations deleted due to missingness)  
Multiple R-squared:  0.1784,    Adjusted R-squared:  0.1753  
F-statistic: 59.05 on 2 and 544 DF,  p-value: < 2.2e-16
```

# Adult CU Forward Stepwise

---

```
call:
lm(formula = CU..Score ~ QN35 + QN44 + QN45 + QN77, data = adult_reg)

Residuals:
    Min      1Q  Median      3Q     Max 
-0.51640 -0.15969 -0.01671  0.11974  0.85511 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept) 0.40913   0.04492   9.109 < 2e-16 ***
QN35        0.10727   0.03392   3.163  0.00165 **  
QN44       -0.06369   0.02092  -3.044  0.00245 **  
QN45       -0.07361   0.01287  -5.721 1.75e-08 ***
QN77       -0.15428   0.04887  -3.157  0.00168 **  
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.211 on 542 degrees of freedom
(19 observations deleted due to missingness)
Multiple R-squared:  0.1027,    Adjusted R-squared:  0.09605 
F-statistic: 15.5 on 4 and 542 DF,  p-value: 5.127e-12
```

# Senior QA Forward Stepwise

```
call:  
lm(formula = Senior..QA.Score ~ QN08 + QN09 + QN35 + QN36 + QN40 +  
    QN41 + QN51 + QN71_2, data = senior_reg)  
  
Residuals:  
    Min      1Q  Median      3Q     Max  
-0.50461 -0.08034  0.00216  0.07869  0.53623  
  
Coefficients:  
            Estimate Std. Error t value Pr(>|t|)  
(Intercept) -1.03841   0.08469 -12.261 < 2e-16 ***  
QN08         0.14138   0.05182   2.728  0.00664 **  
QN09         0.36515   0.06925   5.273 2.16e-07 ***  
QN35         0.27818   0.03944   7.054 7.22e-12 ***  
QN36         0.12792   0.02785   4.592 5.80e-06 ***  
QN40         0.52763   0.07341   7.188 3.04e-12 ***  
QN41         0.47881   0.07135   6.711 6.29e-11 ***  
QN51         0.12298   0.02178   5.647 3.01e-08 ***  
QN71_2       -0.27903   0.07060  -3.952 9.09e-05 ***  
---  
signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1  
  
Residual standard error: 0.1369 on 420 degrees of freedom  
    (137 observations deleted due to missingness)  
Multiple R-squared:  0.5991,    Adjusted R-squared:  0.5915  
F-statistic: 78.45 on 8 and 420 DF,  p-value: < 2.2e-16
```

# Senior PMPM Forward Stepwise

---

```
call:
lm(formula = Composite..Exp.PMPM ~ QN28 + QN77 + QN78, data = senior_reg)

Residuals:
    Min      1Q  Median      3Q     Max 
-454.25 -103.58  -23.43   82.63 1126.51 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept)  674.38     17.74   38.004 < 2e-16 ***
QN28        65.97     22.19    2.973  0.00311 **  
QN77        54.28     19.73    2.751  0.00618 **  
QN78       -724.95    136.76   -5.301 1.83e-07 *** 
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 153.7 on 441 degrees of freedom
(121 observations deleted due to missingness)
Multiple R-squared:  0.09263, Adjusted R-squared:  0.08646 
F-statistic: 15.01 on 3 and 441 DF,  p-value: 2.564e-09
```

# Senior ED Forward Stepwise

---

```
call:  
lm(formula = ED..Score ~ QN09, data = senior_reg)  
  
Residuals:  
    Min      1Q  Median      3Q     Max  
-0.15282 -0.07820 -0.01982  0.05325  0.27369  
  
Coefficients:  
            Estimate Std. Error t value Pr(>|t|)  
(Intercept) -0.04020   0.02490  -1.614   0.107  
QN09         0.19301   0.03366   5.734 1.82e-08 ***  
---  
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1  
  
Residual standard error: 0.09412 on 443 degrees of freedom  
    (121 observations deleted due to missingness)  
Multiple R-squared:  0.06909,   Adjusted R-squared:  0.06699  
F-statistic: 32.88 on 1 and 443 DF,  p-value: 1.819e-08
```

# Senior RDM Forward Stepwise

---

```
call:  
lm(formula = RDM..Score ~ QN28 + QN63, data = senior_reg)  
  
Residuals:  
    Min      1Q  Median      3Q     Max  
-0.08354 -0.06255 -0.04000  0.03364  0.21386  
  
Coefficients:  
              Estimate Std. Error t value Pr(>|t|)  
(Intercept) 0.040004  0.008707  4.595 5.66e-06 ***  
QN28        -0.036513  0.013672 -2.671 0.007851 **  
QN63         0.043532  0.012456  3.495 0.000522 ***  
---  
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1  
  
Residual standard error: 0.09235 on 442 degrees of freedom  
  (121 observations deleted due to missingness)  
Multiple R-squared:  0.03401,   Adjusted R-squared:  0.02964  
F-statistic: 7.782 on 2 and 442 DF,  p-value: 0.0004769
```

# Senior CU Forward Stepwise

---

```
call:  
lm(formula = CU..score ~ QN09, data = senior_reg)  
  
Residuals:  
    Min      1Q  Median      3Q     Max  
-0.32925 -0.16006 -0.03165  0.11201  0.71677  
  
Coefficients:  
            Estimate Std. Error t value Pr(>|t|)  
(Intercept) 0.17056   0.05649   3.019  0.00268 **  
QN09        0.15869   0.07636   2.078  0.03826 *  
---  
Signif. codes:  0 '****' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1  
  
Residual standard error: 0.2135 on 443 degrees of freedom  
(121 observations deleted due to missingness)  
Multiple R-squared:  0.009656, Adjusted R-squared:  0.00742  
F-statistic: 4.319 on 1 and 443 DF,  p-value: 0.03826
```

# Pediatric QA Forward Stepwise

---

```
call:  
lm(formula = Peds..QA.Score ~ QN05 + QN58 + QN77, data = pediatric_reg)  
  
Residuals:  
    Min      1Q Median      3Q     Max  
-0.42894 -0.14356 -0.00656  0.15248  0.50071  
  
Coefficients:  
            Estimate Std. Error t value Pr(>|t|)  
(Intercept) -0.58742   0.03938 -14.917 < 2e-16 ***  
QN05         1.69394   0.05783  29.292 < 2e-16 ***  
QN58        -0.09500   0.03012  -3.154  0.00172 **  
QN77        -0.08874   0.02696  -3.292  0.00108 **  
---  
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1  
  
Residual standard error: 0.1989 on 422 degrees of freedom  
  (140 observations deleted due to missingness)  
Multiple R-squared:  0.6711,    Adjusted R-squared:  0.6687  
F-statistic: 287 on 3 and 422 DF,  p-value: < 2.2e-16
```

# Pediatric PMPM Forward Stepwise

---

```
call:
lm(formula = children..Exp.PMPM ~ QN13, data = pediatric_reg)

Residuals:
    Min      1Q  Median      3Q     Max 
-214.84 -59.65 -12.32  24.29 1963.59 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept) 243.43     12.34  19.719 < 2e-16 ***
QN13        -58.16     16.70  -3.483 0.000541 ***  
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 145.5 on 474 degrees of freedom
(90 observations deleted due to missingness)
Multiple R-squared:  0.02496,   Adjusted R-squared:  0.0229 
F-statistic: 12.13 on 1 and 474 DF,  p-value: 0.0005412
```

# Pediatric ED Forward Stepwise

---

```
call:  
lm(formula = ED..Score ~ QN05, data = pediatric_reg)  
  
Residuals:  
    Min      1Q  Median      3Q     Max  
-0.140873 -0.089210 -0.009682  0.053649  0.265061  
  
Coefficients:  
            Estimate Std. Error t value Pr(>|t|)  
(Intercept) 0.06494   0.01242    5.23 2.44e-07 ***  
QN05        0.08254   0.02013    4.10 4.78e-05 ***  
---  
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1  
  
Residual standard error: 0.1026 on 532 degrees of freedom  
  (32 observations deleted due to missingness)  
Multiple R-squared:  0.03063,  Adjusted R-squared:  0.0288  
F-statistic: 16.81 on 1 and 532 DF,  p-value: 4.782e-05
```

# Pediatric RDM Forward Stepwise

---

```
call:
lm(formula = RDM..Score ~ QN54, data = pediatric_reg)

Residuals:
    Min      1Q  Median      3Q     Max 
-0.063325 -0.063325 -0.033390  0.004709  0.254709 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept) 0.063325  0.004514 14.028 < 2e-16 ***
QN54       -0.068034  0.013486 -5.045 6.24e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.08687 on 532 degrees of freedom
(32 observations deleted due to missingness)
Multiple R-squared:  0.04565,   Adjusted R-squared:  0.04386 
F-statistic: 25.45 on 1 and 532 DF,  p-value: 6.243e-07
```

# Pediatric CU Forward Stepwise

---

```
call:  
lm(formula = CU..Score ~ QN01, data = pediatric_reg)  
  
Residuals:  
    Min      1Q  Median      3Q     Max  
-0.32047 -0.16369 -0.02975  0.09953  0.73563  
  
Coefficients:  
            Estimate Std. Error t value Pr(>|t|)  
(Intercept)  0.32047   0.01457  21.988 <2e-16 ***  
QN01        -0.05611   0.02193  -2.559  0.0108 *  
---  
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1  
  
Residual standard error: 0.2217 on 532 degrees of freedom  
(32 observations deleted due to missingness)  
Multiple R-squared:  0.01216,  Adjusted R-squared:  0.0103  
F-statistic: 6.548 on 1 and 532 DF,  p-value: 0.01077
```

# Adult PMPM LASSO

---

(Intercept)	396.78504
QN02_3	.
QN02_4	.
QN08	22.46172
QN09	66.84488
QN10	.
QN35	.
QN36	.
QN38	.
QN39	.
QN40	38.48083
QN41	208.16254
QN44	.
QN45	.
QN46	.
QN49	.
QN55	.
QN58	.
QN60	.
QN64	.
QN69	.
QN70	.
QN71_1	.
QN71_2	.
QN71_3	.
QN76	.
QN77	.
QN78	-84.28839

# Adult ED LASSO

---

```
(Intercept) 0.09917908  
QN02_3 .  
QN02_4 .  
QN08 .  
QN09 .  
QN10 .  
QN35 .  
QN36 .  
QN38 .  
QN39 .  
QN40 .  
QN41 .  
QN44 .  
QN45 .  
QN46 .  
QN49 .  
QN55 .  
QN58 .  
QN60 .  
QN64 .  
QN69 .  
QN70 .  
QN71_1 .  
QN71_2 .  
QN71_3 .  
QN76 .  
QN77 .  
QN78 0.02960208
```

# Adult RDM LASSO

---

(Intercept)	0.03690074
QN02_3	.
QN02_4	.
QN08	.
QN09	.
QN10	.
QN35	.
QN36	.
QN38	.
QN39	.
QN40	.
QN41	0.03172542
QN44	.
QN45	-0.01532462
QN46	.
QN49	.
QN55	.
QN58	.
QN60	.
QN64	.
QN69	.
QN70	.
QN71_1	.
QN71_2	.
QN71_3	.
QN76	.
QN77	.
QN78	.

# Adult QA LASSO

---

(Intercept)	0.346453249
QN02_3	-0.037660446
QN02_4	0.157637122
QN08	.
QN09	.
QN10	.
QN35	0.180300938
QN36	.
QN38	.
QN39	.
QN40	.
QN41	-0.013645677
QN44	-0.040730023
QN45	.
QN46	.
QN49	-0.038076037
QN55	0.002328535
QN58	.
QN60	.
QN64	-0.023060398
QN69	-0.017819143
QN70	.
QN71_1	.
QN71_2	-0.113273943
QN71_3	.
QN76	.
QN77	.
QN78	0.059124274

# Pediatric PMPM LASSO

---

```
(Intercept) 174.2878  
QN02_3 .  
QN02_4 .  
QN08 .  
QN09 .  
QN10 .  
QN35 .  
QN36 .  
QN38 .  
QN39 .  
QN40 .  
QN41 .  
QN44 .  
QN45 .  
QN46 .  
QN49 .  
QN55 .  
QN58 .  
QN60 .  
QN64 .  
QN69 .  
QN70 .  
QN71_1 .  
QN71_2 .  
QN71_3 .  
QN76 .  
QN77 .  
QN78 .
```

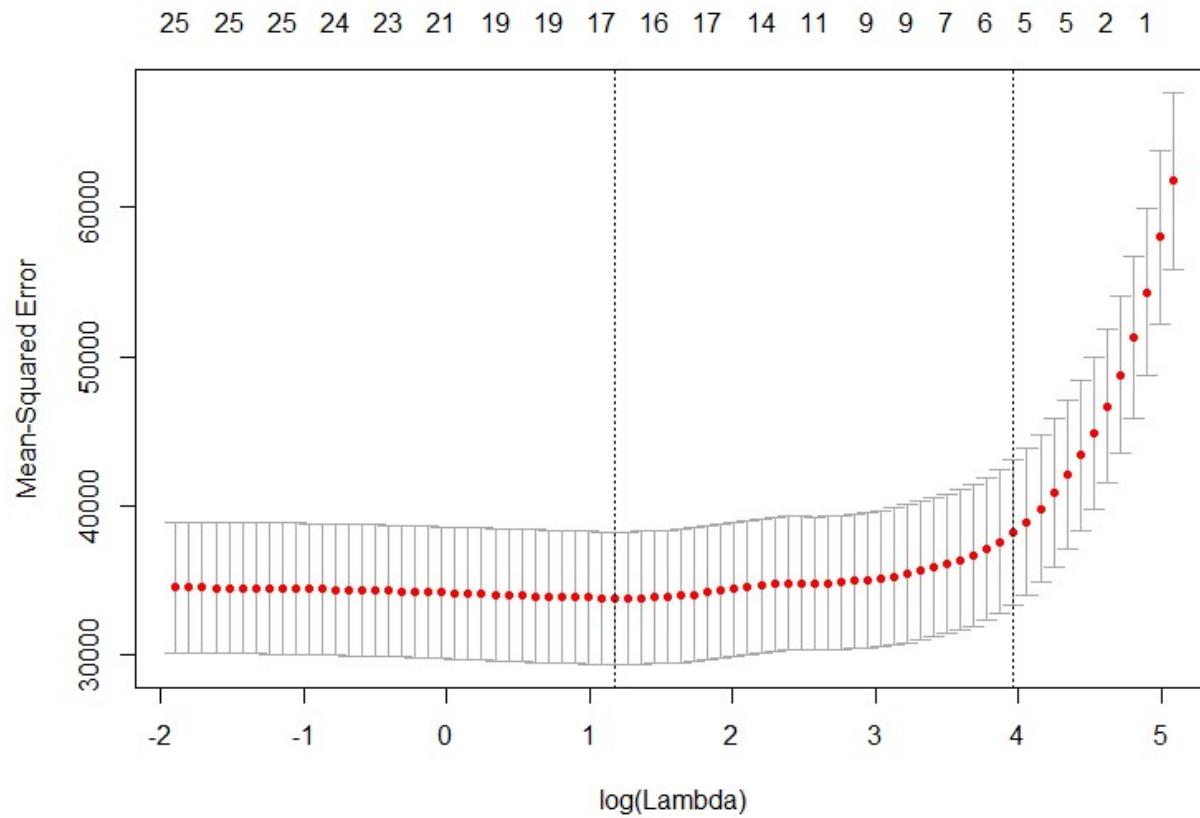
# Senior QA LASSO

---

(Intercept)	0.02095476
QN02_3	.
QN02_4	0.26956884
QN08	.
QN09	.
QN10	.
QN35	0.26578267
QN36	.
QN38	0.15713297
QN39	.
QN40	.
QN41	.
QN44	.
QN45	.
QN46	.
QN49	.
QN55	0.05451242
QN58	.
QN60	.
QN64	.
QN69	.
QN70	.
QN71_1	.
QN71_2	.
QN71_3	.
QN76	.
QN77	.
QN78	0.07230621

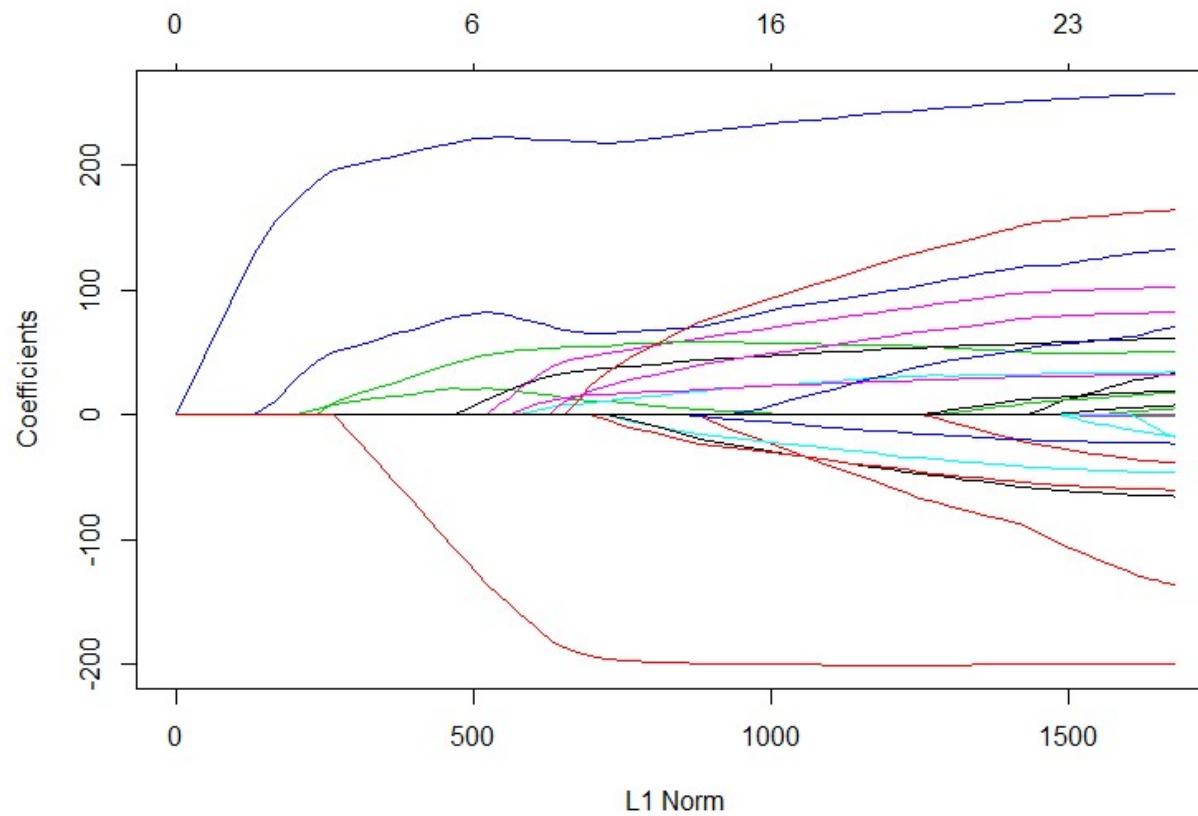
# Adult PMPM Representative LASSO Cross Validation

---



# Adult PMPM Representative LASSO L1 Plot

---



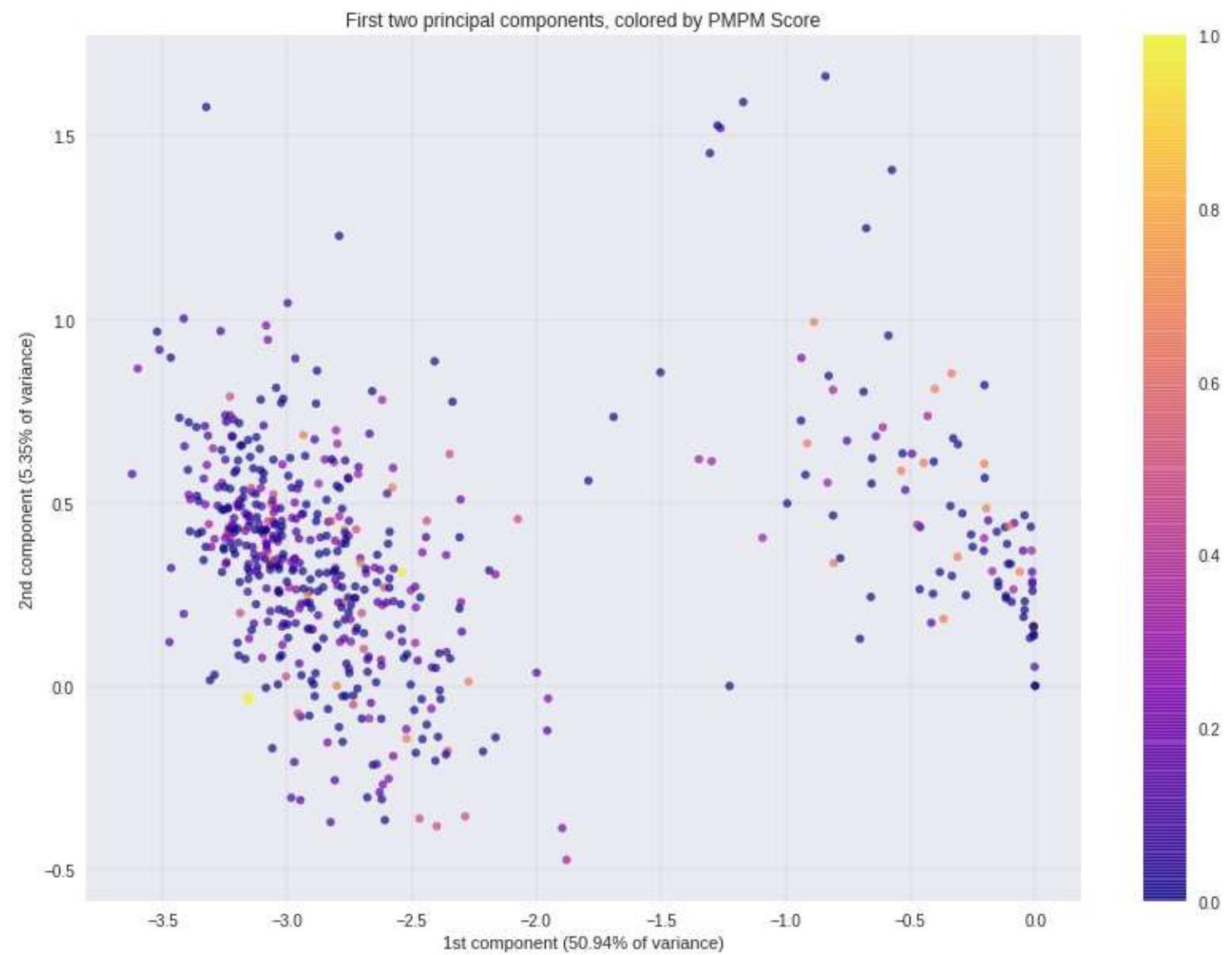
First Component, which explains 50.95% of the variance

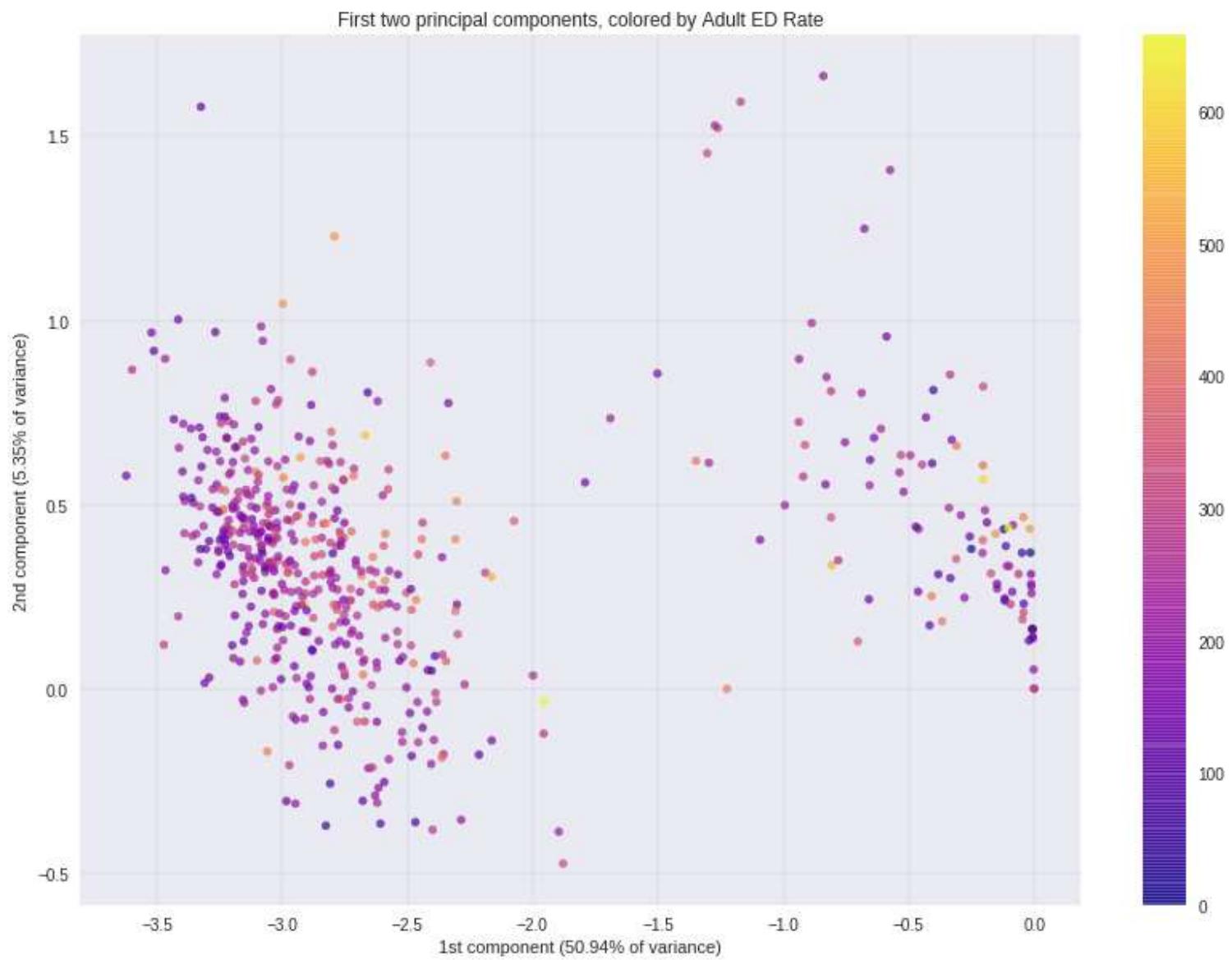
```
=====
QN09 : -0.28862592162798334
QN08 : -0.2866591756521455
QN41 : -0.28229597005312174
QN40 : -0.2770800541050161
QN39 : -0.26089223250712107
QN10 : -0.2600078279816611
QN60 : -0.2599137199541832
QN69 : -0.2596142866925529
QN02_3 : -0.25888997885577614
QN36 : -0.2440690818243177
QN64 : -0.23409260842563298
QN38 : -0.22973241991879584
QN02_4 : -0.21648458830405395
QN35 : -0.17922399965663344
QN44 : -0.16417976990183106
QN49 : -0.14322526322747156
QN46 : -0.13932777316733272
QN58 : -0.10771535256942089
QN71_1 : -0.09434963827587328
QN45 : -0.07882724560939545
QN55 : -0.026036469357854725
```

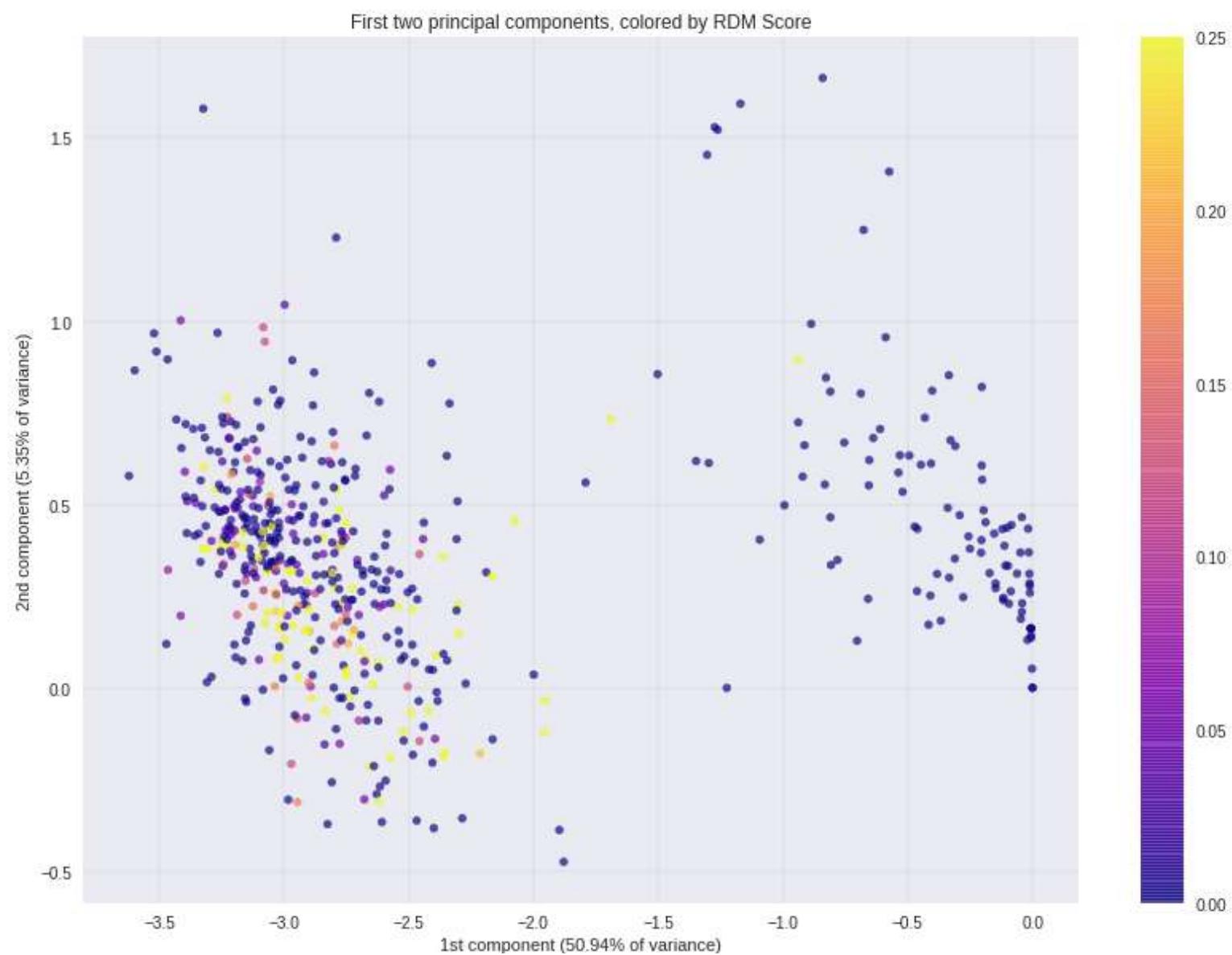
Second Component, which explains 5.35% of the variance

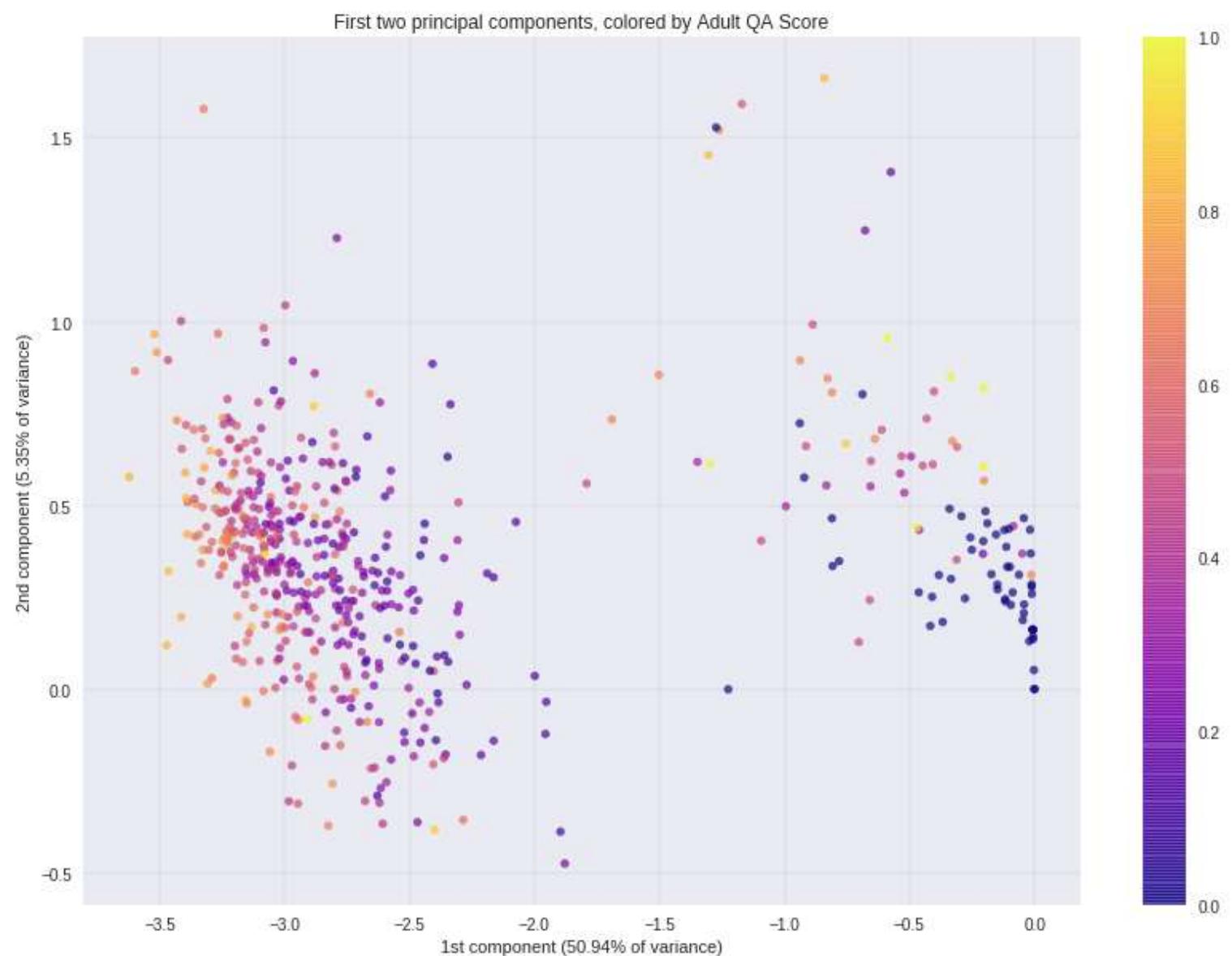
```
=====
QN55 : 0.647387716031148
QN71_1 : 0.29738798897907165
QN38 : 0.27550300108997716
QN36 : 0.2327693620723804
QN35 : 0.22459273375293046
QN46 : 0.21309815236686533
QN45 : 0.20001718703745341
QN39 : -0.18950167625774544
QN40 : -0.18005236347659484
QN49 : 0.16131622804324483
QN08 : -0.1569290365758286
QN41 : -0.14478136782528092
QN09 : -0.12914288609191388
QN02_4 : 0.11480846937175762
QN69 : -0.11393544055990115
QN64 : -0.10920726825048907
QN58 : 0.10890043140909837
QN10 : -0.09399321509353206
QN60 : -0.07486688644654095
QN44 : 0.07404584262700563
QN02_3 : -0.004144505441102483
```











First Component, which explains 52.02% of the variance

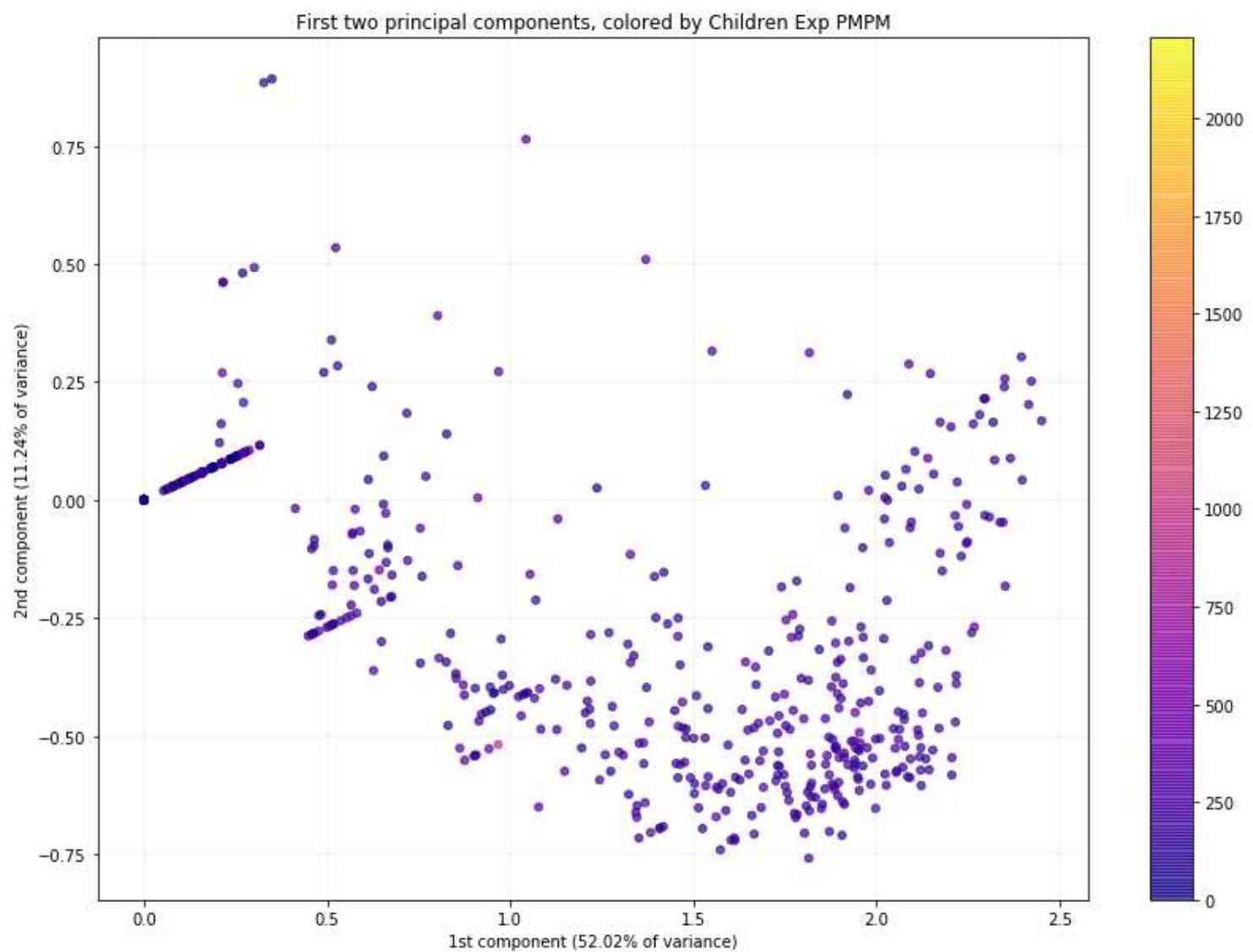
=====

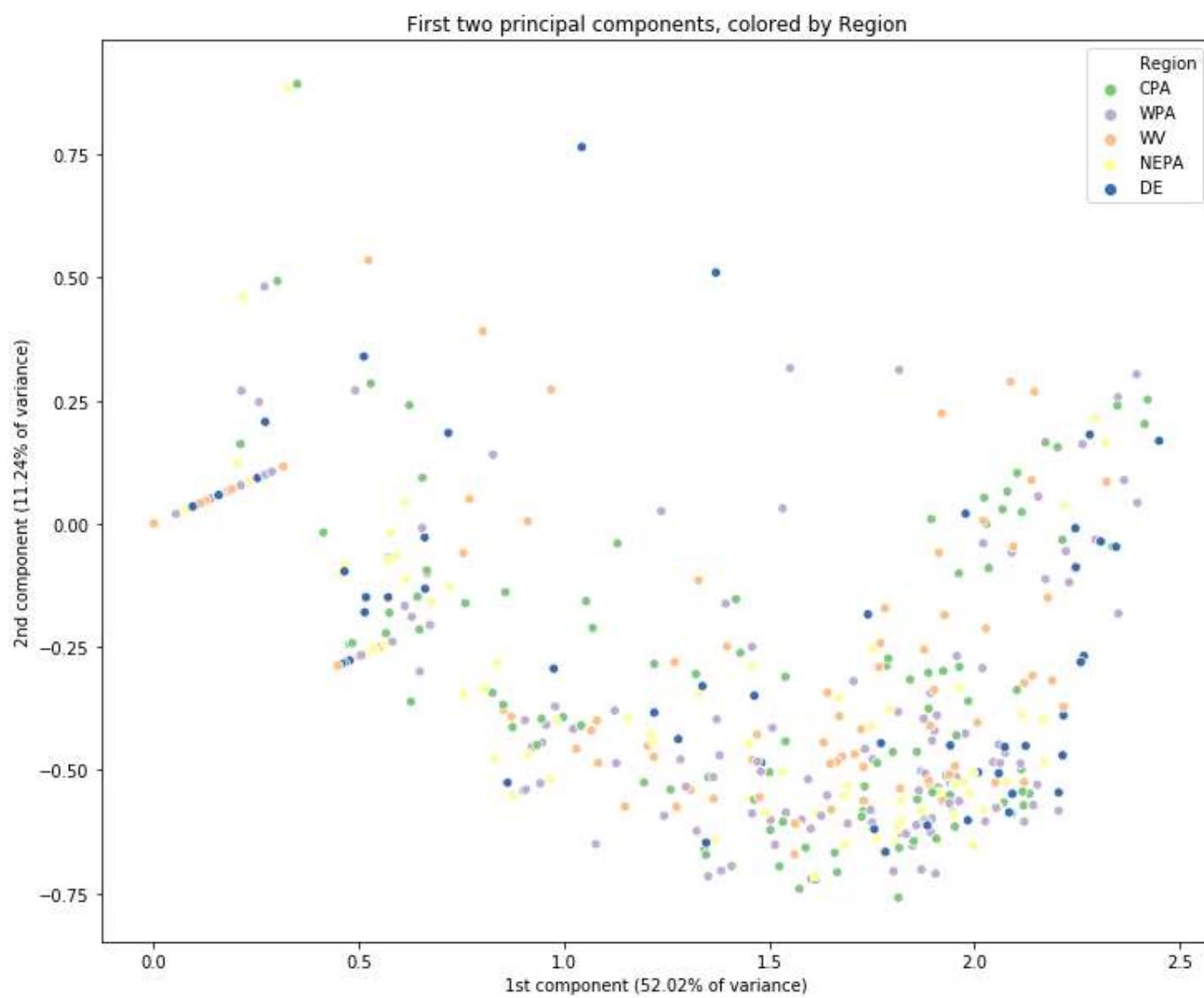
QN13 : 0.42218088114277325  
QN12\_6 : 0.4130799616554425  
QN01 : 0.38575042930292985  
QN77 : 0.3854590148116729  
QN75 : 0.3449924048946113  
QN05 : 0.31594192943137844  
QN57\_2 : 0.29182389894748606  
QN34\_3 : 0.22303800766812568

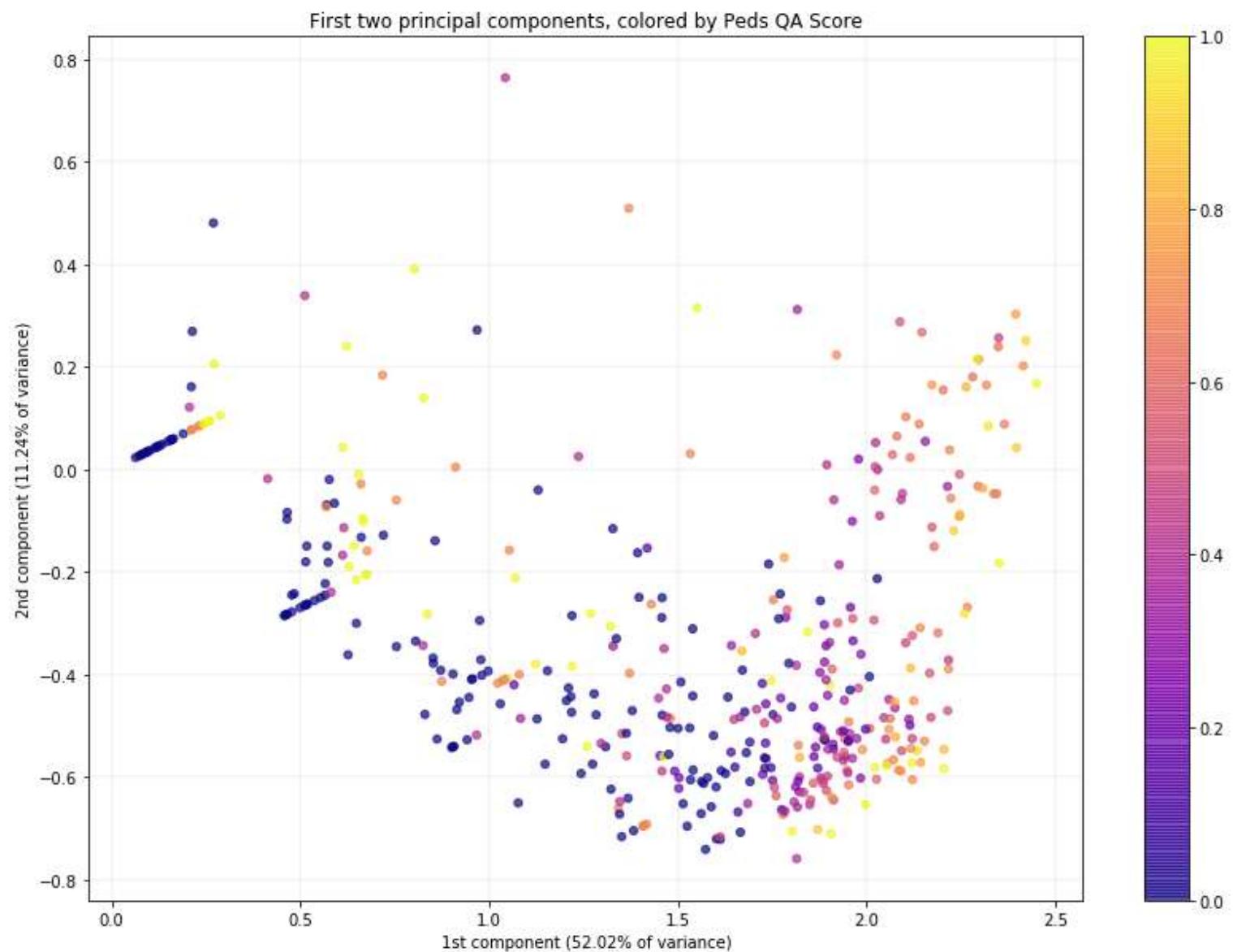
Second Component, which explains 11.24% of the variance

=====

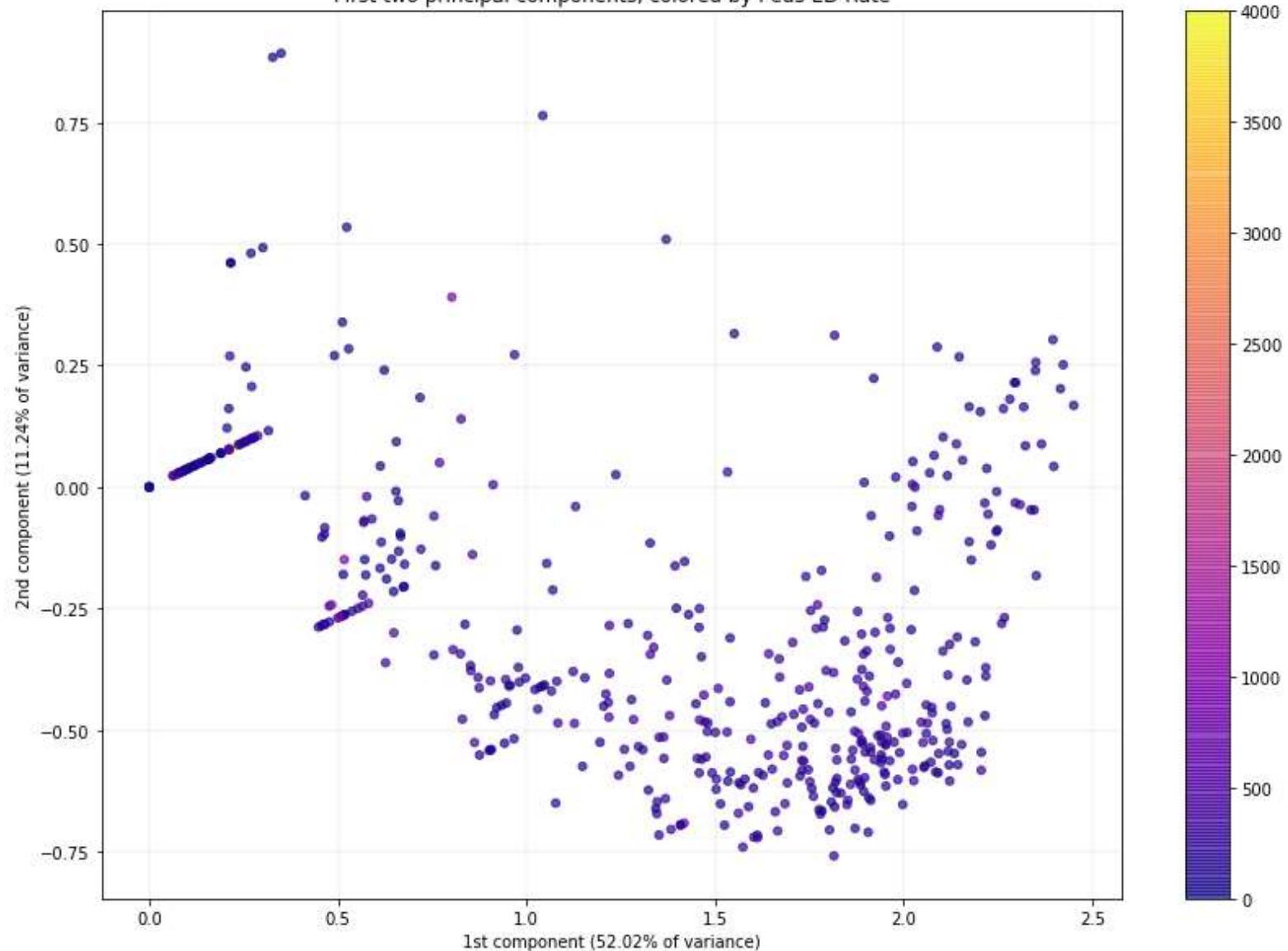
QN34\_3 : 0.8462235409302716  
QN77 : -0.31143421011803957  
QN01 : -0.2785711257228854  
QN57\_2 : 0.19740446334441064  
QN13 : -0.1843274138594686  
QN75 : 0.13844405607479082  
QN05 : 0.11585668284833904  
QN12\_6 : -0.06146490206283878

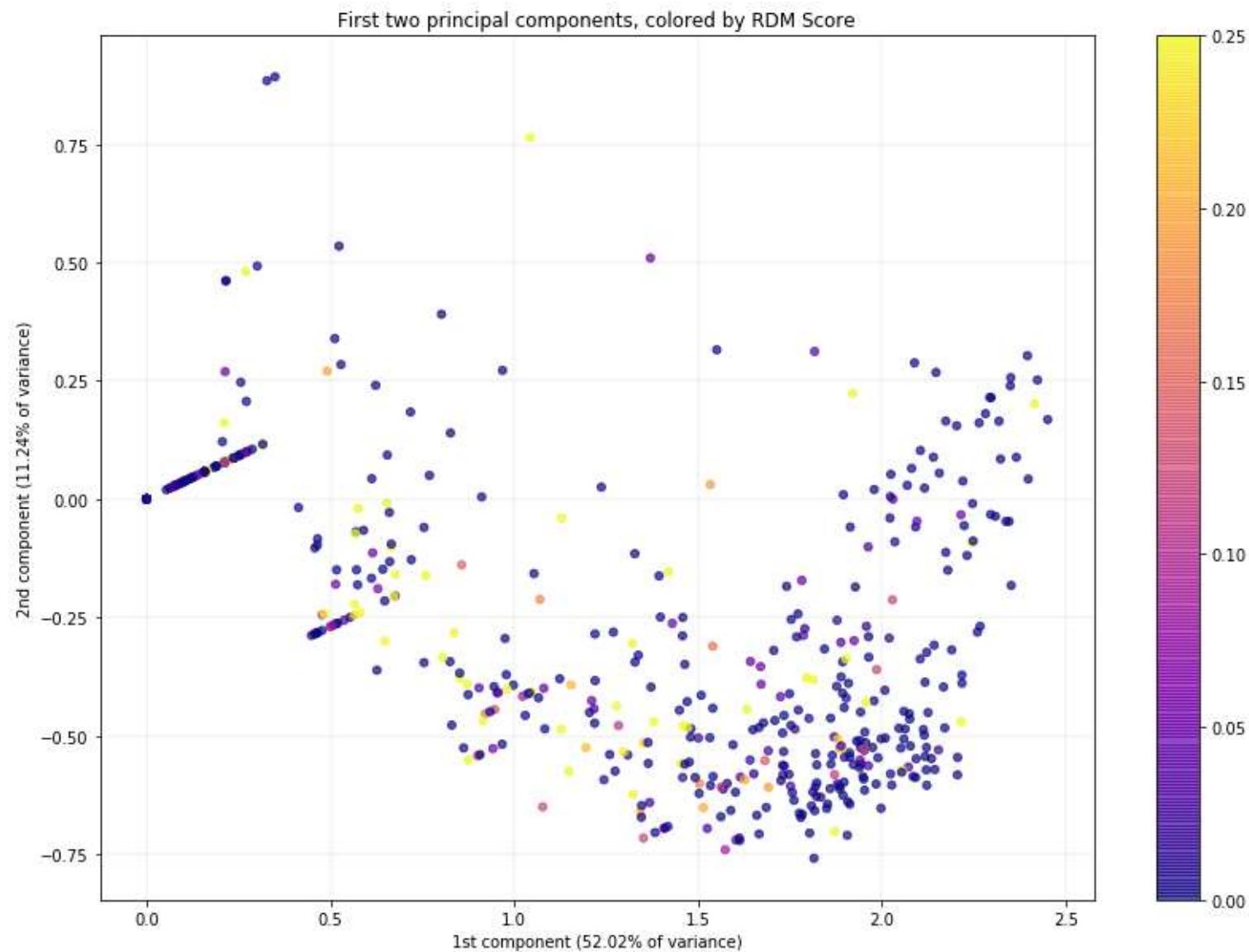






First two principal components, colored by Peds ED Rate



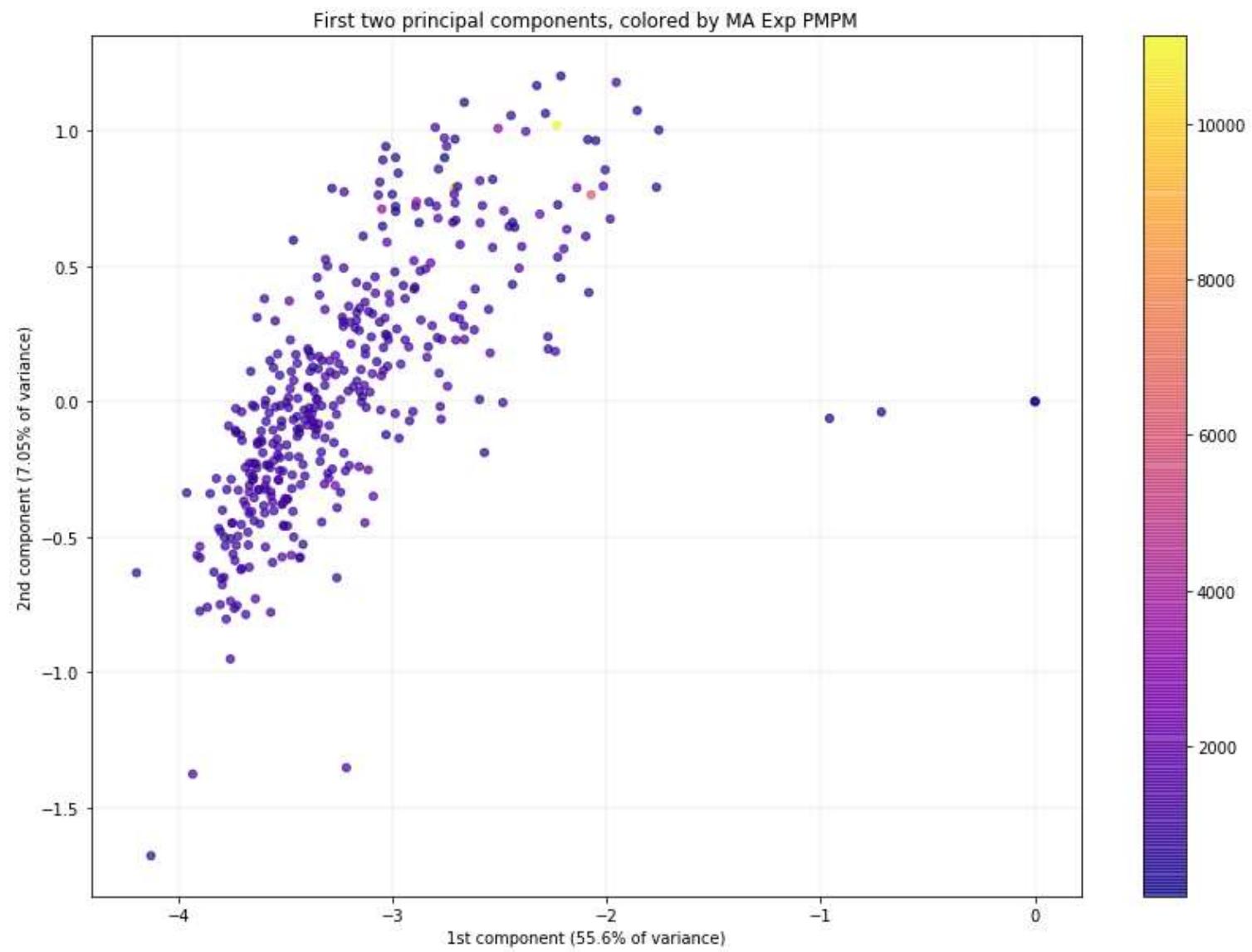


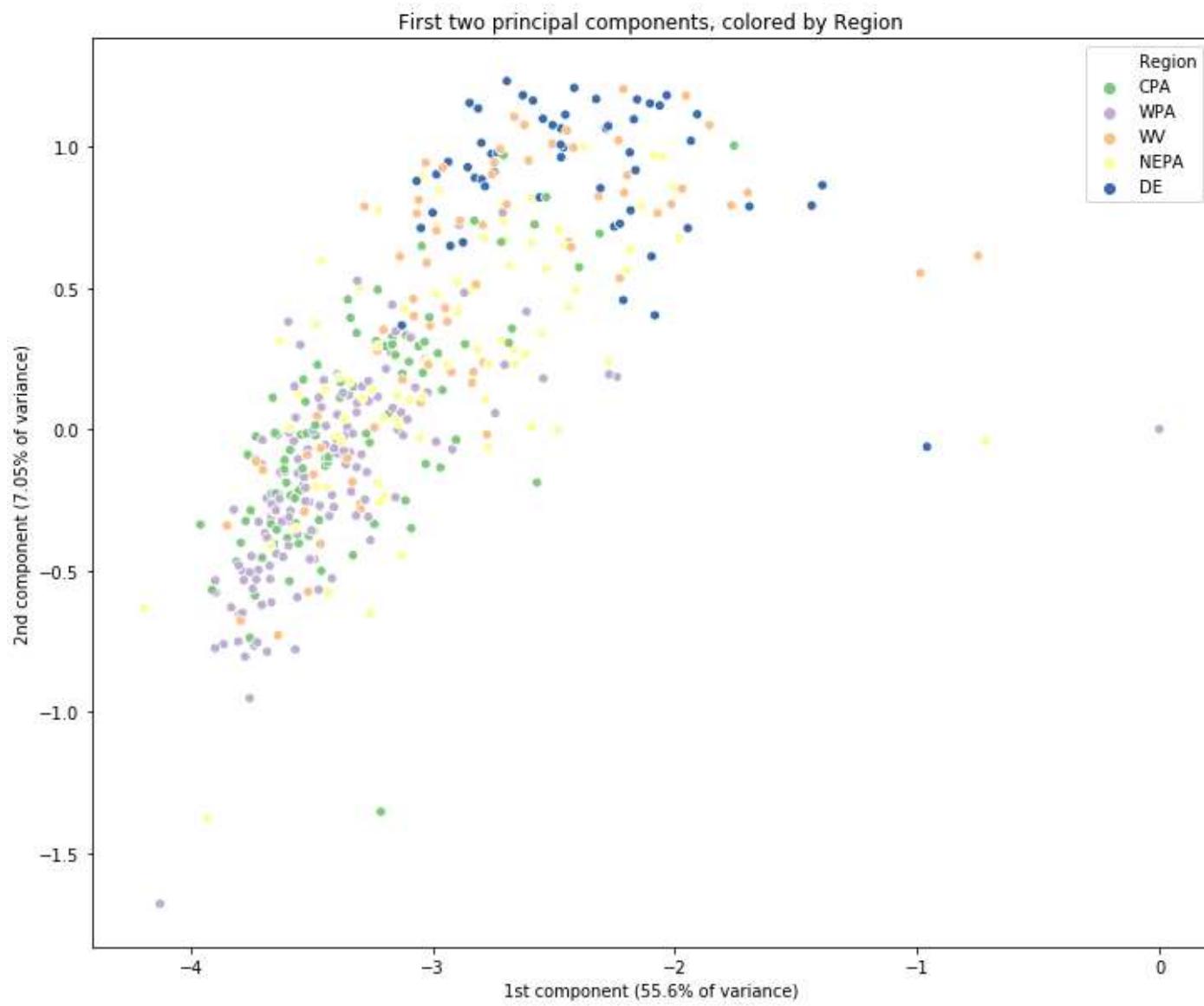
First Component, which explains 55.6% of the variance

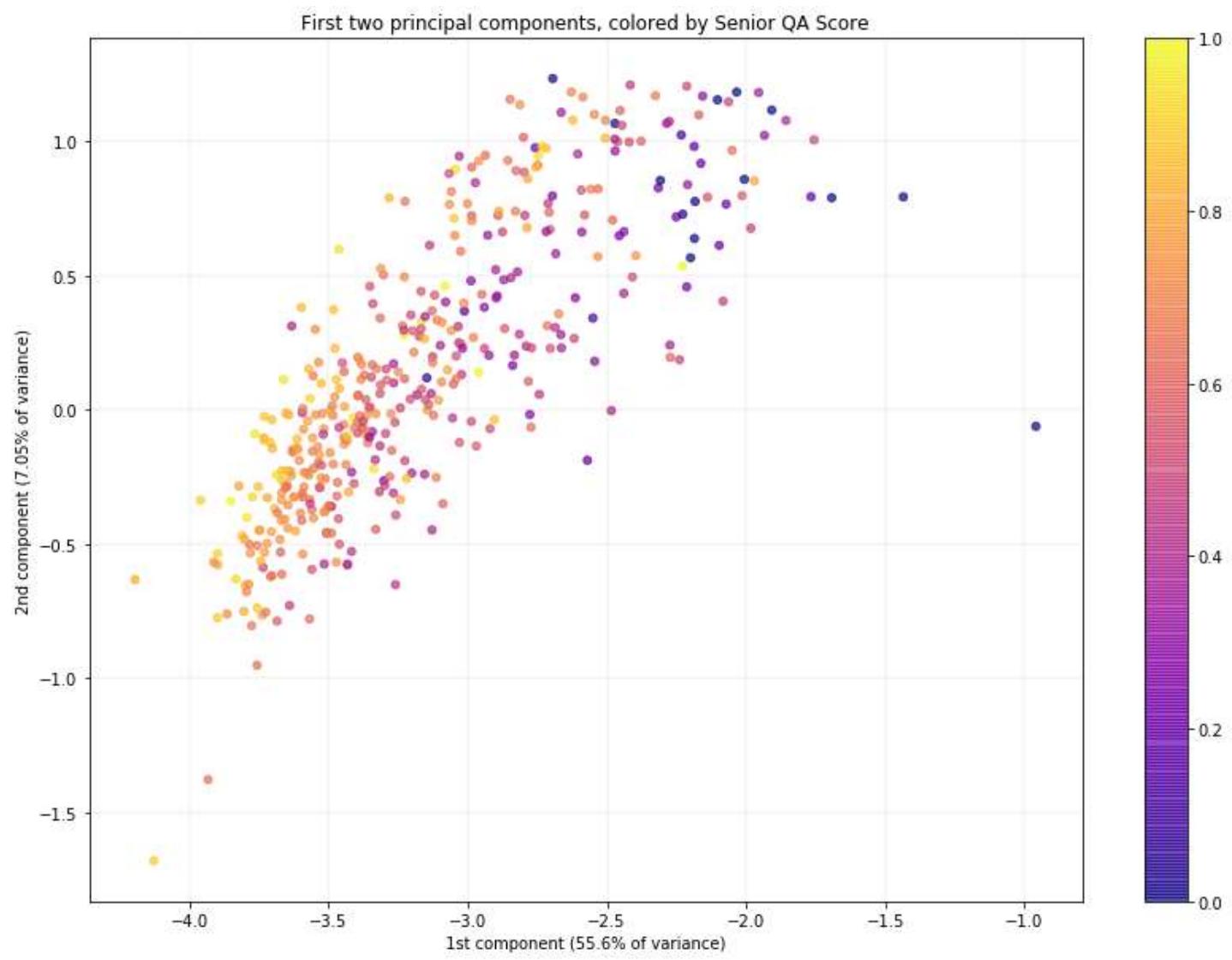
```
=====
QN02_3 : -0.26072219962552545
QN09  : -0.2599145706212447
QN35  : -0.256550009583146
QN40  : -0.25592690611103797
QN41  : -0.2528016767006424
QN08  : -0.25259737304673535
QN02_4 : -0.24561505989064267
QN39  : -0.23919133390223785
QN36  : -0.23374793768881902
QN60  : -0.23199956828023247
QN69  : -0.22613160363332205
QN64  : -0.21449031599005594
QN38  : -0.20738210731970239
QN77  : -0.2069582261870626
QN63  : -0.20357049247839468
QN51  : -0.19183728565414576
QN66  : -0.1847988823479185
QN44  : -0.14493941369790994
QN27  : -0.1347565206981469
QN78  : -0.12377125666757834
QN76  : -0.11598842657018799
QN67  : -0.09307485627548434
QN68  : -0.08637424265802511
```

Second Component, which explains 7.05% of the variance

```
=====
QN27 : -0.4649230205782188
QN66 : -0.43643274032282825
QN51 : -0.3216984491959325
QN44 : -0.2752190250086795
QN76 : -0.2508996704875364
QN63 : -0.23816443196582066
QN41 : 0.2135659015618605
QN39 : 0.20065778740380047
QN40 : 0.19937437515553372
QN78 : 0.18180687698123113
QN02_3 : 0.1714437539578233
QN60 : 0.14759823198440847
QN67 : -0.1343200718405456
QN09 : 0.11571231264856173
QN69 : 0.11280944168449734
QN68 : -0.11253605147926476
QN08 : 0.10601652614495824
QN77 : -0.0643620593259043
QN35 : 0.06238045560656927
QN36 : -0.06197742479187345
QN02_4 : 0.05661008670025285
QN64 : 0.03691830584470045
QN38 : -0.01024509191441412
```







First two principal components, colored by Senior ED Rate

