RISKY BUSINESS: COMPARATIVE MODELING OF COMMERCIAL-POPULATION RISK ADJUSTMENT EQUATIONS

MASSACHUSETTS HEALTH POLICY COMMISSION

JUSTIN KIEL, MS; LAURA NASUTI, MPH, PhD; DAVID AUERBACH, PhD

INTRODUCTION

Risk scores are intended to be a measure of health risk among a given population and have been increasingly used in payment and quality measures. In previous research, the Massachusetts Health Policy Commission (HPC) has found that risk scores are rising roughly 2-3% per year overall, and that much of this growth is inflationary due to coding behavior rather than true changes in patient health status.[1]

Disproportionate increases in patient population risk scores that do not accurately reflect true patient population health can undermine payment systems and quality measures that make use of risk scores and risk adjustment throughout health systems.

Risk adjustment formulas are not standardized: there is a great variety of different methods, variables, and equations to estimate and calculate risk scores. Those that rely on diagnostic coding information are more susceptible to payer and provider manipulation and therefore have a higher potential for overcoding.[2]

OBJECTIVES

Because coding intensity distorts performance evaluation metrics that use risk scores, the HPC has sought to identify comparable alternate risk adjustment equations and methods that are less prone to distortion. Additionally, risk adjustment is increasingly being used to counter disparities in access to care among more marginalized populations by incorporating factors associated with this lack of access (such as education, race/ethnicity, housing status, etc.) and deliberately increasing risk scores for these factors if necessary (they often are negatively associated with spending because of lack of access to care, which would penalize providers or insurers for covering these patients if the coefficients are not adjusted out-of-model).

Thus, to meet these objectives, the HPC has estimated various risk score equations to calculate risk scores using alternative risk adjustment variables and inputs, including social determinants of health.

STUDY DESIGN

The study population for this analysis included 931,963 commercially insured members from five Massachusetts health plans in 2019. All patients had continuous medical and prescription coverage for 12 months and were between the ages of 0 and 64.

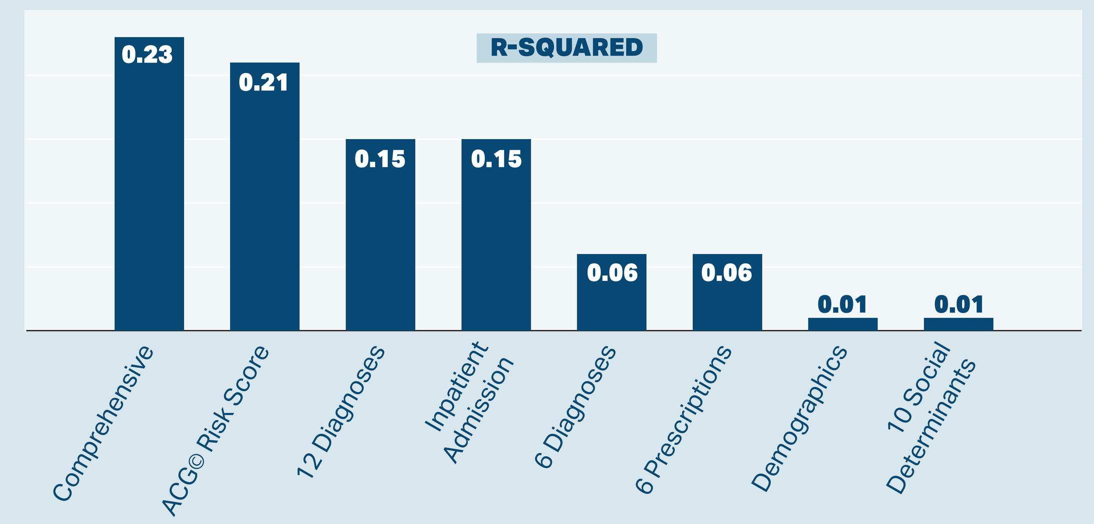
As a baseline, the HPC regressed annual individual total spending on diagnosis-based risk scores (using The Johns Hopkins ACG® System © 1990, 2017, Johns Hopkins University. All Rights Reserved.) for the study population. Several alternative models were then tested.

In one of these models, social determinants of health were included. This included geographic region and variables associated with the individual's zip code: income decile, median family income, home value, percent of white collared workers, percent of single parent households, unemployment percentage, percent of population with a high school diploma, percent of population on FS/SNAP, and the percent in the same house in 12 months. These added variables did not appreciably change the R-squared.

One model included only diagnostic health condition categories that are less likely to be influenced by coding practices, twelve restrictive health conditions: AIDS/HIV, asthma, arthritis, cancer, cardiovascular issues, diabetes, epilepsy, hypertension, mood disorder, multiple sclerosis, psychosis, and renal failure.

RESULTS

Exhibit 1. Comparative Modeling of Risk Adjustment Equations to Predict 2019 Commercial Massachusetts Spending Variation



Source: Traditional risk adjustment model estimated using The Johns Hopkins ACG® System 1990, 2017, Johns Hopkins University. All Rights Reserved. HPC analysis of Center for Health Information and Analysis Massachusetts All-Payer Claims Database, 2019.

Exhibit 2. Comparative Modeling of Alternative and Traditional Risk Adjustment Equations to Predict 2019 Commercial Massachusetts Spending Variation

COMPREHENSIVE RISK ADJUSTMENT MODEL	TRADITIONAL RISK ADJUSTMENT MODEL
R-Squared: 0.23	R-Squared: 0.21
Age	ACG© Risk Score
Sex	
Age-Sex Interaction	
10 Social Determinants of Health	
12 Diagnostic Health Conditions	
Inpatient Admission	

Source: Traditional risk adjustment model estimated using The Johns Hopkins ACG® System © 1990, 2017, Johns Hopkins University. All Rights Reserved. HPC analysis of Center for Health Information and Analysis Massachusetts All-Payer Claims Database, 2019.

Exhibit 3. Ten Social Determinants of Health and Twelve Select Medical Conditions for Alternative Risk Adjustment Modeling

SOCIAL DETERMINANTS OF HEALTH	DIAGNOSTIC HEALTH CONDITIONS
Region	AIDS/HIV
Income Decile	Asthma
Median Family Income	Arthritis
Home Value	Cancer
Percent of White Collared Workers	Cardiovascular Disease
Percent of Single Parent Households	Diabetes
Unemployment Percentage	Epilepsy
Percent of Population with HS Diploma	Hypertension
Percent of Population on FS/SNAP	Mood Disorder
Percent in the Same House in 12 Months	Multiple Sclerosis
	Psychosis
	Renal Failure

Source: HPC analysis of Center for Health Information and Analysis Massachusetts All-Payer Claims Database, 2019.

The baseline model (the ACG® risk score model) predicted the variance of spending with an R-Squared of 0.21. The first alternative model was purely demographic including only age, sex, and age-sex interaction terms. The model had a much lower R-squared of 0.01. Including social determinants of health did not appreciably add to the R-squared value.

The third model combined the age and sex variables with the restrictive list of twelve diagnostic health conditions, resulting in a larger R-squared of 0.15. The fourth model, using only age, sex, and a binary variable for any inpatient admission during 2019, also had an R-squared of 0.15, which is comparative to the diagnosis-based health conditions model.

In risk adjustment literature, there is strong evidence that a health condition that is recorded or registered from prescription use data rather than subjective diagnosis is less susceptible to risk score inflation.[3,4] Using prescription claims data, the HPC replicated five of these twelve diagnostic health conditions (HIV/AIDS, asthma, diabetes, cancer, and psychosis) to compare the efficacy of a prescription-based model to a diagnosis-based model. Restricting the original diagnostic model to just these five health conditions from the original twelve had an R-squared of 0.06. The comparative prescription-based model also had an R-squared of 0.06, identical in predictive power to estimate spending variation.

The sixth and fully comprehensive alternative model (with age/sex, social determinants of health, the twelve health conditions, and inpatient admission) resulted in an R-squared of 0.23, which is marginally greater than the ACG® diagnosis-based risk adjustment model.

CONCLUSIONS

Risk adjustment models that do not rely on gameable variables, like diagnosis-based risk scores, offer alternatives that are less susceptible to coding intensity. Using only a few diagnosis categories for specific, high-cost health conditions such as HIV/AIDS, cancer, or renal failure, can be preferable to using a greater number of health conditions through a traditional diagnosis-based risk adjustment method. Certain diagnoses can also be replaced with more empirical prescription data to predict spending, with prescriptions acting as an internal validation check that the condition is merited and being medically treated.

Simple measures can also have a good deal of predictive power, such as a binary inpatient admission variable, since inpatient admissions are strongly predictive of spending. While it is important not to incentivize marginal hospital admissions, such a variable might also be less susceptible to gaming than relying on diagnosis codes.

Social determinants of health are important to consider and include in any risk adjustment model. While they may have limited predictive power, payment formulae that include risk adjustment should not be solely beholden to regression equations that predict spending – payers and policymakers should place significant weight on these variables in payment and performance metrics that incorporate risk adjustment for health equity reasons.

POLICY IMPLICATIONS

Risk-adjusted annual spending growth is a key measure of performance employed in numerous private contracts and by government agencies. Less gameable risk adjustment methods, in addition to or instead of traditional diagnosis-based risk score models can improve the accuracy of spending growth evaluation, metrics, and policies and ensure payers and providers are rewarded for efficient provision of care and not for their ability to manipulate diagnosis codes. Reducing inflationary trends in risk score growth can help prevent unsustainable growth in health care which is ultimately borne by consumers and patients.

CONTACT

Justin Kiel, MS
Senior Research Associate
Research and Cost Trends,
Health Policy Commission
justin.kiel@mass.gov

www.mass.gov/HPC

David Auerbach, PhD
Senior Director
Research and Cost Trends,
Health Policy Commission
david.auerbach@mass.gov

1. Massachusetts Health Policy Commission. *2019 Annual Health Care Cost Trends Report*. February 2020. https://www.mass.gov/doc/2019-health-care-cost-trends-report/download

2. Landon, Bruce E., and Robert E. Mechanic. "The paradox of coding: Policy concerns in the move to risk-based provider contracts." *The New England journal of medicine* 377, no. 13 (2017): 1211.

3. Ellis, Randall P., Bruno Martins, and Sherri Rose. "Risk adjustment for health plan payment." In *Risk adjustment, risk sharing and premium regulation in health insurance markets,* pp. 55-104. Academic Press, 2018.

4. Jacobs, Paul D., and Richard Kronick. "Getting what we pay for: how do risk-based payments to Medicare advantage plans compare with alternative measures of beneficiary health risk?." *Health Services Research* 53, no. 6 (2018): 4997-5015.