Improving Medicare Advantage (MA) risk adjustment by limiting the influence of outlier predictions

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MEDPAC

Medicare payments to MA plans are risk adjusted

- Medicare pays MA plans a capitated rate
  - Base payment amount × beneficiary-specific risk score
- Risk scores adjust payment
  - Increase payment for beneficiaries expected to be more costly
  - Decrease payment for beneficiaries expected to be less costly
- Risk scores are based on
  - Demographic characteristics
  - Prior year diagnoses grouped into hierarchical condition categories (HCCs)

Model estimation determines size of coefficients (representing associated costs)

- Each demographic and HCC component has a coefficient that represents the expected cost associated with that component
  - A risk score is the sum of the relevant coefficients for a beneficiary
- Model estimation: A regression distributes the medical costs for a beneficiary to the coefficients relevant for the beneficiary
  - Coefficients are estimated using FFS data and reflect the average FFS cost associated with the component
- Risk scores are usually expressed as an index: sum of coefficient costs divided by the average FFS spending
  - In this presentation, coefficients are expressed in dollars

Example calculation of predicted cost, risk score

Model Component	Dollar coefficient	Score coefficient
74-year-old female, community-dwelling, without Medicaid benefits	$3,579	0.338
Rheumatoid arthritis	$4,415	0.417
Diabetes with chronic complications	$3,229	0.305
Vascular disease	$3,134	0.296
Predicted Cost	**$14,357**	
Risk Score		**1.356**

- Score coefficient is equal to the dollar coefficient divided by the average annual FFS spending for non-ESRD beneficiaries, which was about $10,588 in 2019.

Risk adjustment accuracy

- Risk adjustment strives to predict costs accurately on average for a group of people with similar attributes
  - Demographic characteristics and HCCs in the model have been selected for their ability to predict medical costs
  - The majority of medical costs are not predictable by commonly observed information, leaving unexplained cost variation
- More accurate risk adjustment
  - improves the accuracy of payment to MA plans,
  - increases payment equity among plans, and
  - counters plan incentives to attract/retain beneficiaries that contribute to profits and avoid beneficiaries that contribute to losses

Limiting the influence of outliers

- Since 2007, CMS-HCC model has been improved several times (e.g., adding variables, stratifying populations)
- Reinsurance and repayments are common in health insurance markets, but are not possible in MA due to insufficient cost data
- We evaluate a potential improvement to the model that limits the influence of outliers when estimating model coefficients
  - Method developed by McGuire, Schillo, and van Kleef [1]
  - Simulates reinsurance and repayments in model estimation
  - Model accuracy is evaluated overall (using R^2 and Cummings Prediction measures) and for certain groups of beneficiaries (predictive ratios)

[1] McGuire, T. G., S. Schillo, and R. C. van Kleef. 2021. Very high and low residual spenders in private health insurance markets: Germany, The Netherlands and the U.S. Marketplaces. *European Journal of Health Economics* 22, no. 1 (February): 35-50.

Steps to limit outlier predictions

1. Estimate model coefficients using current CMS-HCC model
2. Predict costs for each beneficiary using coefficients from (1) and calculate *prediction error* = *predicted cost* – *actual cost*
3. Apply loss limit to individuals with most underpredicted cost
   - Reduce actual cost data to satisfy loss limit (simulating reinsurance)
4. Apply gain limit to individuals with most overpredicted cost
   - Increase actual cost data to satisfy gain limit (simulating repayments)
5. Use the new data set with redistributed FFS costs to re-estimate CMS-HCC model coefficients to be used for payment

Identifying loss limit and gain limit

- Estimated standard CMS–HCC model using sample of 10.2 million FFS beneficiaries
- Used estimated model to calculate predicted costs and prediction errors (underpredictions and overpredictions)
- Used prediction errors to determine loss and gain limits; set these limits so that
  - Decrease in actual costs by simulated reinsurance is 2 percent of total costs
  - Increase in actual costs by simulated repayment is 2 percent of total costs
  - Result: Loss limit = $106,500; Gain limit = $25,300

Limiting effects of outliers on model performance

- Used the loss and gain limits to adjust actual costs for outliers
  - Trimmed costs for underpredictions above loss limit
  - Augmented costs for overpredictions above gain limit
  - Decrease in actual costs offsets increase in actual costs, so the modification to the model is revenue neutral
- Used adjusted costs to re-estimate model (modified model)

Evaluating the performance of standard and modified models

- R^2: Indicates how well beneficiaries' costs predicted by the model match their actual costs
  - Between 0 and 1; closer to 1.0 is better
  - Outliers reduce model's accuracy resulting in lower R^2
- Predictive ratios: Indicates how well model predicts costs for specific group with same health characteristic (condition, age)
  - PR = (Predicted costs for group) / (Actual costs for group)
  - PR < 1.0 indicates model predicts costs below actual costs for the group (underprediction)
  - PR > 1.0 indicates model predicts costs above actual costs for the group (overprediction)

Limiting outliers improves how well predicted costs fit actual costs

- R^2: 0.13 under standard model; 0.30 under modified model
  - Modified model explains 127 percent more of the variation in costs (consistent with McGuire et al.)
  - In contrast, changes that CMS has made to CMS–HCC model since 2007 increased R^2 from 0.11 to 0.13
- Improved predictive accuracy: Less incentive for plans to use costs to identify favorable risks

Data preliminary and subject to change

Limiting outliers improves predictions for beneficiaries with largest prediction errors

Prediction error	PR from Standard model	PR from Modified model
1% largest underprediction	0.13	0.26
1% largest overprediction	6.5	4.6
All beneficiaries	1.00	1.00

By predicting costs more accurately for the largest underpredictions and overpredictions, plans are less likely to experience substantial financial gains or losses

Note: PR (predictive ratio). PRs are aggregate predicted costs for a group divided aggregate actual costs for a group.

Conclusions

- Limiting the influence of outliers would improve how well predicted costs match actual costs; less incentive to use costs to identify favorable risks
- Extent of substantial underpredictions and overpredictions would be reduced; plans less at risk for substantial losses

Discussion

- Next steps:
  - Commissioner questions about method and content
  - Address Commissioner feedback and continue analysis for future presentations and reports
- Additional risk adjustment issues or ideas for improving risk adjustment in the future