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

Andy Johnson and Dan Zabinski

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MEDPAC

Presentation overview

- October 2021: Presented modification to MA risk adjustment that improves payment accuracy by limiting influence of large prediction errors
- Today: Revisit model improvements from October 2021 with addition of sensitivity analysis
- This analysis will be in the June 2022 report

Medicare payments to MA plans are risk adjusted

- Medicare pays MA plans a capitated rate for each enrollee
  - Base payment amount × beneficiary-specific risk score
- CMS uses risk scores from CMS–HCC model to adjust payments
  - Increase payments for beneficiaries expected to be more costly
  - Decrease payments 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 variable has a coefficient in the CMS–HCC model that represents the expected cost of the variable
  - Beneficiary risk score: Sum of relevant coefficients
- Coefficient values: Determined from regression that distributes beneficiary costs to the relevant coefficients
  - CMS uses FFS data to estimate coefficients, which reflect average cost associated with the variable
- Risk scores are an index: Sum coefficient costs, then divide by average FFS spending; average risk score is 1.0

Risk adjustment accuracy

- Purpose of risk adjustment: Predict costs accurately on average for a group with similar attributes
  - CMS chooses demographic variables and HCCs based on ability to predict costs
  - Large share of costs are not predictable by commonly observed information; much of cost variation cannot be explained
- Benefits of the modification we are presenting:
  - Improves accuracy of payment to plans,
  - Increases payment equity among plans, and
  - Counters incentives for plans to attract/retain beneficiaries that contribute to profits and avoid beneficiaries that contribute to losses

CMS has made several improvements to CMS–HCC model since 2007

- Revised mapping of diagnosis codes to HCCs
- Added and deleted HCCs
- Added variables indicating the number of HCCs for each beneficiary
- Stratified populations defined by institutional status, eligibility status (aged or disabled), and Medicaid status (full benefits, partial benefits, or no benefits)
  - CMS created distinct versions of the CMS–HCC model for seven populations defined by these characteristics

Modification to CMS–HCC model: Limit the influence of outliers

- Reinsurance and repayments: Redistribute plan payments from enrollees that are overpaid to enrollees that are underpaid
- Explicit reinsurance and repayments 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
  - We evaluate model accuracy 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. 2020. Reinsurance, repayments, and risk adjustment in individual health insurance: Germany, The Netherlands and the U.S. Marketplaces. *American Journal of Health Economics 6*, no. 1 (Winter): 139-168.

Benefits of this approach

- Improves the performance of CMS–HCC model
  - Increases accuracy of MA payments by limiting influence of outliers on HCC coefficients
- No additional burden on plans
  - No need to collect additional data
  - Continue to use a risk adjustment method that is straightforward and easy to understand (no black box)
  - No actual reinsurance or repayments

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 largest underpredicted cost
   - Reduce actual cost data to satisfy loss limit (simulating reinsurance)
4. Apply gain limit to individuals with largest 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% of total costs
  - Increase in actual costs by simulated repayment is 2% of total costs
  - Under 2% simulation: 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 offset increase in actual costs, so the modification to the model was revenue neutral
- Used redistributed costs to re-estimate model (modified model)

Limiting outliers improves how well predicted costs fit actual costs

Model	Model R^2
Standard CMS–HCC	0.13
Modified CMS–HCC, 2% simulation	0.19

- 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
- Modified model explains 43 percent more of the variation in costs
- Improved predictive accuracy: Less incentive for plans to use costs to identify favorable risks
- In contrast: CMS has made several changes to CMS–HCC model since 2007; R^2 improved from 0.11 to 0.13

Limiting outliers improves predictions for beneficiaries with largest prediction errors

Prediction error	PR from standard model	PR from modified model (2% simulation)
1% largest underprediction	0.13	0.16
1% largest overprediction	6.4	2.0
All beneficiaries	1.00	1.00

- Predictive ratio (PR): Aggregate predicted costs for a group divided by aggregate actual costs for a group; PR closer to 1.0 is better
- By predicting costs more accurately for the largest underpredictions and overpredictions, plans are less likely to experience substantial financial gains or losses

Sensitivity analysis

Aggregate costs redistributed	R^2 from model
None (standard model)	0.13
1 percent	0.16
2 percent	0.19
3 percent	0.21

Predictive power improves as percent of costs redistributed increases; however, greater cost redistribution increases possibility that HCC coefficients do not reflect actual cost of care

Data preliminary and subject to change

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
- We face many issues regarding MA risk adjustment, such as coding of conditions
  - We have made recommendations regarding these issues
  - The approach we have discussed would not impede or negate more comprehensive approaches

Discussion

- Next steps:
  - Commissioner questions about method and content
  - Address Commissioner feedback and complete this analysis for publication in June 2022