CMS- and HHS-Hierarchical Condition Categories (CMS-HCC, HHS-HCC) Risk Adjustment Models

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CMS-HCC Model: Overview

- The CMS-HCC model uses beneficiary demographic characteristics and prior year diagnoses to predict relative Part A and Part B Medicare fee-for-service program payments.
- The CMS-HCC model does not incorporate Medicare Part D costs, which are predicted separately by the CMS-RxHCC model
- The CMS-HCC model is *prospective*, meaning it uses prior year information to predict costs

Current Uses

- Medicare Advantage capitation payment
- Medicare Shared Savings Program Accountable Care Organizations (ACOs)
- Medicare physician Quality and Resource Use Reports (QRURs)

Development and Maintenance

- Originally developed under contract to CMS by researchers at Boston University and RTI with clinical input from Harvard Medical School physicians
- Currently maintained by RTI under contract to CMS with clinical input from Harvard Medical School and other consultants to RTI
- The model is updated every year to incorporate new diagnosis codes
- The model is recalibrated every two years with new data

Model Variants

- Aged-disabled
  - community continuing enrollee
  - institutional continuing enrollee
  - new Medicare enrollee (less than 12 months claims experience)
- End Stage Renal Disease
  - Dialysis
  - Transplant
  - Functioning graft (post-transplant)

Risk Adjusters

- Demographics/enrollment file information
- Diagnoses
- Rx (Part D) data not used at this time
  - Data are available for only about ½ of FFS Medicare enrollees
  - Incentive to prescribe issues
- Frailty adjustment
  - Add on adjustment for certain Medicare health plans (PACE, certain Special Needs Plans)
  - Uses beneficiary survey activities of daily living limitations
  - Data not available for all Medicare beneficiaries

Demographic Factors

- 24 age-sex cells
  - E.g., male age 80-84
- Medicaid dual eligible status
  - By sex and aged vs. disabled entitlement
- Disabled status
  - Current disabled:
    - Separate age/sex and Medicaid factors
    - Selected diagnoses have different risk weights
  - Currently aged, originally entitled to Medicare by disability
    - Separate factor by sex
- Demographic data are obtained from Medicare administrative data systems

Diagnoses--I

- For model calibration and FFS applications: obtained from FFS provider claims (bills) submitted to Medicare
- Use International Classification of Disease, Version 9, Clinical Modification diagnosis codes (ICD9-CM)
  - Transitioning to ICD-10 codes in FY2016
- Diagnoses from the following settings/providers are used
  - Hospital inpatient
  - Hospital outpatient
  - Physician
  - Clinically-trained non-physician (e.g., clinical psychologist)

Diagnoses--II

- Diagnoses from lab, radiology, home health, etc. not used
- The number of times a diagnosis is recorded does not matter
- The setting from which a diagnosis is reported does not matter
  - Inpatient diagnoses are not weighted more heavily than outpatient diagnoses

Severity

- The CMS-HCC model counts only the most severe manifestation among related conditions
- This principle is implemented through “disease hierarchies”
- Example
  - If both “diabetes with complications” and “diabetes without complications” are present, only the former is counted

Multiple Diagnoses

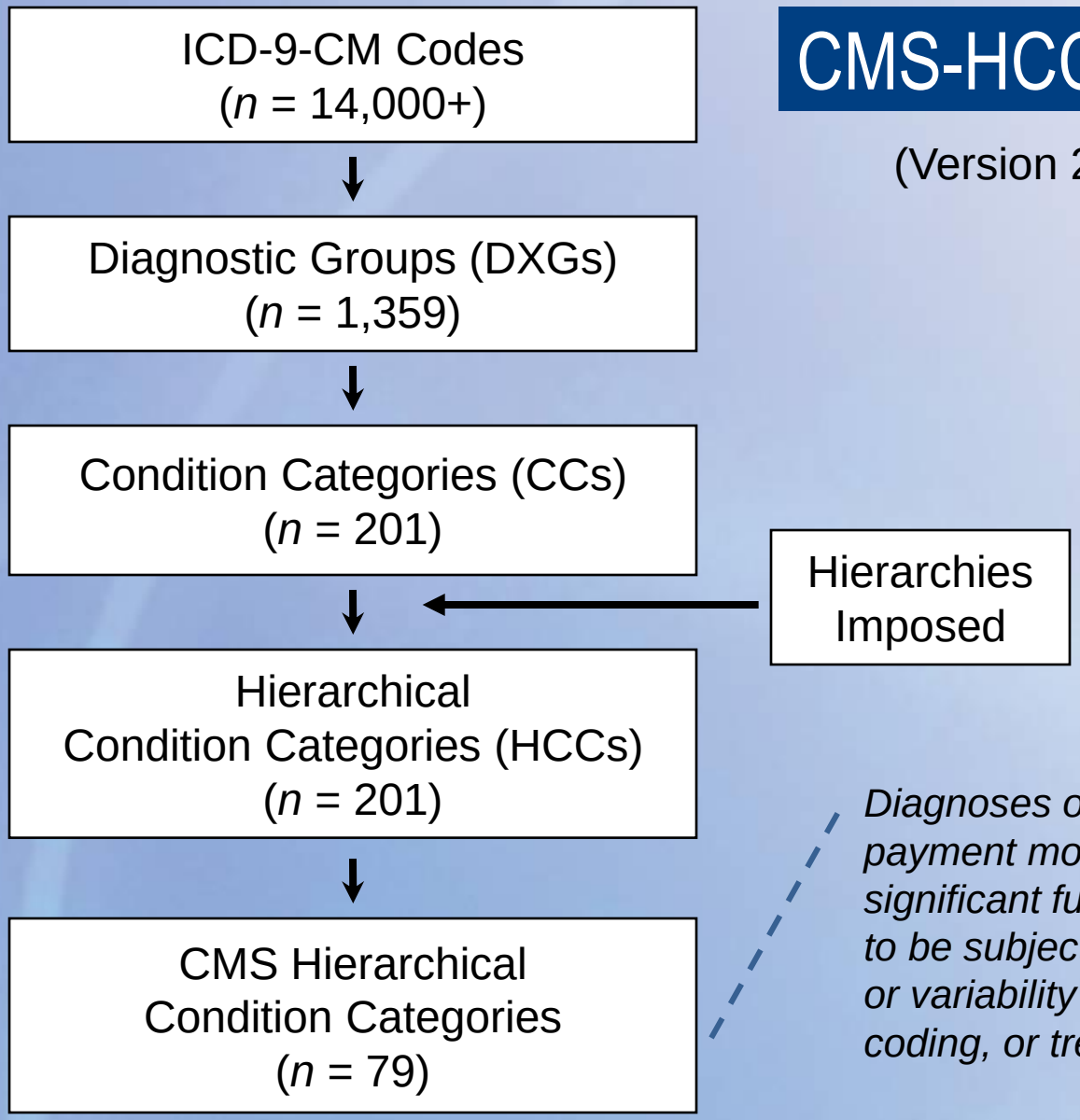
- Unrelated conditions are counted cumulatively
- CMS-HCC model is additive across disease hierarchies
  - Cancer, heart disease, lung disease, cerebrovascular disease, etc. are counted separately and additively
- Total disease burden is measured by
  - Severity within disease hierarchy (related conditions)
  - Cumulative burden of multiple conditions (unrelated conditions)
- Disease interactions are allowed for interactive effects among multiple conditions
  - For example, CHF and COPD have an interactive effect, beyond their separate, additive effects. This is recognized in the model.

Included Conditions

- The full CMS-HCC model classifies all conditions. But not all conditions are used in payment and other applications of the model.
- The CMS-HCC payment model includes clinically significant, generally high-cost medical conditions
  - Cancer, heart disease, hip fracture, etc.
- Conditions excluded from the payment model
  - Do not predict future cost
    - E.g., appendicitis
  - High degree of discretion or variability in diagnosis, diagnostic coding, or treatment
    - E.g., symptoms, osteoarthritis

CMS-HCC Model Structure

(Version 22 counts)

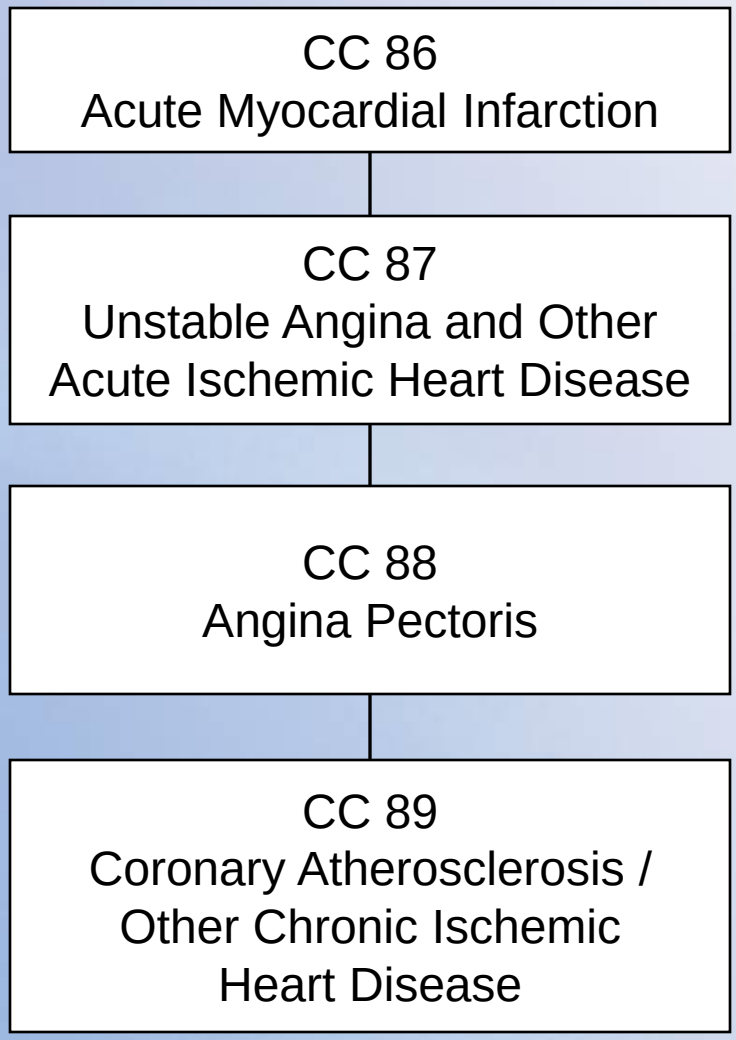


Diagnoses or codes are excluded from the payment model if they are not predictive of significant future costs or they are judged to be subject to a high degree of discretion or variability in diagnosis, diagnostic coding, or treatment.

Coronary Artery Disease Hierarchy (V22)

Hierarchies are imposed among related CCs, so that a person is coded for only the most severe manifestation among related diseases.

For example, ICD-9-CM ischemic heart disease codes are organized in this hierarchy, arranged in descending order of clinical severity and cost.



Clinical Vignette (V22 HCCs)

The CMS-HCC model is additive across major body systems or disease types, but hierarchical within clinical domain. To illustrate, this set of codes corresponds to a person with AMI, angina, COPD, chest pain, and ankle sprain.

ICD-9-CM	DXG	CC	HCC
410.91 AMI of unspecified site, initial episode of care	81.01 AMI, initial episode of care	86 Acute Myocardial Infarction (AMI)	86 Acute Myocardial Infarction (AMI)
413.9 Other and unspecified angina pectoris	83.02 Angina pectoris	88 Angina pectoris	*Excluded by hierarchy*
491.9 Unspecified chronic bronchitis	108.01 Emphysema / chronic bronchitis	111 Chronic Obstructive Pulmonary Disease (COPD)	111 Chronic Obstructive Pulmonary Disease (COPD)
518.1 Interstitial emphysema			

Included in payment model

Excluded from payment model

786.50 Unspecified chest pain	166.18 Chest pain	178 Major Symptoms, Abnormalities	178 Major Symptoms, Abnormalities
845.00 Ankle sprain	162.12 Sprains	174 Other Injuries	174 Other Injuries

Model Calibration

- Calibrated on 100% Medicare FFS data
  - ~ 25-30 million beneficiaries
- Two years of data, e.g., 2010-2011
  - Base year to accumulate diagnostic profile (2010)
  - Prediction year for Medicare payments (2011)
- Predict: Medicare program payments
  - Excludes beneficiary cost sharing
- Adjust for partial year two eligibility (e.g., due to death)
  - Full 12 months of year one eligibility is required
- Multiple regression is used to estimate incremental cost impact of each demographic factor and diagnostic category

Example of risk score calculation

- Male, 82 years old, with prior year diagnoses of AMI and COPD

	Predicted Increm. Cost
Male, age 80-84	$5,037
AMI, HCC 86	$2,550
COPD, HCC 111	$3,214
Total predicted cost (sum)	$10,801
Population mean cost	$9,287
Risk score = (predicted cost)/(mean cost)	1.163

- Interpretation
  - This beneficiary is predicted to be 16 percent more expensive than the average cost Medicare beneficiary

HHS-HCC Model: Overview

- Used in calculating risk transfers among health plans in the state individual and small group markets established under the Affordable Care Act
  - Includes exchange and non-exchange plans
  - Non-grandfathered plans
- Risk transfers are payments from plans with lower-risk enrollees to plans with higher-risk enrollees
- Goal of risk transfers is to reduce the impact of adverse (risk) selection on the costs and premiums of health plans

HHS-HCC Versus CMS-HCC Model

- HHS-HCC model
  - Non-elderly population
    - Clinical categories revised (127 HCCs)
    - Principles and structure similar to CMS-HCC model
  - Concurrent
    - Uses current year information to predict current year expenditures
    - Driven by data availability
  - Predicts medical + Rx
  - Calibrated using MarketScan® commercial claims data
- CMS-HCC model
  - Predominantly elderly population
  - Prospective
  - Predicts medical expenditures only (no Rx)
  - Calibrated using Medicare fee-for-service claims

HHS-HCC Model Variants

- 3 models by age
  - Adult (age 21+)
  - Child (age 2-20)
  - Infant (age 0-1)
- 5 models by plan cost sharing level (“plan liability”)
  - Platinum
  - Gold
  - Silver
  - Bronze
  - Catastrophic
- 3 x 5 = 15 models total

Risk Adjustment Issues: Diagnostic Coding

- Intentional and unintentional variation in completeness of diagnostic coding
- “Diagnostic discovery”
- Diagnosis and diagnostic coding
  - Vague or differing diagnostic criteria
  - Complexity of clinical terminology and coding
    - ~14,000 ICD9 Dx codes
    - ~70,000 ICD10 Dx codes
    - Multiple and/or redundant ways to code conditions
  - Shifts over time in diagnostic criteria or terminology
    - Autism
    - Major depression vs depression

Prospective vs Concurrent Risk Adjustment

- Prospective
  - Adjusts for systematic risk
  - Chronic conditions
  - Does not account for insurance risk
  - Explains 10-20% of expenditure variation
- Concurrent
  - Acute conditions
  - Case-mix/insurance risk
  - Explains 35-50% of expenditure variation

Other Issues in Risk Adjustment--I

- Performance measurement is hard
  - Signal (performance/efficiency) to noise (variation in expenditures) may be low
  - Need large sample sizes of patients/cases/episodes to average out noise and observe signal (performance)
    - Medicare ACOs: minimum 5,000 assigned beneficiaries
- Unexplained variance in expenditures
  - Is all of the residual "inefficiency"?
  - Unmeasured risk factors
    - Functional status
    - Socio-economic factors
    - More detailed clinical data
  - Randomness

Other Issues in Risk Adjustment-II

- Differences between the calibration and application populations
  - Medicare FFS (calibration) vs. Medicare Advantage (application)
  - MarketScan® vs state individual/small group market enrollees
- Lags between calibration and application
  - E.g., Sovaldi™

Regression-Based vs Categorical Models

- Regression-based
  - Capture a wide variety of clinical profiles with a relatively simple, parsimonious, transparent structure
  - Assume a condition has the same incremental effect on expenditures regardless of the other conditions a person has
    - Additive structure
    - “Interaction terms” can be added to account for non-additive interactions among conditions

References

- CMS-HCC Model
  - Pope et al., 2004, Risk Adjustment of Medicare Capitation Payments Using the CMS-HCC Model. *Health Care Financing Review* Volume 25, Number 4.
  - Pope et al. 2011, Evaluation of the CMS-HCC Risk Adjustment Model. Report to CMS.

    http://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/Evaluation_Risk_Adj_Model_2011.pdf
- HHS-HCC model and ACA risk transfers
  - Kautter et al., 2014, Affordable Care Act Risk Adjustment: Overview, Context, Challenges. *Medicare & Medicaid Research Review*, Volume 4, Number 3.
  - Kautter et al., 2014, The HHS-HCC Risk Adjustment Model for Individual and Small Group Markets Under the Affordable Care Act. *Medicare & Medicaid Research Review*, Vol. 4, Number 3.
  - Pope et al., 2014, Risk Transfer Formula for Individual and Small Group Markets Under the Affordable Care Act. *Medicare & Medicaid Research Review*, Volume 4, Number 3.

Public Use Software

- CMS-HCC models
  - http://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Risk-Adjustors.html
- HHS-HCC models
  - http://www.cms.gov/cciio/Resources/Regulations-and-Guidance/index.html#Premium Stabilization Programs