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Midas Risk-Adjustment Model 3.0

The Midas Risk Adjustment Model risk-adjusts individual patient encounters concurrently or following discharge by assigning probabilities and expected values for mortality, length of stay, readmissions, and complications.

Midas sorts encounters into proprietary clinical clusters, which are clinically homogeneous comparison groups for encounter-level predictors of outcomes. Retrospective risk-adjustment methods help clinicians, quality professionals, and case managers evaluate quality of care by providing a reliable and accurate means to compare aggregate hospital performance and provider-specific outcomes.

What's New?

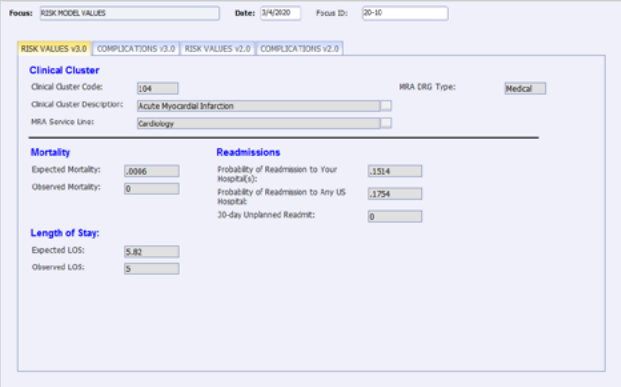
With Midas Risk Adjustment Model version 3.0 (MRA 3.0), the models were trained on the most recent three years of combined data from the Midas comparative database and Centers for Medicare and Medicaid Services (CMS) claims data. The models were updated to include codes through the CMS 2019 ICD-10 code update, including coefficient values for 2018 and 2019 ICD-10 codes. Clinical and complication clusters were reviewed by clinicians and clinical coding specialists, then reorganized to address low volume clusters and to align with clinical evidence-based guidelines. In addition, the Risk of Mortality model was revised, and the associated sub-classification of clinical clusters into high risk (HR) and low risk (LR) was updated.

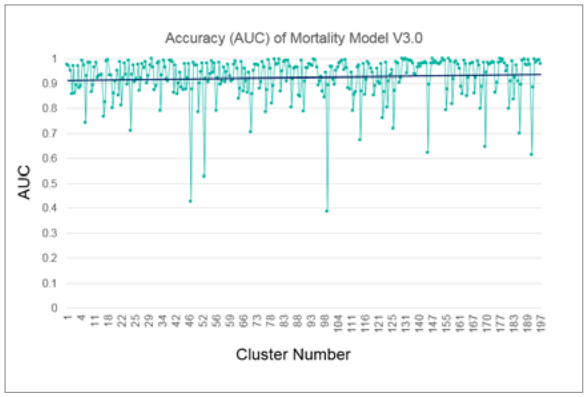
What's Not Included in Risk Model 3.0

Values for charges and individual relative weights (IRW) are not included in this version of the model. Midas is currently evaluating charge data, but because charges are integral to the IRW calculation, both types of values have been removed. In addition, the new ICD-10 codes for COVID-19 are not included in the model. Beginning with this release, Midas will no longer incorporate ICD-10 codes into the model until enough data exists to support clinical code alignment. Future ICD-10 codes will be added to the next model version when there is enough statistically relevant data to make the necessary computations in the data models.

Methodology

The Midas Risk Adjustment methodology is different from traditional risk classification models, which categorize patients according to varying levels of severity or intensity and assign same risk values to all patients in the same risk group for a specific clinical population. In contrast, the Midas Risk Adjustment model assigns unique probabilities and expected values calculated for each encounter based on patient-level details such as gender, age, diagnoses, procedures, and co-morbid conditions. In this manner, Midas methodology offers a patient-centered approach with the ability to identify and account for individual patient variation within a clinical population of interest. When evaluating mortality, readmissions, utilization, and patient safety outcomes, such focus is especially beneficial.





Clinical Clusters

The concept of clinical clusters and their definitions are proprietary to Midas. There are two types of clinical clusters: medical and surgical. Encounters with a medical DiagnosisRelated Group (DRG) are assigned to a medical cluster, while those with a surgical DRG are assigned to surgical clusters. Moreover, each medical clinical cluster is defined by a set of principal diagnosis codes, and each surgical cluster by a set of principal procedure codes.

Midas clinical clusters were designed to reflect the complete cross-section of patients seen in an acute-care setting. The clusters create a common measurement across disparate patient types and enable healthcare organizations to understand and identify the clinical complexity of their patients. Populations are segmented according to acute care inpatients (ACA), inpatients (IP) or Medicare only (Medicare) populations. Clinical clusters are also organized into a hierarchy to support reporting. The organizing framework is as follows:

Clinical Cluster
↓
Clinical Cluster Group
↓
Clinical Cluster Category
↓
Service Line

The clinical cluster methodology enables the development of highly accurate models by appropriately aggregating and segmenting patient populations along multiple dimensions.

Mortality Models

One or more mortality models are developed for each clinical cluster. Within each cluster, mortality rate can vary depending on several factors, including the presence or absence of complications and comorbidities. One approach to deal with such variability and to increase overall accuracy is to develop stratified models that operate in different ranges of the predicted values. Encounters belonging to each clinical cluster were split into high-risk (HR) and low-risk (LR) models using clinical criteria. The separate HR and LR models were then processed, and their combined performance was compared to that of a single model for the entire cluster. If either LR or HR model did not converge during training (e.g., due to sparseness of data) or if the combined model did not significantly outperform the single model, then adjustments were made to the clinical criterion for splitting the cluster into HR and LR sub-clusters, and the process was repeated. A single model was used if it was not clinically and technically relevant to establish individual HR and LR models for a cluster. Nearly 68% (134/197) of clusters have stratified HR and LR models that had a combined performance superior to the single model.

Elaborate data cleansing and feature engineering were performed to ensure data integrity, quality, completeness, and accuracy. First, encounters assigned to clinical clusters were screened for coding quality and correctness. Second, features (including ICD-10 codes and complications) that were highly correlated with mortality were judiciously removed to prevent the models becoming biased towards these features. Third, reporting Z codes were also selectively excluded to avoid potentially spurious correlations with mortality. Finally, select codes were verified for age and gender appropriateness.

Length of Stay (LOS) Models

A single combined LOS model was developed for each clinical cluster; these models yielded high accuracy, and therefore, it was not necessary to develop stratified models as in the case of mortality.

LOS models included the features from the mortality models as well as MS-DRG assignment and discharge disposition. Missing discharge dispositions were assumed to be discharges to "Home." Patients who expired, had age ≤ 0 days, LOS ≤ 0 days, LOS ≥ 365 days, or a discharge disposition of "Against Medical Advice" were excluded from modeling; however, these encounters will still receive risk-adjusted values. Features were evaluated to ensure an adequate frequency for consideration. The observed length of stay was fractional (converted from minutes) and highly positively skewed. Several methods were compared for the best fit, including a standard Gaussian regression without trimming and a Gaussian model of trimmed LOS.

Readmissions Models

Readmissions models were also developed by clinical cluster without stratification. Some clinical clusters did not contain adequate patient encounters or readmissions to be modeled separately. Data from all these clusters were pooled together into a single set with the cluster number/ID added as a feature, and a single model was developed for this combined set. The models for readmission considered the same inclusion and exclusion rules described above for the LOS models. Features were examined for sufficient variability before inclusion.

Complications Models

The complications models were developed using data organized by complication cluster rather than clinical cluster. The data used for model training included an aggregation of the patients with the complication under study and controls from stratified sampling by cluster of patients with other complications and patients with no complications. The number of controls were based on case-control sampling so that the patients with the complication represented at least 5.5% of the cases. The control cases were sampled from patients with other complications and patients with no complications with a target of 25% and 75% of the controls, respectively.

All of the training data had the same fields and included the features present in the preceding models with the following exclusions: diagnoses that were NPOA, procedures performed after two days in a facility, palliative care and do not resuscitate codes, and procedures with a high likelihood of being used to treat a complication. These exclusions were created to avoid inflating the probability of developing the complication.

The models for complications were run separately by complication. A minimum complications rate of 5.5% was used for the Lasso logistic regressions and cross-validation. The models for complications included the demographic and clinical features described in previous models, along with clinical cluster but excluded MS-DRG relative weight, and discharge status. In addition, specific procedures were excluded on a per-complication basis.

Model Structure

All risk models were developed using Lasso regression and 4- to 10-fold validation. To obtain the best C-statistic possible, Lasso regression was used to focus on the minimum number of variables needed, after which additional variables provided no additional value. Cross-validation results were then used to select a model that minimized the mean absolute error (MAE) for length of stay and maximized the area under curve (AUC; i.e., c-statistic) for mortality, readmissions, and complications. Expected length of stay was computed using Gaussian regression, while readmission and mortality probabilities were computed using logistic regressions. Midas Risk Models were trained and tested with approximately 37 million inpatient encounters procured from the Midas DataVision database and combined with CMS claims data.

Risk Model Focus Study & Transparency Report

The Midas Risk Adjustment Model Transparency Report offers drill-down capability into the Midas Risk Adjustment methodology for mortality, length of stay, readmissions, and complications. The Transparency Report displays general demographic information for the encounter and all encounter codes found on the patient discharge record. Encounter codes are then applied to the model and categorized into the following areas of the Transparency Report: qualifying variables, simulation variables, and variables not included in the model. Each model selects variables most representative of the clinical cluster from a statistical standpoint. The Transparency Report displays the variables used to compute selected risk values and can simulate new results using variables that could have contributed either positively or negatively to the risk values. The report is accessed via a link at the bottom of the Risk Model Values Focus Study within the DataVision server application.

Midas Risk Model Applications

Healthcare professionals may use the Midas Risk Adjustment Model and associated tools to identify opportunities for improvement and to evaluate effectiveness of care. There are a variety of different applications and personas that may benefit from use of the Midas Risk Adjustment Model:

- **Case Managers** can use it as an evaluation tool for care coordination and transition planning.
- **Infection Control** providers can use it as a retrospective tool for development of screening tools.
- **Quality Managers** can use it to evaluate care outcomes and provider performance as well as to inform clinical documentation improvement efforts
- **Providers** can use it to better understand patient selection criteria for procedures and treatments and relate the resources that are used by various patient types.

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Conduent's differentiated services and solutions improve experiences for millions of people every day, including two-thirds of all insured patients the U.S., 11 million employees who use its HR Services, and nearly nine million people who travel through toll systems daily. Conduent's solutions deliver exceptional outcomes for its clients including $16 billion in medical bill savings, up to 40% efficiency increase in HR operations, and up to 40% improvement in processing costs, while driving higher end-user satisfaction. Learn more at www.conduent.com.

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