

Symmetry[®] Episode Risk Groups[®]

A successful approach to health risk assessment

Introduction

Risk assessment, the measurement of the expected health care cost or utilization of an individual or population, enables health plans and other managed care organizations to understand the health risks of the members they enroll and to predict the potential medical and pharmaceutical costs associated with those risks. Whether to support accurate payment rates, obtain meaningful comparisons of provider performance or, as one of many factors, help identify patients of highest risk, risk assessment is a critical tool for any health care organization.

Symmetry[®] Episode Risk Groups[®] (ERG[®]) represents a modern approach to measuring risk, using an individual's episodes of care as markers of risk, rather than simply using diagnoses from medical encounters. These episodes are built by collecting all inpatient, outpatient and ancillary services into mutually exclusive and exhaustive categories, which provides details about a patient's underlying medical condition, rather than just the individual services provided in its treatment. This focus allows ERG to provide appropriate incentives for medical care, supporting a wide range of practical applications.

The episodes supporting ERG development are created using the uniquely powerful Episode Treatment Groups[®] (ETG[®]) methodology, which provides clinical richness while relying on information readily available in medical and pharmacy claims. Each ETG has an episode-specific severity score that reflects the risk due to a patient's demographics, comorbidities and condition-specific complications. The incorporation of this severity score into ERG allows for significant differentiation of risk within the same base condition.

ERG offers three model options:

1. Retrospective (or concurrent) models use risk markers for an individual for a base year to measure cost risk for that same year. Retrospective models can be used for risk adjustment of the conditions a member was actually treated for and are often used for comparisons of provider and health plan performance, such as physician profiling.
2. Prospective models use risk markers for an individual for a base year to measure cost risk for the next year. Prospective models are often applied when setting payment rates or used as part of a set of multiple factors for risk stratification to support care intervention and disease management.
3. Actuarial/underwriting models use risk markers for an individual for a base year to measure cost risk for a 12-month period beginning 6 months after the base year. Actuarial models are used for determining future risk in situations where a prospective model may not be immediately useable, due to expected delays in claims data or delayed application of the risk scores.

These models are available with different variations of input and output data requirements, cost threshold values and enrollment criteria, in order to meet a wide variety of business needs. Separate models are available for both commercially insured and Medicare Advantage populations.

The next section of this paper provides an overview of four main steps in the ERG 10.0 grouping and ERG scoring process. A second section provides an assessment of the predictive performance of ERG 10.0 risk prediction models. The examples and performance statistics provided in this paper are specific to the models for commercially insured populations, but similar functionality is available for Medicare Advantage populations.

ERG: Grouping and risk-scoring process

The ERG approach involves four important steps (see Figure 1):

1. **Create ETG episodes of care.** The building blocks of ERG are created using ETG methodology. The software identifies and combines related services — both diagnostic and procedural — into medically relevant units describing complete episodes of care. Each patient will have an ETG for each of his or her episodes of care during the review period.
2. **Map ETGs to ERGs.** Episodes are further categorized into one of 862 Episode Risk Groups. The ERGs, markers of member risk, are based on the member’s ETGs and associated severity levels, which account for the clinical comorbidities and complications affecting each episode. In the case of a member having related ERGs, a hierarchy is applied to determine which is most clinically meaningful. A member can be assigned zero, one or — if she or he has multiple medical conditions — multiple ERGs.
3. **Develop member’s ERG profile.** Age, gender and mix of ERGs provide a clinical and demographic risk profile for a member.
4. **Create member risk scores.** A member’s risk score is computed by summing the predetermined weights attached to each ERG and to the demographic characteristics observed in his or her profile. Retrospective, prospective, actuarial and demographic risk scores are computed for each member.

Figure 1. ERG development of member health risk score

| Inputs | Process | Outputs |
|---|--|---|
| Medical claims data Pharmacy claims data Member enrollment data | <p>Step 1: Create ETG episodes of care</p> <p>Using the ETG methodology, enrollment data, and the diagnostic and procedural information available on medical and pharmacy claims, health care services for a member are first assigned to unique episodes of care (ETGs).</p> <p>Step 2: Map ETGs to ERGs</p> <p>Episodes are further categorized into one of 862 Episode Risk Groups, based on the member’s ETGs and associated severity levels. A member can be assigned zero, one or multiple ERGs.</p> <p>Step 3: Develop member’s ERG risk profile</p> <p>Age, gender and mix of ERGs provide a clinical and demographic risk profile for a member.</p> <p>Step 4: Create member risk scores</p> <p>A member’s risk score is computed by summing the predetermined weights attached to each ERG and to their demographic characteristics. Retrospective and prospective risk scores are computed for each member.</p> | Retrospective risk score Prospective risk score Actuarial/underwriting risk score Demographic risk score |

STEP 1

Create ETG episodes of care

The fundamental building blocks of ERG 10.0 are the individual ETG episodes of care observed for each member. The foundation of an episode is an anchor record, which demonstrates that a clinician has evaluated the patient and decided which further services may be required to identify or treat a medical condition. Three types of services are eligible to be anchor records:

- A claim submitted by a clinician for services related to the evaluation of a member's condition
- A claim submitted by a clinician for services for surgical or related procedures
- A claim submitted by a treatment facility for room and board or emergency room services

Ancillary records such X-rays, pharmaceuticals and lab tests are grouped to the most appropriate anchor record, based on the type of provider, the nature of the service performed and the diagnoses assigned. This process creates clinically relevant clusters around each anchor record.

Clusters are then grouped into episodes based on a series of clinical rules. ETG prioritizes related medical conditions, allowing focus on the condition that best describes the mix of services required for the ongoing evaluation, management and treatment of an episode of care. For incidental diagnoses, rather than indicate a separate incidence of a new condition, ETG combines the services into the episode for the primary disorder. This complex, hierarchical grouping of conditions provides a "filter" for characterizing markers of patient risk.

The complete episodes are assigned to a base ETG category, examples of which are shown in Table 1.

Next, the ETG methodology identifies any episode-specific comorbidities and complications. Comorbidities represent ongoing chronic conditions that impact treatment requirements for the episode. Complications indicate a sicker patient who may require more extensive treatment for a related condition.

A model specific to each base ETG's unique pattern of increased severity — a model that factors in presenting comorbidities and complications — determines whether there is substantial variation in the resource costs of the episodes in that ETG that merit division of the episodes into distinct levels. If there is such variation, the episodes are split into 2, 3 or 4 severity levels. If there is minimal variation, all episodes in the base ETG are assigned severity level 1.

Variation introduced by different types of treatment — such as whether surgery is performed or the type of surgery performed — is not factored into ETG severity levels. Therefore, patients with the same ETG and severity level will have comparable risk based on clinical status alone.*

Table 1

| Examples of base ETGs | |
|-----------------------|--|
| ETG | Description |
| 130100 | AIDS |
| 130200 | HIV sero-positive w/o AIDS |
| 901100 | Rx only — HIV/AIDS antiviral treatment |
| 207200 | Leukemia |
| 238800 | Mood disorder, depression |
| 386900 | Cardiomyopathy |
| 351500 | Glaucoma |
| 903300 | Rx only — glaucoma treatment |
| 437200 | Viral pneumonia |
| 440000 | Malignant lung metastases |
| 521800 | Cirrhosis |
| 601100 | Pregnancy with delivery |
| 667600 | Parasitic skin infection |
| 711902 | Major joint inflammation, knee and lower leg |
| 711400 | Adult rheumatoid arthritis |

Note that base ETGs can be created from pharmaceutical claims alone, to accommodate cases in which a physician prescribes medication for an ongoing condition without requiring the patient to make an office visit. These instances are not technically episodes of care; they are categorized into base ETGs based on the likely indications for the drug treatment prescribed in order to retain as much information as possible from the original claims data. These pharmacy-only base ETGs have been proven valuable in assessing total risk.

* The ETG output includes a treatment indicator, a guide to the type of treatment the patient received, so those data can be included in analysis at the episode level.

STEP 2

Map ETGs to ERGs

The ETG output provides a record of the different episodes of care identified for an individual. A key step in developing ERGs is deciding how these episodes can best be used as markers of risk. Both clinical input and empirical evidence guided the mapping, which involves a number of steps and assumptions:

- ETGs with relatively low prevalence were combined with other Episode Treatment Groups based on clinical similarity and implications for risk assessment.
- ERG assignment does not vary with the number of episodes or ETGs observed for an individual within the same ERG. Patients with single or multiple episodes within an ERG receive identical assignments.
- ERG assignment is not dependent on episode completion status. (ETGs are considered complete when no related treatments are identified within a time frame that is specific to the base ETG.)
- To enhance clinical relevance and homogeneity in terms of risk, in each of the other steps described, ETGs were typically combined only with other ETGs in the same major practice category (see Table 2).
- Finally, in assigning episodes to ERGs, a hierarchy was employed that prioritizes selected related ETGs within an MPC. This method prevents duplicating or overestimating risk for members with closely related medical conditions.

In general, differences in treatment are not factored into the ERGs in order to keep the risk prediction blind to choices in utilization. The risk assessment should not reward or penalize treatment decisions, such as the decision to admit a patient to the hospital, perform a surgery or prescribe a medication, so that the assessment may be useful for payment purposes or assessing efficiency in providing medical care. The exception to this rule is anti-neoplastic chemotherapy and radiation therapy; because of the high clinical stakes involved with these therapies, the decision to pursue anti-neoplastic treatment is considered to be a good indicator of actual disease status, and ERG therefore does consider indicators of active cancer management in risk group assignment.

Table 2

| Major practice categories | |
|---------------------------|--|
| MPC | Description |
| 1 | Infectious diseases |
| 2 | Endocrinology |
| 3 | Hematology |
| 4 | Psychiatry |
| 5 | Chemical dependency |
| 6 | Neurology |
| 7 | Ophthalmology |
| 8 | Cardiology |
| 9 | Otolaryngology |
| 10 | Pulmonology |
| 11 | Gastroenterology |
| 12 | Hepatology |
| 13 | Nephrology |
| 14 | Urology |
| 15 | Obstetrics |
| 16 | Gynecology |
| 17 | Dermatology |
| 18 | Orthopedics and rheumatology |
| 19 | Neonatology |
| 20 | Preventive and administrative |
| 21 | Late effects, environmental trauma and poisoning |
| 22 | Isolated signs and symptoms |

STEP 3

Develop ERG profile

A member's age, gender and mix of ERGs are used to create his or her ERG profile. Every member is assigned to an age-gender group, using 17 age groups: 0–1, 2–12, 13–18, 19–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74, 75–79, 80–83 and older than 83. Members without claims will have no episodes of care and no ERGs. For these members, risk is based solely on age, gender and length of enrollment.

Members with claims are assigned to one or more ERGs depending on their mix of episodes of care. The rules employed in mapping ETGs to ERGs are identical for all three applications of the model: retrospective, prospective and actuarial/underwriting.

STEP 4

Create member risk scores

The next step is the assignment of a weight to each ERG and demographic marker of risk. These weights describe the contribution to risk of being in a specific age-gender group or having a particular medical condition included in an ERG. The model of risk can be defined generally as:

$$\text{RiskR}_i = a_s * \text{AgeGender}_{i,s} + \sum b_e * \text{ERG}_{i,e}$$

Where RiskR_i is the ERG risk score for person i ; $\text{AgeGender}_{i,s}$ indicates their age-gender group; $\text{ERG}_{i,e}$ indicates their ERG (e) assignments; and a_s and b_e represent the risk weights. The age-gender and ERG markers are set to 1 if the marker is observed for an individual, 0 if not. Each member has his or her own profile of age-gender and ERGs. A person's risk score is the sum of these risk weights for each marker observed.

ERG 10.0 provides significant flexibility for supporting different business applications and data availability. Models are built by combining the following options, as dictated by specific business needs:

- **Retrospective and prospective applications** — An ERG may have a different impact on risk depending on whether current or future risk is being measured. Chronic conditions have similar impacts on current and future risk. In contrast, acute conditions generally have a greater impact on retrospective than prospective risk. To accommodate this, separate models are defined for retrospective, prospective and actuarial applications. Risk weights for each model are derived separately.
- **Actuarial and underwriting timing** — A/U practices require time between the period used in measuring risk and the future time period being predicted. This allows the additional time necessary for claims lag and analysis prior to development of group premiums. The ERG A/U model has a six-month interval between the experience period and the prediction period.

- **Pharmacy benefit status** — Separate models are available depending on the availability of pharmacy input data and/or the need to predict pharmacy-related costs. Medical claims data can be used alone to predict either medical cost risk or medical plus pharmacy cost risk, or medical plus pharmacy claims data can be used to predict medical plus pharmacy cost risk.
- **Length of enrollment** — A member’s length of enrollment may impact his or her risk. Partial enrollment models utilize different risk weights corresponding to the member’s length of enrollment during the period used to measure risk.
- **Dollar thresholds** — ERG models support application of either a \$100,000 or \$250,000 cost threshold, above which, costs are truncated. This option is important for several reasons. First, truncating expenditures for higher-cost members limits the impact of extreme outliers on model development and testing. Second, most real-life applications of health risk assessment involve some use of a threshold or stop-loss above a predetermined catastrophic amount.

As seen in Figure 2, the type of claims input into the processing engine, the risk outcome desired, the risk score being produced, the length of enrollment being analyzed and the expenditure threshold are all factors in determining which model is utilized when calculating a given risk score. Each option can be combined with any combination of other options to most appropriately assess the risk of the target population.

Figure 2

| Options for ERG models | |
|-------------------------------------|--|
| Claims input/to predict claim costs | Med&Rx/Med&Rx; MedOnly/Med&Rx; MedOnly/MedOnly |
| Member risk-prediction period | Retrospective; Prospective; Actuarial/Underwriting (A/U) |
| Length of member enrollment | 1–3 months; 4–6 months; 7–9 months; 10–12 months |
| Expenditure threshold | \$100,000; \$250,000 |

Each set of options uses a different set of predefined weights. A total of more than 60,000 separate risk weights produce very finely calibrated ERGs.

Estimating ERG risk weights

The risk weights for ERG 10.0 were determined using regularized linear regression and a data set containing member enrollment, medical claims and pharmacy claims data for a managed care population of more than 8 million members. The ERG development data were obtained from the Optum national database comprised of claims and membership information aggregated from a number of data sources.

Tables 3–5 provide three examples of how retrospective, prospective and A/U ERG risk are calculated. The total risk scores in each table reflect each member’s measure of risk relative to that of the overall population used in developing ERG 10.0. A score of 1.00 indicates risk comparable to that of the research population; a score of 1.10 indicates 10% greater risk; a score of 0.85, 15% lower risk and so on. The score is the sum of risk weights that are specific to the model being used, the conditions found and demographics.

The first example presents a 58-year-old man who, over a 10-month enrollment period, was observed to have five unique episodes of care — diabetes, ischemic heart disease, an ulcer and two episodes for a minor skin problem. These ETGs map to four different ERGs. Risk calculations are based on the presence or absence of the patient’s actual underlying medical condition, not the number or type of treatments. For example, the two acute incidents of minor skin problems are combined into a single ERG.

Table 3

| Examples of ERG risk score assignment | | | | | | | |
|--|----------------|------------------------|------------|------------------------------------|---------------------------|-------------------------|-----------------|
| Example 1: Male, age 58 | | | | | | | |
| Model: MedRX-MedRX, 100k threshold, 10–12 months | | | | | | | |
| ETG | Severity level | Description | ERG | Description | Retrospective risk weight | Prospective risk weight | A/U risk weight |
| 163000 | 2 | Diabetes | 163000_0_2 | Diabetes, severity 2 | 0.8258 | 1.0922 | 1.1732 |
| 386500 | 1 | Ischemic heart disease | 386500_0_1 | Ischemic heart disease, severity 1 | 0.6524 | 0.5171 | 0.4507 |
| 473800 | 3 | Ulcer | 473800_0_3 | Ulcer, severity 3 | 1.1726 | 0.6749 | 0.6234 |
| 666800 | 1 | Contact dermatitis | 666800_0_1 | Contact dermatitis, severity 1 | 0.1136 | 0.0341 | 0.0185 |
| 666800 | 1 | Contact dermatitis | 666800_0_1 | Contact dermatitis, severity 1 | — | — | — |
| Demographic risk group: Male 55–59 | | | | | 0.0532 | 0.4387 | 0.5264 |
| Enrollment length of 10 months | | | | | 0.0579 | 0.0147 | 0.0388 |
| Total risk score | | | | | 2.8755 | 2.7717 | 2.8310 |

The three right-hand columns of Table 3 show the risk weights assigned to each ERG, to the patient’s age/gender group and to the patient’s enrollment length, and the three resulting total risk scores. The 58-year-old male described in Example 1 has a prospective total risk score of 2.7717, indicating a high level of health risk — almost three times that of the average person for the large managed care population used to develop ERG. His retrospective total risk score, 2.8755, is higher than his prospective score because it’s driven by an ulcer, which may not be a recurring condition and therefore presents less risk for the next year. The prospective and A/U model total risk scores also differ, reflecting the impact of different timing for the predicted outcome; the risk attributed to the ulcer decreases even more for the A/U model. The additional risk provided by the member’s enrollment length reflects the small amount of uncertainty as to the member’s true conditions, when compared to a member with a full 12 months of enrollment.

This example also demonstrates the continued risk of significant chronic conditions, such as diabetes and heart disease. The risk weights are specific to the underlying clinical condition: factors such as whether the patient is insulin dependent and the presence and type of comorbidities contribute to the risk weight.

The second example, a 14-year-old girl with full enrollment in the prior year, demonstrates the effect of another chronic condition, asthma, the risk of which is fairly stable across models, and an acute infectious disease, the risk of which is decreased after enough time has passed (as evidenced by the decreased A/U weight). Because we have a more complete picture of her condition due to her full enrollment, her risk is slightly reduced by her enrollment length weight.

Table 4

| Examples of ERG risk score assignment | | | | | | | |
|--|----------------|------------------------------------|------------|--|---------------------------|-------------------------|-----------------|
| Example 2: Female age 14 | | | | | | | |
| Model: MedRX-MedRX, 100k threshold, 10–12 months | | | | | | | |
| ETG | Severity level | Description | ERG | Description | Retrospective risk weight | Prospective risk weight | A/U risk weight |
| 438800 | 1 | Asthma | 438800_0_1 | Asthma, severity 1 | 0.2560 | 0.2047 | 0.1835 |
| 473100 | 1 | Infection of stomach and esophagus | 437100_0_1 | Infection of stomach and esophagus, severity 1 | 0.0932 | 0.1044 | 0.0586 |
| Demographic risk group: Female 13–18 | | | | | 0.0538 | 0.1742 | 0.2272 |
| Enrollment length of 12 months | | | | | –0.0489 | –0.0157 | –0.0232 |
| Total risk score | | | | | 0.3541 | 0.4676 | 0.4461 |

The third example, a 35-year-old woman, shows how the risk of a high-severity fracture has a high retrospective risk weight, but significantly decreased risk for both the prospective and A/U time periods. ERGs for similar high-cost but highly acute events tend to show similar patterns of risk (e.g., appendicitis, pregnancy with delivery).

Table 5

| Examples of ERG risk score assignment | | | | | | | |
|--|----------------|---|------------|---|---------------------------|-------------------------|-----------------|
| Example 3: Female age 35 | | | | | | | |
| Model: MedRX-MedRX, 100k threshold, 10–12 months | | | | | | | |
| ETG | Severity level | Description | ERG | Description | Retrospective risk weight | Prospective risk weight | A/U risk weight |
| 317500 | 1 | Carpal tunnel syndrome | 317500_0_1 | Carpal tunnel syndrome, severity 1 | 0.3045 | 0.1720 | 0.1484 |
| 713101 | 4 | Closed fracture or dislocation — foot & ankle | 713101_0_4 | Closed fracture or dislocation — foot & ankle, severity 4 | 2.3811 | 0.1128 | 0.0201 |
| Demographic risk group: Female 35–39 | | | | | 0.0513 | 0.3424 | 0.4152 |
| Enrollment length of 12 months | | | | | –0.0489 | –0.0157 | –0.0232 |
| Total risk score | | | | | 2.6880 | 0.6115 | 0.5605 |

ERG: How well does ERG perform?

There are a number of criteria to consider when evaluating the performance of a health risk assessment model. The previous section demonstrated the administrative practicality and clinical relevance of ERG 10.0 for both risk adjustment and population stratification. However, it is also important to address the predictive accuracy of the models: how close actual expenditures, or risks, are to risks predicted. This accuracy is often evaluated by the R^2 statistic, which is the percentage of variance in the target variable that is predictable by the model. An R^2 of 1 indicates that the model perfectly predicts the outcome on the evaluation data set, and an R^2 of 0 indicates that the model performs no better than simply using the population average. Table 6 summarizes the R^2 values obtained from an evaluation data set of over 4 million members. This population is similar to one that most users would have: a commercially insured population with a wide range of demographics, health statuses and enrollment lengths. Costs for members with annual expenditures exceeding the indicated thresholds were truncated to the given threshold amount.

Table 6

| Predictive performance of ERG 10.0 | | | |
|------------------------------------|--------------|-------------------------|-----------------------|
| Expenditure threshold (annual) | Input/output | Retrospective ERG R^2 | Prospective ERG R^2 |
| \$250,000 | Med/Med | 0.57 | 0.19 |
| | Med/MedRx | 0.57 | 0.25 |
| | MedRx/MedRx | 0.57 | 0.26 |
| \$100,000 | Med/Med | 0.57 | 0.20 |
| | Med/MedRx | 0.57 | 0.27 |
| | MedRx/MedRx | 0.57 | 0.28 |

The R^2 values for retrospective ERGs are consistent across expenditure thresholds and input/output types. As expected, ERG predicts an individual's current year expenses most precisely. For prospective ERGs, R^2 values range from 0.19 to 0.28, as prospective models are more heavily influenced by the added variation due to choices of threshold and output type.

Summary and conclusions

Health risk assessment is increasingly important for the day-to-day operations and strategic decision making of health care organizations. Risk assessment is also a critical component of health-based payment systems that plays a key role in effective resource allocation and in targeting opportunities for clinical and financial improvement.

Health risk assessment has a number of practical applications for health care analysis and health services research. Accurate assessment is essential to creating valid comparisons of the efficiency and quality of the services provided to patients. Combining risk scores with a variety of other clinical factors such as evidence-based gaps in care can contribute to assertive, effective care management. It also plays an important role in underwriting and actuarial processes.

Symmetry ERG provides an effective tool for understanding patient profiles of medical conditions and how they impact current and future health risk. The efficiencies gained by organizations using consistent methods for performing both risk assessment (ERG) and episode-of-care grouping (ETG) also offer significant advantages. The ETG methodology and the architecture for mapping ETGs to ERGs employ systematic, logical and transparent clinical approaches.

Optum strives to continually improve ERG. As the field of medicine evolves and predictive modeling techniques advance, updates to ERG will be made.

About Optum

At Optum, we are a leading health services innovation company dedicated to helping make the health system work better for everyone. We create simple, effective and comprehensive solutions for organizations and consumers across the whole health system by integrating our foundational competencies of consumer experience, clinical expertise, data and analytics, and embedded technology into all Optum services. By understanding the needs of our customers, members and patients and putting them at the center of everything we do, we will achieve our aspiration of improving experiences and outcomes for everyone we serve while reducing the total cost of care.

To learn more about Episode Risk Groups, please contact us at
1-800-765-6807 or **empower@optum.com**.

The views and opinions expressed herein are not necessarily those of Optum, its employees, or others. Optum provides this white paper for informational purposes only. It is not intended as advice for a particular situation, nor is it intended to be legal or professional advice. Consult with an appropriate professional for your situation.

Optum Symmetry ERG prospective risk scores should not be used as the sole factor to identify individuals for enrollment in care and disease management programs. Optum recommends that future cost predictions should only be used as one of multiple factors for enrollment in care management programs.

The information in this document is subject to change without notice. This documentation contains proprietary information, which is protected by U.S. and international copyright.

No part of this document may be reproduced or transmitted in any form or by any means, electronic or mechanical, include photocopying and recording, without the express written permission of Optum.



11000 Optum Circle, Eden Prairie, MN 55344

Optum® is a registered trademark of Optum, Inc. in the U.S. and other jurisdictions. All other brand or product names are the property of their respective owners. Because we are continuously improving our products and services, Optum reserves the right to change specifications without prior notice. Optum is an equal opportunity employer.

© 2020 Optum, Inc. All rights reserved. WF2380810 05/20