

the Idea

ROSS HEALTH ACTUARIAL

MANAGED CARE • RISK MODELING • DECISION SUPPORT

STRUCTURAL INFERENCES FROM ACTUARIAL MODELS

Actuarial models are commonly used to predict or estimate the cost, frequency, or some other facet of a financial system. However, actuarial models can also provide inferences on the structural characteristics which determine the behavior of financial systems. These structural characteristics can be equally important to evaluating and managing the risks associated with a given business decision.

NON-STRUCTURAL EXAMPLE: A COST ESTIMATE

The classic example of developing a cost estimate proceeds as follows:

$$\text{Hospital PMPM} = (\text{Prior Costs} / \text{Covered Lives}) * \text{Trend Increase.}$$

Provided we do a good job of measuring prior costs and covered lives, and that we have a good estimate for trend, this model will develop a reasonable estimate of future costs. However, this model does little to help us understand or manage the system.

STRUCTURAL EXAMPLE 1: MODELING STRUCTURAL COMPONENTS

The hospital (inpatient) PMPM estimate can also be developed as follows:

$$\text{Hospital PMPM} = (\text{Confinement Rate}) * (\text{Average Length of Stay}) * (\text{Cost per day}).$$

From a non-structural perspective, we can “plug in” the estimated values for each of these components, and get the same projected costs as in the non-structural example. From a structural perspective, though, this model provides useful information for managing the risk.

the Idea is a publication of Ross Health Actuarial which is intended to briefly highlight issues and ideas relevant to health care financing, modeling, political issues, and other areas of interest. The information presented does not constitute professional advice, and is not intended to be a complete examination of the issues.

the Idea: **STRUCTURAL INFERENCES**

We can see that the Hospital PMPM can be reduced by:

- Reducing the confinement rate, i.e. by shifting some confinements to outpatient services.
- Reducing the average length of stay, i.e. by performing pre-admission testing, aggressive discharge planning, and post-discharge care.
- Negotiating reduced costs per day.

Note that the structural inferences provide useful information that is independent of the point estimate of hospital PMPM cost. Indeed, the management interventions listed above may increase the difficulty in accurately predicting the hospital PMPM cost, but nonetheless succeed in reducing the costs.

STRUCTURAL EXAMPLE 2: MODELING STABILITY

A classic actuarial/underwriting problem is to determine a level premium rate for all participants in a voluntary plan of health insurance. What price is high enough? However, this is a trick question. The answer: NO price is high enough. Lower cost individuals or sub-groups will leave the plan when the premium rate significantly exceeds their expected costs; as a result, the premium rate for the remaining group must be increased. However, this encourages even more to leave the group, requiring an even higher rate, and so on. This process is referred to in the classical literature as an “Assessment Spiral,” and is lovingly referred to by actuaries and underwriters as a “death spiral.”

Stability is a structural characteristic which can be understood and modeled as it relates to two or more plan choices presented to individuals or sub-groups. For example:

- In a flexible benefits plan, the choice is between a “high” and a “low” plan, both in the same risk pool. How does a plan sponsor rate the options to maintain stability in the plan? Rating the high option plan on a self-supporting basis will usually produce an assessment spiral that will result in the elimination of the high option over time.
- In a managed competition model, the choice is between similar plans, but the risk is divided into independent risk pools; i.e. HMO A and HMO B. Since each risk pool must be self-supporting, the rating methodology must not result in an assessment spiral against one of the plans. This is the focus of current risk adjustment methodologies.

the Idea: STRUCTURAL INFERENCES

STRUCTURAL EXAMPLE 3: MODELING INCENTIVES

Consider the case of a proposed primary care capitation arrangement. The capitation provides an incentive to the primary care physician to refer care to a specialist. For example, in managing a patient with asthma and allergies, a primary care physician may have some scope to handle the problem directly, or may refer the patient to a specialist. The structural inference is that this arrangement may encourage inefficient behavior. Similarly, the use of risk-sharing arrangements which place the primary care provider at least partially at risk for specialty utilization creates a structural model that encourages more efficient behavior.

STRUCTURAL EXAMPLE 4: MODELING BEHAVIOR

Structural inferences from actuarial models very often concern the behavior of players in the insurance system, given the choices presented. This is seen in several of the above examples. Another example will illustrate the impact of choice in evaluating risk:

A fundamental difference between dental and medical services concerns timing and patient choice. A patient generally has a great deal of control over the timing of when dental services and costs are incurred, as compared to medical services. For example, a person having a heart attack generally has the choice of going to a hospital, or dying. In contrast, a person with a cavity may be able to postpone a trip to the dentist for quite some time. Although the occurrence of the cavity is ultimately the “insurable event,” the dental insurance relates to the date on which dental services are provided. As a result, the patient can set the dental appointment to optimally coincide with available dental insurance.

The structural inference is that dental insurance is more vulnerable to timing issues than is medical insurance. Members of groups without prior dental coverage will postpone visits to the dentist until after the effective date of coverage, a common underwriting concern with such groups. In addition, there have been a few cases with excessive utilization in the final months of a dental plan, as members accelerated trips to the dentist in advance of benefits being cancelled.

the Idea: STRUCTURAL INFERENCES

CONCLUSION: MODEL DEVELOPMENT AND INTERPRETATION

In the ideal case, actuarial models will be developed which:

- Contain sufficient detail to understand the structural characteristics and behavior of the system being modeled.
- Require inputs for which directly relevant, reliably accurate and statistically credible data are readily and inexpensively available.
- Rely on accurate projections of the impact of changes to the system.

In practice, model development presents an ongoing challenge due to:

- Unexpected or difficult to model structural characteristics. For example, reducing the hospital confinement rate tends to increase the average severity of the remaining confinements, and exerts an upward pressure on length of stay and cost per day, as well as on hospital outpatient costs.
- Less than ideal data quality, due to lack of availability (e.g. other party to negotiation cannot or will not provide relevant data), time/cost constraints, small statistical base, etc.
- Projections of trend assumptions or the effectiveness of new management interventions reflect an inherent uncertainty.

As a result, effective model development and interpretation will combine a mixture of sensitivity analysis to various model components and assumptions, discussions and sharing of insights between the actuary and plan management, and due prudence in formulating actions based on the models.

Ross Health Actuarial has the experience to develop and interpret actuarial models to aid you in making effective decisions to advance the goals of your organization.

© 2005 Ross Health Actuarial.

Ross Health Actuarial is an independent consulting firm providing health actuarial services to payers, providers, and state governments in the health care financing arena.

Contact:

Timothy M. Ross, ASA, MAAA
(715) 381-1345

timross@rosshealthactuarial.com

www.rosshealthactuarial.com