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Articles in the *North American Actuarial Journal* of Interest to Health Actuaries

By Ian Duncan

There is only one article in Volume 20, No. 1 (March 2016) of direct interest to health actuaries, "Testing Alternative Regression Frameworks for Predictive Modeling of Health Care Costs." However, given the Society of Actuaries' (SOA's) current focus on predictive analytics, and the fact that I am one of the authors, this article is a must-read for all health actuaries! In addition, I am providing the abstracts to two other articles that, although not directly health care related, may nevertheless prove interesting, particularly to those health actuaries (such as those specializing in long-term care or retiree medical valuations) for whom longevity and survivorship are issues.

TESTING ALTERNATIVE REGRESSION FRAMEWORKS FOR PREDICTIVE MODELING OF HEALTH CARE COSTS

I. Duncan, M. Loginov and M. Ludkovski

Predictive models of health care costs have become mainstream in much health care actuarial work. The Affordable Care Act requires the use of predictive modeling-based risk-adjuster models to transfer revenue between different health exchange participants. Although the predictive accuracy of these models has been investigated in a number of studies, the accuracy and use of models for applications other than risk adjustment have not been the subject of much investigation. We investigate predictive modeling of future health care costs using several statistical techniques. Our analysis was performed based on a dataset of 30,000 insureds containing claims information from two contiguous years. The dataset contains more than 100 covariates for each insured, including detailed breakdown of past costs and causes encoded via coexisting condition flags. We discuss statistical models for the relationship between next-year costs and medical and cost information to predict the mean and quantiles of future cost, ranking risks and identifying most predictive covariates. A comparison of multiple models is presented, including (in addition to the traditional linear regression model underlying risk adjusters) Lasso GLM, multivariate adaptive regression splines, random forests, decision trees and boosted trees. A detailed performance analysis shows that the traditional regression approach does not perform well and that more accurate models are possible.

FORECASTING LONGEVITY GAINS FOR A POPULATION WITH SHORT TIME SERIES USING A STRUCTURAL SUTSE MODEL: AN APPLICATION TO BRAZILIAN ANNUITY PLANS

César Neves, Cristiano Fernandes and Álvaro Veiga

In this article, a multivariate structural time series model with common stochastic trends is proposed to forecast longevity gains of a population with a short time series of observed mortality rates, using the information of a related population for which longer mortality time series exist. The state space model proposed here makes use of the seemingly unrelated time series equation (SUTSE) and applies the concepts of related series and common trends to construct a proper model to predict the future mortality rates of a population with little available information. This common trends approach works by assuming the two populations' mortality rates are affected by common factors. Further, we show how this model can be used by insurers and pension funds to forecast mortality rates of policyholders and beneficiaries. We apply the proposed model to Brazilian annuity plans where life expectancies and their temporal evolution are predicted using the forecast longevity gains. Finally, to demonstrate how the model can be used in actuarial practice, the best estimate of the liabilities and the capital based on underwriting risk are estimated by means of Monte Carlo simulation. The idiosyncratic risk effect in the process of calculating an amount of underwriting capital is also illustrated using that simulation.

FAMILIAL RISK FOR EXCEPTIONAL LONGEVITY

Paola Sebastiani, Stacy L. Andersen, Avery I. McIntosh, Lisa Nussbaum, Meredith D. Stevenson, Leslie Pierce, Samantha Xia, Kelly Salance and Thomas T. Perls

One of the most glaring deficiencies in the current assessment of mortality risk is the lack of information concerning the impact of familial longevity. In this article we update estimates of sibling relative risk of living to extreme ages using data from more than 1,700 sibships, and we begin to examine the trend for heritability for different birth-year cohorts. We also build a network model that can be used to compute the increased chance for exceptional longevity of a subject, conditional on his or her family history of longevity. The network includes familial longevity from three generations and can be used to understand the effects of paternal and maternal longevity on an individual's chance to live to an extreme age. ■

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