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

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After a good run of health-related articles, Volume 19, No. 2 did not have any articles of direct interest to health actuaries, although those actuaries interested in the relationship between disease and longevity may be interested in "Causes-of-Death Mortality: What Do We Know on Their Dependence?" by Séverine Arnold (-Gaille) and Michael Sherris. (We reproduce the abstract of this article below.) Health actuarial topics are back in force in Vol. 19, No. 3 with several interesting articles. Colin M. Ramsay and Victor I. Oguledo address an increasingly important topic for health actuaries—absenteeism and presenteeism—in "Optimal Disability Insurance with Moral Hazards: Absenteeism, Presenteeism, and Shirking." Sam Gutterman has an article on "Mortality of Smoking by Gender," which I am sure all health actuaries will want to read. The relationship between health and longevity continues to be an important source of articles with "Mortality, Health and Marriage: A Study Based on Taiwan's Population Data" by Hsin Chung Wang and Jack C. Yue.

ABSTRACT: CAUSES-OF-DEATH MORTALITY: WHAT DO WE KNOW ON THEIR DEPENDENCE?

Over the last century, the assumption usually made was that causes of death are independent, although it is well-known that dependencies exist. Recent developments in econometrics allow, through Vector Error Correction Models (VECMs), to model multivariate dynamic systems including time dependency between economic variables. Common trends that exist between the variables may then be highlighted, the relation between these variables being represented by a long-run equilibrium relationship. In this work, VECMs are developed for causes-of-death mortality. We analyze the five main causes of death across 10 major countries representing a diversity of developed economies. The World Health Organization website provides cause-of-death information for about the last 60 years. Our analysis reveals that long-run equilibrium relationships exist between the five main causes of death, improving our understanding of the nature of dependence between these competing risks over recent years. It also highlights that countries usually had different past experience in regard to cause-of-death mortality trends, and, thus, applying results from one country to another may be misleading.

OPTIMAL DISABILITY INSURANCE WITH MORAL HAZARDS: ABSENTEEISM, PRESENTEEISM, AND SHIRKING

Presenteeism occurs when employees are present at the workplace but cannot perform at their best due to ill health or other reasons, while absenteeism occurs when employees are absent from the workplace. While absenteeism is important, researchers now say presenteeism can be more costly to businesses and may be responsible for as much as three times the health-related lost productivity as compared to absenteeism, and may cost the U.S. economy as much as US$150 billion per year. Given the cost of absenteeism and presenteeism, one of the objectives of this paper is to provide actuaries with the techniques and insights needed to design disability insurance policies that take into account the dynamics of absenteeism and presenteeism. To this end we develop a simple multi-state sickness-disability model of the evolution of an employee's health over time. We assume employees receive sick-pay, the size of which depends on their health state and there is a government-sponsored unemployment insurance program. In our model it is possible for employees in good health to avoid work by staying home, which is called *shirking*. To reduce shirking, the employer decides to check the health status of a certain percentage of employees who call in sick. Given the sick-pay structure, the probability of a health check, and the existence of unemployment insurance, employees develop rational strategies about whether to engage

in shirking, absenteeism or presenteeism. These strategies are captured in a set of Volterra integral equations. We use these Volterra integral equations to show how the employer can design a disability insurance plan that can incentivize employees to eliminate shirking and to act in a manner that will maximize the employer's expected profits.

MORTALITY OF SMOKING BY GENDER

Exposure to cigarette smoke has had and will continue to have a huge effect on mortality. Significant differences in smoking prevalence rates by gender have contributed to varying levels and rates of improvement in mortality over the last several decades and are expected to continue to influence mortality improvement differently over the next several decades.

The combined effect of greater historical smoking prevalence rates by males and their corresponding earlier and larger reduction has in part been responsible for the recent improvement in mortality rates for males compared to that for females in the United States. Similar patterns are evident in almost all economically developed countries, although their timing and levels differ. The patterns in less-developed countries will likely follow similar patterns as concerns emerge about the effect of smoking on the mortality of their citizens.

The objective of this paper is to compare smoking prevalence and cessation by gender and the effect on smoking-attributable and, in turn, all-cause mortality. A summary of mortality attribution approaches used to enhance the evaluation of the effect of smoking and projections of mortality rates by gender is also provided. ■

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