GENERAL and GEOGRAPHICAL RISK FACTORS in HEALTH INSURANCE

HU-MATHS-IN
Hungarian Service Network for Mathematics in Industry and Innovations

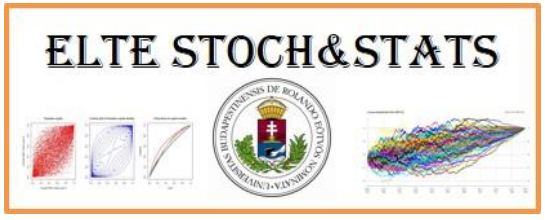
The Industrial Problem

The change from fixed amount to service covering health insurances needs to be supported by ***exploring risk factors and groups*** on the basis of legally permissible, readily available, inexpensive and accurate data, covering the whole country.

Insurance Sector

Research group

ELTE Stochastics and Statistics



Statistical and stochastic modelling and data analysis for industrial applications.

Company

Company name

AEGON

Aegon Magyarország Általános Biztosító Zrt.

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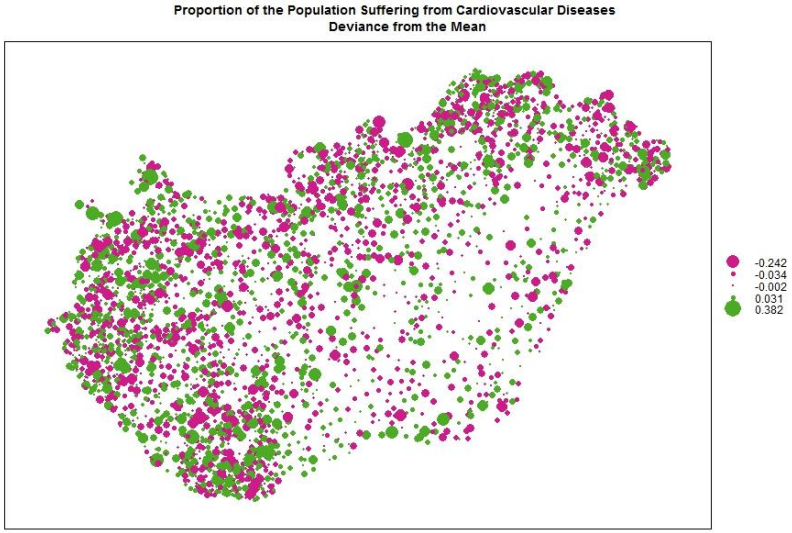
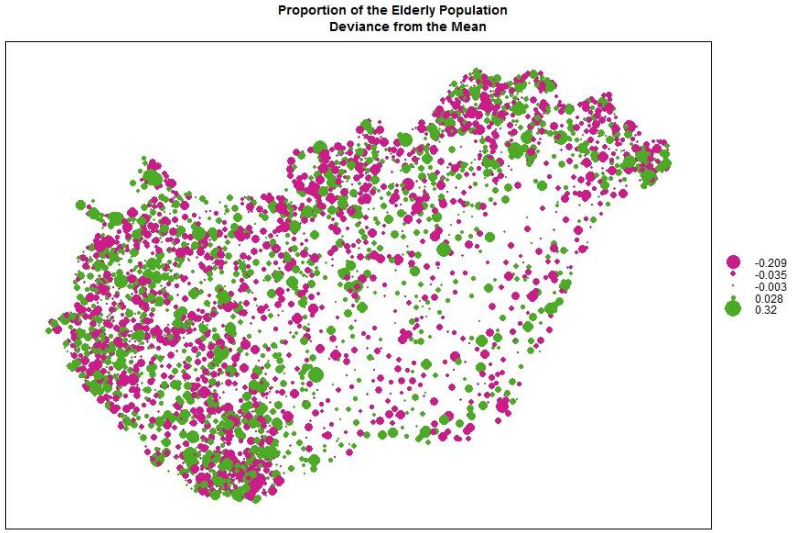
Challenges & Goals

- Mortality risk factor stratification is thoroughly studied for life insurances, but less so are disease group specific risk factors, and the former studies are not transferable.
- No segmentation of disease incidence data by age cohorts or other factors is available.
- Just a few, and universal risk classes/strata are needed for the ease and transparency of premium calculation.
- Risk changing with age cohorts are of special concern for the company.



risk is a



To the left: Proportion of the population suffering from cardiovascular diseases. To the right: Proportion of the elderly population. Deviances from the mean are displayed. Bubble sizes are proportional to the magnitude of deviance.

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Mathematical and computational methods and techniques applied

- Transformed Poisson/quasi-Poisson generalized linear model on disease incidence intensities. Appearance of over-dispersion is disease specific.
- The model for incidence intensities is additive on population related, and multiplicative on supplementary risk factor data.
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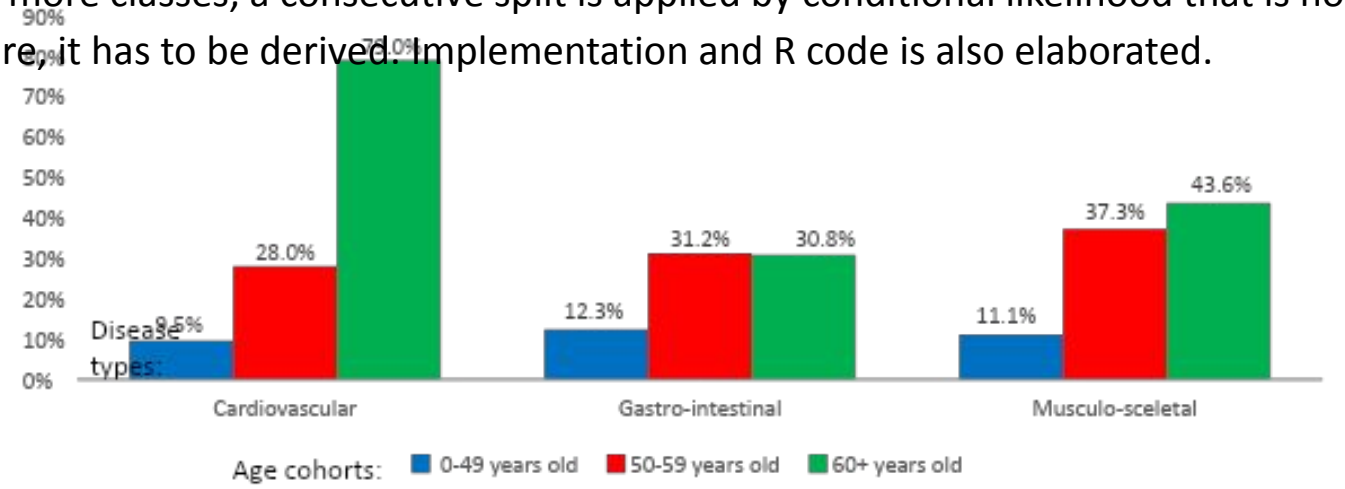
- The direct estimation by generalized linear model is analytically intractable.
- In case of more classes, a consecutive split is applied by conditional likelihood that is not available in literature, it has to be derived. Implementation and R code is also elaborated.



Percentage of age cohorts affected by disease groups.

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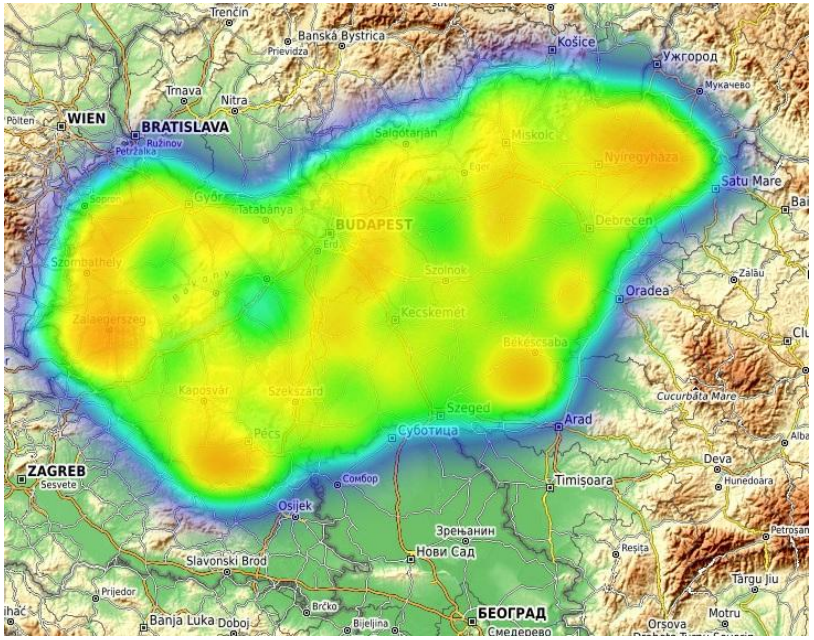
Results & Benefits to the Company

Results

- The methodology is applied to data on cardio-vascular, gastro-intestinal and musculo-skeletal diseases. Tumors need a distinct study.
- Age is significant for all three disease groups and particularly significant for cardiovascular diseases.
- Other significant factors are income, divorce and ammonium contamination in drink-water.
- Nitrate contamination of drink-water is significant in *decreasing* the cardiovascular risk. Reason may be: Nitrate is also used in medication of certain disorders.

Benefits

- Competitive advantage in premium calculation
- Acquisition of low risk clients through risk dependent brokerage for agents
- Portfolio cleaning
- Targeted advertisements to low risk groups



Spatial distribution of deviance of predicted and estimated risk.

The company becomes capable of creating homogeneous hazard groups and hence, compute more competitive premiums and acquire less risky clients.