CREATION AND INTERPRETATION METHODOLOGY FOR MODELING COMPLEX HIERARCHICAL DYNAMIC SYSTEMS IN EPIDEMIOLOGY: APPLICATION TO STUDY OF AIR-POLLUTION HEALTH EFFECTS

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We propose methodology to construct adequate models of complex hierarchical dynamic systems in environmental epidemiology and its problem-oriented interpretation. The approach assumes 3-stage strategy for modeling: from creating multivariate multilevel hierarchical structural model based on essential use of system analysis to general mathematical formalization (on this stage different options for the hierarchy realization are proposed) and final to the specific statistical model. The final model is built on GEE, GLM techniques and time-series analysis.
We developed "multi-layer" approach to epidemiology sound interpretation of the models. We built special functional time-depended coefficients, which give evaluation and epidemiologically reasonable interpretation of affects of variables of interest in any time point and for any time period.
This methodology was applied for modeling health effect of air-pollution with data of lung function daily measurements in the group asthmatic and healthy children in two Israel cities. The model dataset consists of individual variables (age, gender, BMI), meteorological variables (daily maximum temperature, average humidity and barometric pressure), air-pollution variables (No_x, So_x, ozone, suspended particulate matters $PM_{2.5}$ and PM_{10}). Lags of air-pollution effect up to 3 days were studied.
The model results show the significant direct and indirect influence of air pollution on the lung function with reasonable interpretation of the effects.