Logit-Loglinear Models for Analysis of Health of Lead Exposed Workers

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1. Introduction

Much of data collected in environmental epidemiology studies is categorical. The health outcome usually is dichotomous, i.e. the study participants are classified as to whether or not they experience a particular health outcome (Baker D. et al., 1999). But sometimes health outcome of more than two categories is subject of interest. The risk factors can have two or more categories. Researchers are interested in relationship between health outcome and set of risk factors estimating their separate categories. Data analysis by constructing multiway tables is complicated. Logit-loglinear models can be helpful in such analysis.

2. Aim

The aim of this study was to design a model for estimation of relationship between arterial hypertension and lead in hair as compound parameter of complex exposure.

3. Material and methods

The study included data about health status, anthropometrical measurements, environmental and other risk factors of 1117 workers exposed to lead. Lead concentration in hair (PbH) was used as indicator of internal dose of different exposure. The workers were grouped into 3 groups according to the PbH level: group I – PbH tercile 1 (0.01-2.20 µg/g), group II – PbH tercile 2 (2.21-5.90 µg/g), and group III – PbH tercile 3 (>5.90 µg/g). Other categorical variables, such as sex (two categories: male/female), overweight (two categories: yes/no) and age groups (four categories: <35, 35-44, 45-54, >54 years) were included in analysis. Dependent variable – arterial hypertension (AH) – had two categories (yes/no). It was considered that a person had overweight if his/her body mass index exceed 29 kg/m^2. Arterial hypertension was diagnosed for a person which systolic blood pressure was >=140 mmHg or diastolic blood pressure was >=90 mmHg, or a person was treated for this condition within the last two weeks.

4. Results

Crosstabulation of AH in groups of PbH tercile and sex showed existing of significant differences: the AH prevalence was significantly lower for men of the 2nd tercile compared with other terciles ($p<0.05$).

The influence of different exposure to lead on AH was examined using logit-loglinear model. It also contained parameters of sex, overweight and age.

The backward elimination was used for model selection. This procedure is preferable in hierarchical models (Afifi A.A. and Clark V., 1996). It allowed to select the best model because no one previous model was found to be better.

Model included main effects of factors and their 2-way and 3-way interactions. Estimated simultaneous effect of PbH tercile*overweight*sex was significant ($p<0.05$) for men with overweight in the 2nd tercile. Predicted odds ratio (OR) for the 2nd tercile compared to the 1st tercile was 0.15 (asymptotic 95% CI: 0.03-0.85). OR for men with overweight in the 2nd tercile compared to the 3rd tercile was 0.13 (asymptotic 95% CI: 0.03-0.63). Estimates of main effects of age, overweight and sex also were significant.

The model predicts that 66.4% of men with overweight in the 2nd tercile and age over 54 years old will have AH, whereas without overweight that will be 78.6%. In age group of 45-54 years old these numbers are 55.7% and 64.2%, respectively.

5. Conclusions

The model determined relative magnitude of influential factors on arterial hypertension.

Logit-loglinear modeling is very labour-consuming process. So models with 3-4 variables are most practicable.

Logit-loglinear models allow to estimate the relative importance of separate categories and various interactions of different factors.

REFERENCE

Afifi, A.A., Clark, V. (1996). Computer-aided multivariate analysis. Chapman & Hall.

Baker, D., Kjellstrom, T., Calderon, R., Pastides, H. ed. (1999). Environmental Epidemiology. WHO.

RESUME

Les modeles logit-loglineaires pour l'analyse de la sante des travailleurs affectes par le Pb

Les etudes de l'epidemiologie de l'environnement demandent de l'analyse des donnees categoriques. Les chercheurs sont interesses par la liaison entre les indicateurs de sante et l'ensemble des diferents facteurs de risque. Les modeles logit-logineaires peuvent etre utilises pour cette analyse. Le modele develope a etabli, que la quantite total de Pb dans les cheveux et le surpoids sont significants pour la tension arterielle haute des hommes. Les modeles logit-loglineaires permettent d'evaluer la signification relative de facteurs et leurs categories pour les criteres etudies de l'effect en sante.