広島統計談話会

Hiroshima Statistics Study Group

第 316 回談話会を下記のように開催致しますので

御参集下さいますようご案内申し上げます。

You are cordially invited to the 316th meeting as scheduled below.

日　時：　2019 年 4 月 19 日（金）15:00 –

Date　：　April 19, 2019 (Fri) 15:00 –

場　所：　放射線影響研究所　講堂

Place　：　RERF Auditorium

演　者：　キズメット A. コルドバ（放射線影響研究所 統計部 研究員）
ジョン B. コローン（放射線影響研究所 統計部 主任研究員）

Speaker　：　Kismet A. Cordova, M.P.H.
Research Scientist, Department of Statistics, RERF
John B. Cologne, Ph.D.
Senior Scientist, Department of Statistics, RERF

演　題：　「構造回帰モデルによる指標に対する共変量効果の解釈可能な推定」

Title　：　“Interpretable estimates of covariate effects on indicators with structural regression models”

要　約：

Summary:

Multiple indicator multiple causes (MIMIC) models allow us to assess effects of covariates in structural equation models. Unobserved latent factors, estimated with a confirmatory factor analysis model, can be regressed on predictors of interest, such as radiation dose. However, the resulting measures of association can be difficult to interpret, since the underlying latent factors are unobserved and thus have arbitrary scales that are not familiar to subject-matter researchers. On the other hand, the latent-factor indicators (the observed, or manifest, outcome variables) typically are established measures with which researchers are familiar, so it is of interest to estimate covariate effects on the indicators. We applied a MIMIC model to a set of clinical indicators of atherosclerosis measured in atomic bomb survivors to assess radiation effects through meditated pathways using latent factors, with the goal of providing interpretable summaries of the indirect effects of radiation on each of the individual observed outcomes. The cross-sectional study sample comprised 3,217 atomic bomb survivors enrolled in the Adult Health Study who consented to participate and visited the Radiation Effects Research Foundation for clinical exams from 2010-2014. The 14 physiological measurements of interest were grouped into three pre-defined latent factors representing potential underlying mechanisms of atherosclerosis: arterial stiffness, calcification, and plaque. Compared with separate ordinary regressions of each indicator on radiation dose and other relevant covariates, the MIMIC model resulted in more stable estimates, narrower confidence intervals, more power, and better model fit. The hypothesized measurement model was consistent with the data, and interpretable summaries of the indirect effect of radiation on each indicator via the corresponding latent factor were achieved. However, this modeling structure included important assumptions, and the validity of those assumptions required careful review. When analyzing multiple correlated outcomes to assess radiation effects to an underlying system, a MIMIC model affords the opportunity to test complex pathway diagrams and interrelationships among variables, while also providing concrete, interpretable results. However, these models are especially appropriate when there is a clear, pre-defined hypothesis about the structure of the data, which requires careful thought and close collaboration between clinicians and statisticians.