**Modeling Incidence and Severity of Disease using Healthcare Data**

Lauren Nicole Geiser, Beverly Anne Setzer, Jason Cory Brunson, Reinhard Laubenbacher

1. University of Dayton, 2. North Carolina State University, 3. Center for Quantitative Medicine, UConn Health

---

**Admission-Level Models**

**Predicting MI Occurrence**

- **Goal:** Predict MI diagnosis for a patient admitted to an ICU
- **Observational Unit:** Hospital admission (n=50,806)
- **Response Variable:** Diagnosis of MI during admission

(1) \( g(\pi_1) = \beta_0 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_7 x_7 + \epsilon \)

(2) \( g(\pi_1) = \text{Model 1 predictors} + \beta_2 \text{Drugs} \)

(3) \( g(\pi_1) = \text{Model 2 predictors} + \beta_2 \text{Drugs} \)

**Predicting In-Hospital Mortality for MI Patients**

- **Goal:** Conduct follow-up analysis to a study (1) examining the impact of lab tests and ethnicity data on predicting in-hospital mortality for MIs
- **Observational Unit:** Hospital admission (n=12,348)
- **Response Variable:** In-hospital mortality during admission

(1) \( g(\pi_2) = \beta_0 + \beta_2 \text{DRG} + \beta_3 A_G + \epsilon \)

(2) \( g(\pi_2) = \text{Model 1 predictors} + \beta_2 \text{Sev} \)

(3) \( g(\pi_2) = \text{Model 2 predictors} + \beta_2 \text{A_G} \)

---

**Time Series Models**

**Modeling MI Risk Progression with Age**

- **Goal:** Predict MI risk progression with age
- **Observational Unit:** Population ICU admissions at each month of life
- **Response Variable:** Diagnosis of MI during admission

**Data:**
- Aggregated patient data by month of age
- Lose patient-level correlations

**Framework:** Generalized linear regression and time series modeling

---

**Conclusion**

We were able to create data-driven risk models and model pipelines that can be generalized and applied to subsequent projects, but were limited by the scope and sparsity of the data. Future work will include fitting time series models to longer-term, more consistent data sets; expanding to multivariate time series models; and combining diagnosis-specific risk models into a visual reference tool.