

## PODIUM SESSION III: MODELING STUDIES

MOI

**IMPACT OF INCLUDING CARDIOVASCULAR AND RESPIRATORY OUTCOMES ON ESTIMATES OF CLINICAL AND ECONOMIC BENEFITS OF INFLUENZA VACCINATION IN THE U.S. ELDERLY POPULATION**Gao X<sup>1</sup>, Snedecor S<sup>1</sup>, Ethgen O<sup>2</sup>, Botteman M<sup>1</sup><sup>1</sup>PharMerit North America LLC, Bethesda, MD, USA, <sup>2</sup>GSK Biologicals, Rixensart, Belgium

**OBJECTIVES:** Influenza virus activity increases hospitalizations for a broad range of cardiopulmonary diagnoses, including pneumonia and influenza (P&I). However, only a few economic studies have even partially incorporated broader respiratory (including P&I) and cardiovascular outcomes (R&C) in assessing vaccination effects. We developed a conceptual model that assessed the costs and benefits of vaccinating elderly individuals from a US societal perspective based on 2 different outcomes (P&I only vs. R&C). **METHODS:** A literature-based decision model was used to estimate the short- and long-term costs and quality-adjusted life expectancy (QALE) associated with annual influenza vaccination for the elderly population (aged  $\geq 65$  years,  $N = 37,888,000$ ). One version of the model included P&I outcomes only whereas the other version included the broader influenza-related R&C outcomes. The reduction rate of influenza due to vaccination was 30% and applied to the probability of seeking medical attention, antivirals and antibiotics utilization, and indirect costs. The reduction in hospitalization due to influenza was calibrated to reflect recent epidemiologic estimates. **RESULTS:** When only P&I were modeled, the number of hospitalizations was 63,000 and 88,000 with and without vaccination, respectively. The QALE per person was 7.7514 versus 7.7509 years; and the average cost per person was \$118 versus \$121, respectively. When R&C were modeled, the number of hospitalizations increased to 180,000 and 239,000; the QALE per person decreased to 7.7392 and 7.7355; and the average cost increased to \$325 and \$388, respectively, with and without vaccination. The inclusion of all R&C outcomes improved the estimated vaccination benefits, with more hospitalizations avoided (34,000), QALE gained (123,000 QALYs), and cost savings (>\$2 billion). Results were similar in sensitivity analyses. **CONCLUSIONS:** Excluding R&C outcomes considerably underestimates the burden of influenza and the economic benefits of influenza vaccination. Future economic assessments of influenza vaccination strategies should include all R&C outcomes.

MO2

**A SYSTEMATIC EVALUATION OF EMPIRICAL BAYES METHODS UNDER TIME CENSORED CONDITIONS**Murray J<sup>1</sup>, Fryback DG<sup>2</sup><sup>1</sup>Eli Lilly and Company, Indianapolis, IN, USA, <sup>2</sup>University of Wisconsin – Madison, Madison, WI, USA

**OBJECTIVES:** Quality assurance must identify problems among a group of providers using sparse observations within some providers, posing problems of estimation. We compare Empirical Bayes (EB) methods for estimating means and confidence intervals to classical statistical estimates when time frames are censored. **METHODS:** Retrospective data on four measures with various units of analysis were selected: (1) quality of care for psychiatric emergencies by physicians, (2) cesarean sections rates in hospitals, (3) LOS for five DRGs in hospitals, and (4) "cost" for five DRGs by hospital. Data was available for overall time frames of one to two years. Individual unit of analysis results from the overall time frame were assumed as the "best" estimate of true performance. Data sets were subset into shorter time periods (i.e., months or quarters). EB priors were estimated by averaging results across units of analysis within each censored time frame. Priors were combined with the observed data to form posterior estimates for individuals; bootstrap methods were used to estimate Bayesian confidence intervals. Bayesian and Classical estimates of means and confidence intervals were compared within and across time periods by units of analysis on four measures of "goodness": (1) Absolute difference between the "true" mean and the classical and EB estimates, (2) frequency of the EB mean being closest to the "true" mean, (3) average widths of the EB and classical intervals, and the actual probability coverage of the estimated intervals. **RESULTS:** EB methods were consistently closer in absolute difference and by frequency to the "true" mean. EB confidence intervals were consistently narrower giving less uncertainty about the location of the true mean while maintaining the expected probability coverage. **CONCLUSION:** Empirical Bayes methods can mitigate the adverse effect of sparse samples at the provider level compared to classical estimation for quality assurance when limited time constrains observations.

MO3

**INTEGRATING INDIVIDUAL PATIENT LEVEL RCT DATA WITH A COMPREHENSIVE DECISION ANALYTIC COST EFFECTIVENESS MODEL**Manca A<sup>1</sup>, Saramago P<sup>1</sup>, Henriksson P<sup>2</sup><sup>1</sup>University of York, York, UK, <sup>2</sup>Linköping University, Linköping, Sweden

**OBJECTIVES:** Randomised controlled trials (RCTs) are the gold standard for demonstrating the efficacy of medical interventions. However, RCTs may be neither sufficient nor the most efficient vehicle to generate cost effectiveness (CE) evidence to inform health care resource allocation decisions. RCT evidence may a) not be directly relevant to a given jurisdiction; b) exclude relevant treatment strategies; c) be too short in follow up. Comprehensive decision-analytic models (CDAMs) can help address the above challenges. These models are typically populated using summary measures, and often require strong distributional assumptions concerning their input parameters. We extend the use of CDAM, to accommodate and exploit the wealth of information contained in an individual patient-level dataset (IPD). **METHODS:** Using the UK

RITA-3 trial, we show how to conduct a Bayesian analysis of IPD with the aim to a) estimate input parameters to populate a CDAM, and b) inform probabilistic sensitivity analysis (PSA) to evaluate the decision problem. The proposed framework allows simultaneous estimation of a system of risk equations for specific events of interest, estimation of costs and quality of life implications related to the occurrence of these events, and PSA into a single CE model. Results are compared and contrasted with those from a standard two-stage approach, i.e. estimation of parameters through classical statistical inference, followed by PSA in a spreadsheet. **RESULTS:** Using IPD within the proposed analytical framework produced more accurate estimates than the standard two-stage approach in terms of posterior distributions of the incremental costs and QALYs. This resulted in a reduced decision uncertainty, as represented by the CE acceptability curve. **CONCLUSIONS:** CDAM based on IPD looks more promising and appropriate from the methodological point of view than standard (two-stage) modeling methods. This general analytical framework can be further extended to facilitate statistical evidence synthesis in the presence of multiple data sources.

MO4

**RE-EXAMINING THE SPECIFICATION OF REGRESSION MODELS OF MULTINOMIAL RESPONSES: AN APPLICATION TO PREDICTING POST-STROKE DISCHARGE DISPOSITION**Bergtold J<sup>1</sup>, Onukwugha E<sup>2</sup><sup>1</sup>Kansas State University, Manhattan, KS, USA, <sup>2</sup>University of Maryland School of Pharmacy, Baltimore, MD, USA

Current approaches to specifying multinomial logistic models (MLM) have not highlighted the statistical adequacy of the model specification or the implications of possible misspecification due to patterns common to observational data. The probabilistic reduction (PR) approach provides a framework to guide model specification when using observational data. **OBJECTIVE:** The objective of this study is to examine the specification of MLM using the PR approach, with an application to identifying predictors of hospital discharge disposition among stroke patients. **METHODS:** Within the PR approach, the index function associated with the choice probability is functionally related to the inverse conditional distribution. Operationalization of the index function leads to the consideration of nonlinear terms and interacted terms, based on the inverse conditional distribution and the existence of dependence across model covariates. To illustrate the methodology, an empirical application examined predictors of hospital discharge disposition among live discharges of adult stroke patients in Maryland using a population-based discharge dataset ( $N = 79,561$ ). Categories of discharge disposition included home, home health care, rehabilitation, nursing home, discharges against medical advice, and 'all other'. Covariates controlled for patient demographic and clinical characteristics. A traditional MLM specification and a model specified following the PR approach were estimated and compared. **RESULTS:** Results based on the information criteria (traditional specification: AIC = 194377.1 and AICC: 194377.2; PR specification: AIC = 192705.5 and AICC: 192738.1) estimates and the likelihood ratio test ( $p$ -value = 0.000) showed that the PR approach provides a better fit and that the traditional specification of the model is misspecified. We also estimate marginal effects of the explanatory variables on the probability of each discharge category. **CONCLUSION:** The novel finding is that the PR approach can be used to specify discrete choice models that provide a better fit to observational data, compared to models specified using more common approaches.

**PODIUM SESSION III: NEUROLOGICAL DISORDERS – Outcomes Research & Health Care Policy Studies**

NDI

**COST-EFFECTIVENESS OF DISEASE-MODIFYING THERAPY FOR MULTIPLE SCLEROSIS: A POPULATION-BASED EVALUATION**Noyes K<sup>1</sup>, Bajorska A<sup>1</sup>, Chappel AR<sup>2</sup>, Schwid S<sup>1</sup>, Mehta LR<sup>2</sup>, Holloway R<sup>1</sup>, Dick A<sup>3</sup><sup>1</sup>University of Rochester School of Medicine, Rochester, NY, USA, <sup>2</sup>University of Rochester, Rochester, NY, USA, <sup>3</sup>The RAND Corporation, Pittsburgh, PA, USA

**OBJECTIVES:** Costly disease modifying therapies (DMTs: interferon beta-1a and beta-1b and glatiramer acetate) were introduced in the 1990s to reduce the frequency of relapses and to slow disease progression in patients with multiple sclerosis (MS). At the same time, these therapies are characterized by uncomfortable side effects and high costs. This study examines data from a 2000–2005 population-based survey of MS patients from the Sonya Slifka Study to evaluate the cost-effectiveness (CE) of DMTs in the US compared to no DMT. **METHODS:** We generated 10-year disease progression paths using first-order Markov models to estimate transitional probabilities and logistic models to estimate relapse rates based on published estimates of DMT treatment effects. To estimate costs, we used Medicare rates for reported utilization events. Outcomes were measured as gains in quality-adjusted life years (QALY) and relapse-free years, differences in the number of disease progressions (as measured by disability status), and gains in years spent in lower disability states. Monte Carlo ( $n = 50$ ) simulations, resampling ( $n = 250$ ) methods, and sensitivity analyses were conducted to evaluate uncertainty. **RESULTS:** Using DMT for 10 years resulted in significant health gains. The choice of the optimal therapy depends on the outcome, with interferons generating the highest QALY gain (0.187 QALY), fewer disease progressions (by 0.91), fewer years spent in higher disability states (by 0.81 year), and leading to more relapse-free years (by 1.12 year) compared to glatiramer or no DMT. The CE of all DMTs exceeded \$1,000,000/QALY, with glatiramer being the most cost-ineffective (\$5,209,524/QALY). As the cost of DMT decreases, DMTs become more