PODIUM SESSION III: MODELING STUDIES

MO1

IMPACT OF INCLUDING CARDIOVASCULAR AND RESPIRATORY OUTCOMES ON ESTIMATES OF CLINICAL AND ECONOMIC BENEFITS OF INFLUENZA VACCINATION IN THE U.S. ELDERLY POPULATION

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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 ≥ 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

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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

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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) modelling 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

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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

ND1

COST–EFFECTIVENESS OF DISEASE–MODIFYING THERAPY FOR MULTIPLE SCLEROSIS: A POPULATION–BASED EVALUATION

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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

cost-effective. **CONCLUSIONS:** While the current practice of recommending DMT for any patient with progressive MS results in substantial health gains, these gains come at a very high drug cost, rendering the incremental cost-effectiveness ratios of each of the DMTs far above currently accepted standards.

ND2

DIRECT HEALTH CARE AND WORKLOSS BURDEN OF CHEMOTHERAPY–ASSOCIATED PERIPHERAL NEUROPATHY IN BREAST, OVARIAN, HEAD AND NECK, AND NON–SMALL CELL LUNG CANCER

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OBJECTIVES: Chemotherapy-associated peripheral neuropathy (CAPN) is a painful side-effect of chemotherapy. Comprehensive measures of health outcomes, medical costs, and workloss burden of CAPN in patients with breast, ovarian, head/neck, or non-small cell lung cancer (NSCLC) have not been quantified. This study assesses the outcomes and direct and indirect cost burden of CAPN in these four tumor types from a third-party payer perspective. **METHODS:** Data were from an administrative claims database of privately insured companies covering 1999–2006. Patients with qualifying tumors, and claims for chemotherapy and services indicative of peripheral neuropathy (PN) within 9-months of chemotherapy were selected. Cases were matched 1:1 to controls with no PN-related claims based on cancer type, diabetes history, demographics, and propensity for reporting PN claims during the study period (estimated on baseline resource use and comorbidities). Direct costs and resource use were calculated for a 12-month study period using diagnosis and procedure codes, pharmacy claims, and provider specialty codes. Indirect costs were obtained for a subset of patients that had disability and medically related absenteeism data. Comparisons of cost and resource use between cases and controls used paired t-tests. **RESULTS:** Among patients treated for breast, ovarian, head/neck, and NSCLC, 454 were identified who met inclusion criteria and had evidence of CAPN. Average direct costs were $17,344 higher for CAPN cases than non-CAPN controls (p < 0.0001). Outpatient costs were the highest component for both cases and controls with cases having excess outpatient costs of $8092 (p < 0.001). On average, each CAPN case had 12 more outpatient visits than controls (51.3 vs. 39.8 visits; p < 0.0001), and spent more days in the hospital (5.6 vs. 3.2 days; p < 0.001). Indirect resource use and costs were higher for cases but not statistically different from controls. **CONCLUSIONS:** CAPN is associated with increased direct medical cost and resource use of patients with breast, ovarian, head/neck, or NSCLC.

ND3

PRESCRIBING PATTERNS AMONG DEMENTIA PATIENTS AT THE VETERANS AFFAIRS MARYLAND HEALTH CARE SYSTEM (VAMHCS)

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OBJECTIVES: Dementia patients often receive cholinesterase inhibitors and/or memantine (CIM) for cognitive symptoms, and antidepressants (AD) for behavioral symptoms. Ideally, patient demographics or clinic locations have no effect on care received. We explored whether patient demographics and/or outpatient referrals to specialized dementia or mental health clinics influenced the likelihood of receiving CIM/AD medications. **METHODS:** Veteran's Affairs Maryland Health Care System (VAMHCS) electronic medical records were used to select a cohort, based on diagnosis codes or medications indicating Alzheimer's or related dementias. Patients aged 60 and above, with index dates after 1999 were selected. Additional criteria included: minimum of one year follow up or death within a year of index date. The outcome (referent) was categorized as: receipt of CIM, receipt of AD, receipt of both CIM/AD (receipt of neither medication type). Multivariable multinomial logistic models (MLM) explored predictors of CIM and AD utilization categories, including age, time in cohort, race, marital status, and referrals to dementia or mental health clinics. **RESULTS:** A cohort of 1359 patients, average age of 78.1 (SD 6.0) years and 22% African-Americans, was followed up for an average of 3.1 (SD 1.9) years. Thirty-five percent had mental health or dementia clinic visits while 18% visited both clinics. Significant associations were found for receiving both CIM and AD medications versus receiving no medication for years in cohort (OR = 1.237, p < 0.0001), African-American race (OR = 0.437, p = 0.0001), age (OR = 0.966, p = 0.0288),) marital status (OR = 1.492, p = 0.0339) and mental health clinic visit (OR = 3.386, p < 0.0001). Dementia clinic visit was associated with CIM only but not receipt of both medications (OR = 1.405, p = 0.0996). **CONCLUSIONS:** In veterans with possible dementia, demographic factors and care at dementia/mental health clinics impact the likelihood of receiving CIM/AD medications. These found associations need to be further investigated for their potential impact on patient outcome.

ND4

COST–UTILITY OF INTERFERON BETA–1B IN THE TREATMENT OF PATIENTS WITH A CLINICALLY ISOLATED SYNDROME SUGGESTIVE OF MULTIPLE SCLEROSIS: MODEL UTILIZING FIVE YEAR BENEFIT DATA

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OBJECTIVES: To estimate the cost-utility of interferon-beta-1b (IFNB-1b) for the treatment of patients with a clinically isolated syndrome (CIS) suggestive of multiple sclerosis (MS) using five year BENEFIT clinical trial data. **METHODS:** We developed a Markov model of the epidemiology and treatment of CIS and MS. A hypothetical cohort of 1000 patients with incident CIS, with initial health states defined by Kurtzke's Expanded Disability Symptom Scale (EDSS), was specified. The cohort was assumed to be treated with either IFNB-1b (250 mcg eod) following an initial demyelinating event suggestive of MS or not treated until confirmation of Poser-defined MS. Data from BENEFIT were used to model EDSS transitions and transition from CIS to MS. Relapses were estimated from BENEFIT and published natural history data. Following transition to MS, all patients were assumed to be treated with IFNB-1b until reaching EDSS 6.5. Direct and indirect medical costs of MS treatment and IFNB-1b were estimated using published literature and pricing schedules. Patient utilities were derived from EQ-5D data from BENEFIT, supplemented by published data defined by EDSS score and relapse occurrence. Mortality was estimated using life tables and EDSS data. Costs (2007 AUD) and outcomes were discounted at 5% per annum. Sensitivity analyses were performed on all key model parameters. **RESULTS:** Use of IFNB-1b was associated with fewer EDSS transitions, longer time to CDMS diagnosis, and a reduced relapse burden. In the base case (Australian perspective; 25-year time horizon), the incremental cost utility of IFNB-1b versus no treatment was AUD 20,000 (USD 14,000) per quality-adjusted life year (QALY) gained. Findings were sensitive to time horizon, IFNB-1b cost and treatment effect, and underlying rate of disease progression. **CONCLUSIONS:** This model shows that IFNB-1b treatment of patients with CIS is cost-effective with a cost per QALY gained within the range of many well accepted health care interventions.

PODIUM SESSION IV: HEALTH CARE MANAGEMENT STUDIES

HM1

EFFICIENCY AND ECONOMIC BENEFITS ASSOCIATED WITH THE USE OF A PAYER–BASED ELECTRONIC HEALTH RECORD IN AN EMERGENCY DEPARTMENT AMONG A HEALTH INSURED POPULATION

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OBJECTIVES: Health information exchange technologies are being implemented widespread with goals of improving efficiency and costs of care. The need for timely, accurate, and pertinent information is most critical in the emergency department (ED). This study evaluated the use of a payer-based electronic health record (P-EHR), which includes a clinical summary of a patient's medical and pharmacy claims, in an ED on length of stay (LOS) and costs of care among a commercially insured population. **METHODS:** A large urban hospital implemented a P-EHR in the ED. The P-EHR was evaluated using administrative claims and supplemental hospital data. Encounters with P-EHR use were identified from claims between September 1, 2005 and February 17, 2006. Accounting for seasonal variation, historical comparison encounters were identified from November 1, 2004 to March, 31, 2005. Outcomes included ED LOS and cost for the ED encounter. Control variables included age, gender, pre-encounter six month health care utilization and costs, comorbidity burden, plan type, day of week (weekend vs weekday), primary diagnosis, triage severity scores, and ED census. Analyses used multivariate generalized linear models and non-parametric bootstrap for standard errors of predictions. **RESULTS:** A total of 2288 ED encounters were analyzed (779 P-EHR/1509 comparison). ED-only P-EHR encounters were discharged 19 minutes quicker (95%CI:5–33 minutes) as compared to encounters not associated with the P-EHR. Among encounters resulting in hospitalization, the P-EHR was associated with a 77 minute reduction in LOS (95%CI:28–126 minutes) as compared to non-P-EHR encounters. The use of the P-EHR was also associated with $1560 (95% CI:$43–$2910) savings in total plan expenditures for encounters resulting in hospitalization. No significant difference in costs was observed among ED-only encounters. **CONCLUSIONS:** This study highlights that a P-EHR can have a meaningful impact on ED throughput and costs. These benefits may translate into improvement in the care provided to patients and their satisfaction.

HM2

USING DECISION MODELING TO MAP PHARMACISTS INTERVENTIONS TO OUTCOMES FOR PATIENTS WITH DIABETES

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OBJECTIVES: To determine the cost savings resulting from specific pharmacist interventions provided to patients with diabetes and their physicians, using a decision-analysis modeling approach. **METHODS:** Prospective, cohort study using Lucas County employees with diabetes enrolled in an employer-sponsored Medication Therapy Management program in Northwest Ohio. An expert (comprising of clinical pharmacists and researchers) opinion guided clinical model pathway was developed to identify and map specific pharmacist interventions to corresponding responses and outcomes. Interventions included: 1) alerting physician of patient's abnormal A1c and/or blood sugar profile; 2) pattern management; 3) instructing on the proper use of injectable; 4) glucometer training; 5) advising patients on best way to correct hypoglycemic/hyperglycemic episodes. Data was extracted from patient charts and entered into Microsoft Excel. A 1-year decision-analytic model was constructed using The TreeAge Pro Suite 2008 to identify the cost-savings per intervention. Probabilities for the interventions, responses, and outcomes were obtained from real-world data. For example,