telemedicine (evaluation of usefulness); • the view of information systems or architectures. The following characteristics were taken: • purpose of the system; • interaction of patients and physicians; • training and impact on lifestyle - the formation of health-preserving behaviors (with the exception of smoking, adequate physical activity, etc.); • self-management. **RESULTS:** The following problems of implementation of telemedicine systems were identified: • high cost, the need to purchase special equipment and devices; • the need for training and motivation of both staff and patients; • lack of a unified architecture, protocol stack and hardware-software platform for the integration of systems at all stages of the process - from data collection to its processing, decision-making and patient feedback. Despite the fair amount of existing telemonitiring systems almost all of its provide only data collection, while the entire analytical part falls on the doctor. Almost all of studies were focused on the elderly and adults. **CONCLUSIONS:** A promising direction is the development of a prototype system for remote health monitoring in pediatric patients. The study was supported by the Russian Foundation for Basic Research, the project ¹ 13-04-12055.

PRM66

USING MACHINE LEARNING TO POPULATE A MARKOV MODEL BY MINING BIG DATA DIRECTLY FROM HOSPITAL EHRS – AN APPLICATION TO DYNAMICALLY PREDICT HOSPITAL-ACQUIRED PRESSURE ULCERS

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OBJECTIVES: Real-world big data accessible through electronic health record (EHR) systems offer opportunities to collect generalizable information to populate economic models. Using a supervised machine learning approach, the objectives were: (a) to mine a hospital EHR for transition probabilities of high-risk patients for developing hospital-acquired pressure ulcers (HAPUs); and (b) to compare efficiency and accuracy of predictive methods between Markov modeling and Bayesian inference with EHR data. **METHODS:** This study used a de-identified panel of patient hospitalizations since 2010 in a U.S. tertiary academic medical center EHR to study Braden scores of patient risk for developing HAPUs. The study focused on patients hospitalized for ≥5 days and at least two Braden scores. Braden scores were converted from an ordered scale into five categories (i.e. minimal risk; at risk; moderate risk; high risk; very high risk). A 10-stage Markov model was constructed via supervised machine learning using R software designating the five Braden categories as transition states, as well as end-states for discharge or HAPU incidence. Results of the Markov approach were age-adjusted and compared to prior probabilities of HAPU risk derived from naïve and full Bayesian inference. Measures of computational accuracy and efficiency were derived to compare analytical approaches. **RESULTS:** The EHR provided a panel of over 34,787 patients. The Markov model yielded transition probabilities for each of 7 transitions. Patient risk for developing a HAPU is highly predictable after approximately 4-6 iterations. The very high-risk cohort had a clinically meaningful increase in risk for HAPU development of 2.35% compared to a minimal risk transition probability of 0.05% ($p<0.001$). Neither of the Bayesian classifiers provided accurate comparisons. **CONCLUSIONS:** Real-world big data from an EHR enables outcomes researchers to mine transition probabilities using supervised machine learning. These results can be obtained to efficiently populate Markov models for cost-effectiveness and decision analysis.

PRM67

BURDEN OF EPILEPSY IN COLOMBIA

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OBJECTIVES: Epilepsy lays an important burden on healthcare systems and society in general. Disability adjusted life years (DALYs) have been developed to compare the burden of this disease both between conditions and between geographical boundaries. With improving data on disease incidence and prevalence in Colombia, we can refine our DALYs-based estimates. **METHODS:** Using different strategies, including the official healthcare provision database (called RIPS) and death certificates, as well as extrapolation from published neuroepidemiologic studies, we estimated the incidence and prevalence by age groups, the disease duration and the attributable mortality. Base don previous studies, we assumed an average disability weight of 0.113. With this information, and using the classic methodology described by Murray & Lopez, we calculated DALYs for the year 2012. **RESULTS:** 49,984 (10.4%) of the 479,836 Colombian epilepsy patients are in the 15-19 year-old group. Overall, it was found that epilepsy was responsible for 0.88% of all deaths (12,837) in Colombia, 8,219 (64%) of them in 60-year olds or older. A total of 5.25 DALYs per 1,000 person-years are lost due to epilepsy in Colombia, 75% of which (3.91 DALYs) are due to premature mortality, with a higher burden in men (6.12 DALYs) than in women (4.41 DALYs). **CONCLUSIONS:** We reported new estimations on epilepsy incidence and prevalence by age groups in Colombia and conclude that DALYs lost due to epilepsy in Colombia are almost double the previous figure, mostly because of the underestimation of attributable mortality. With this figure, epilepsy ranks 12th instead of 19th in the list of the most important causes of DALYs lost.

RESEARCH ON METHODS – Modeling Methods

PRM68

GENERALIZED IMPLEMENTATION OF EM ALGORITHM FOR ESTIMATION OF TRANSITION PROBABILITY MATRIX

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OBJECTIVES: Health economic models typically follow a Markovian framework with discrete health states. The transition probability matrix (TPM), which characterizes the health state transitions, is the key driver of such a model. Estimation of TPM depends upon the observation intervals of clinical studies and the model cycle length. Generally Maximum-Likelihood (ML) or eigen-decomposition method can be used to estimate the TPM. However, these methods are not feasible for studies with non-uniform observation intervals (e.g., observations taken at 1, 3 & 6 months), or when eigenvalues are negative or complex. The current objective is to provide a generalized algorithm to estimate TPM in all possible situations using all the available data. **METHODS:** Craig & Sendi (2002) illustrated an EM algorithm approach to estimate 1 month TPM for a 3-state model, where 1 and 2 month observations were available. We generalized this procedure and created an algorithm for any observation intervals and any number of states. We evaluated this algorithm in the following situations: i) Observations at multiple intervals to estimate a single cycle TPM, ii) Seventh month observed transitions to estimate a 2-month TPM when the eigenvalues are complex, iii) Sixth month observed transitions to estimate a 2-month TPM when the eigenvalues are negative. **RESULTS:** The generalized EM algorithm approach replicated results obtained from ML and eigen-decomposition method. In cases where eigenvalues were negative and complex, this method provided solutions which were valid and interpretable. In all three situations mentioned above, the generalized EM algorithm produced consistent and valid results. **CONCLUSIONS:** A generalized EM algorithm can be a useful tool to estimate TPM, in complex situations where ML estimation and eigen-decomposition cannot be used. It allows the use of all the observed data to estimate the TPM, thus increasing the accuracy of the health economic models.

PRM69

PATIENT HETEROGENEITY IN COST-EFFECTIVENESS MODELS FOR CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD): ARE CURRENT MODELS SUITABLE TO EVALUATE PERSONALIZED MEDICINE

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OBJECTIVES: To assess how suitable current COPD cost-effectiveness models are to evaluate personalized treatment options for COPD by exploring the type of heterogeneity included in current models and by validating outcomes for subgroups of patients. **METHODS:** A consortium of COPD modelling groups participated in three evaluations. First, they reported all patient characteristics included in the model and provided the level of detail in which the input parameters were specified. Second, groups simulated disease progression, mortality, QALYs and costs for hypothetical subgroups of patients that differed in gender, age, smoking status and FEV1% predicted. Finally, model outcomes for exacerbations and mortality for subgroups of patients were validated against published subgroup results of two large COPD trials. **RESULTS:** Nine COPD modelling groups participated. Most models included gender (7), age (9), smoking status (6) and FEV1% predicted (9), mainly to specify disease progression and mortality. Almost all input parameters were specified by FEV1% predicted. In addition, disease progression was higher for females and smokers in three and five models, respectively and costs were higher for older patients in three models. Differences between subgroups on other parameters were more variable between the models. Trial results showed higher exacerbation rates for females, which was found in one model, higher mortality rates for males (found in two models), lower mortality for younger patients (found in four models), and higher exacerbation and mortality rates in severe COPD compared to moderate COPD patients (found in four models). **CONCLUSIONS:** The majority of currently available COPD cost-effectiveness models are able to evaluate the cost-effectiveness of personalized treatment based on gender, age, smoking and FEV1% predicted. Treatment in COPD is however, more likely to be personalized based on clinical parameters. Two models include several clinical patient characteristics and seem most suitable to evaluate personalized treatment, although some important clinical parameters are still missing.

PRM70

MODELING THE BURDEN OF ABDOMINAL AORTIC ANEURYSM (AAA) IN EUROPE IN 2013

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OBJECTIVES: To estimate the number of prevalent cases of abdominal aortic aneurysm (AAA) and deaths attributable to AAA in five major European Union (5EU) markets: France, Germany, Italy, Spain, and the United Kingdom (UK). **METHODS:** We used disease modeling software, DisMod II (World Health Organization), to assess AAA burden via a multi-state life table where differential equations define relationships between incidence, prevalence, and disease-specific mortality. Market-specific input data included age- and sex-specific population structure, age- and sex-specific all-cause mortality, and cubic spline interpolation of size- and sex-specific AAA prevalence. Other input data consisted of relative risk (RR) estimates of death for persons with AAA compared with persons without AAA, adjusted for age, ethnicity, height, weight, smoking, and cardiovascular disease history. **RESULTS:** We estimated 2,484,058 prevalent cases in the 5EU in 2013 (90% CI: 2,282,702–2,638,106), resulting in 48,805 deaths attributable to AAA (90% CI: 39,924–54,291). In the combined 5EU, females accounted for 20.2% of prevalent cases and 43.2% of deaths. France had the lowest number of prevalent cases (581.8 per 100,000 population) and deaths (11.0 per 100,000 population) among the 5EU markets, while Italy had the highest number of prevalent cases (1,103.7 per 100,000 population) and deaths (22.3 per 100,000 population). The number of

deaths attributable to AAA in Italy represented 28.0% of the 5EU total, despite Italy accounting for only 19.3% of the 5EU population in 2013. **CONCLUSIONS:** Our study reveals that the burden of AAA among the 5EU markets is most severe in Italy, which accounted for the highest number of both prevalent cases and deaths attributable to AAA in the 5EU. Throughout the 5EU, females accounted for a disproportionately high percentage of deaths despite constituting a low percentage of prevalent cases. Consequently, current screening guidelines should target both sexes, rather than males only.

PRM71

COST-EFFECTIVENESS OF ESCALATING TO NATALIZUMAB OR SWITCHING AMONG IMMUNOMODULATORS IN RELAPSING-REMITTING MULTIPLE SCLEROSIS IN ITALY

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OBJECTIVES: Published literature suggests that treatment escalation to natalizumab, in relapsing-remitting multiple sclerosis (RRMS) patients with inadequate response to first-line injectable treatments, is clinically more effective than switching among immunomodulators. This analysis evaluates the cost-effectiveness of escalation vs. switching, adopting the Italian social perspective. **METHODS:** A lifetime horizon Markov model compared early escalation to natalizumab vs. switching among immunomodulators (interferons or glatiramer acetate) followed by escalation to natalizumab, in a cohort of patients who failed a first-line therapy. Specifically the two compared treatment algorithms were: a) escalation until progression of Expanded Disability Status Scale (EDSS) score of 7.0; b) switching until EDSS=4.0, followed by escalation until EDSS=7.0. For the two options, the model analyzed social costs and quality adjusted survival (QALYs). The model captured the effects of therapies in prolonging time without disability progression and burden of relapses. Clinical data was derived from a published study comparing the two treatment strategies. Unit tariffs and costs were adapted to the Italian setting. **RESULTS:** Early escalation to natalizumab was dominant over switching among immunomodulators. The two options led to similar costs (€1.008 mln/patient in the escalation group, vs. €1.034 mln/patient in the switching group), but early escalation was associated to prolonged quality adjusted survival (11.54 vs. 9.94 QALYs; +16.05%). A slight overall survival increase was also observed (21.14 vs. 20.80 life years). The increased acquisition costs related to prolonged treatment with natalizumab were offset by savings due to decreased burden of relapses and a reduction of disability-related costs. **CONCLUSIONS:** Early escalation to natalizumab is a cost-effective option in RRMS patients who don't adequately respond to conventional immunomodulators compared to switching among immunomodulators and escalation later. This shows that patients benefit from early escalation to natalizumab and prolonging immunomodulation, using therapies with similar mechanisms of action, could determine inappropriate usage of economic resources and poor benefit for patients.

PRM72

CONTRASTING PREDICTIONS OF CARDIOVASCULAR INCIDENCE DERIVED FROM ALTERNATIVE RISK PREDICTION MODELS IN TYPE 1 DIABETES

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OBJECTIVES: Cardiovascular disease (CVD) risk prediction models are available for the general population (Framingham) and for type-2-diabetes (T2D) (UKPDS 68 and 82) but may not be appropriate in type-1-diabetes (T1D). The IMS CORE Diabetes Model (CDM) uses Framingham and UKPDS risk equations (REs) to predict CVD incidence in T2D and has recently been updated to include two CVD risk prediction approaches specific to T1D populations based on data from the Epidemiology-of-Diabetes-Interventions-and-Complications-study (EDIC) and a novel RE from the Pittsburgh-Epidemiology-of-Diabetes-Complications-Study (PEDC). The objective of this study was to compare CVD incidence across T1D model projections utilizing UKPDS, EDIC and PEDC REs and compare these to published EDIC findings. **METHODS:** The CDM was applied to project the incidence of myocardial-infarction (MI), stroke, heart-failure (HF) and ischemic-heart-disease (IHD) utilizing three alternative CVD REs, the UKPDS 68 RE (UK68-RE), EDIC-RE and PEDC-RE. The risk profile of a newly diagnosed T1D population (age 21 years, HbA1c 7%, systolic-blood-pressure 114 mmHg, body-mass-index 32 Kg/m2, high-density-lipoprotein 45 mg/dl and total-cholesterol 170 mg/dl) was projected over 30 years. The incidence of total CVD was estimated as the sum of the individual composites (%CVD=%MI+%stroke+IHD+HF) to enable comparison to published EDIC findings. **RESULTS:** When UK68-REs were applied, the 30-year cumulative incidence of CVD for a newly diagnosed T1D individual was projected at 2.66%, 0.27%, 3.88% and 0.72% for MI, stroke, IHD and HF, respectively. This compared to 4.10%, 0.66%, 3.36 and 0.58% utilizing EDIC-RE and 5.27%, 1.01%, 3.44 and 1.18% utilizing PEDC-RE. Total predicted CVD incidence added up to 7.53%, 8.70% and 10.90% for UK68-RE, EDIC-RE and PEDC-RE respectively, which compares to 8.70% incidence of CVD as observed during the EDIC study. **CONCLUSIONS:** As expected, the CDM reproduced the published EDIC CVD incidence when using the EDIC approach but demonstrated a slight underestimation utilizing UK68-RE and overestimation with PEDC-RE.

PRM73

VALIDATION OF A MARKOV MODEL FOR ECONOMIC EVALUATION OF SCREENING AND PREVENTIVE INTERVENTIONS IN ALZHEIMER'S DISEASE IN DENMARK

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OBJECTIVES: Alzheimer's disease (AD) afflicts up to 9% of people aged 65 and over worldwide, with prevalence projected to increase. AD is associated with reduced quality of life and high treatment and management costs. A number of recently developed screening and preventative interventions offer reduction in resource use and improvement in quality of life for AD patients. The majority of existing models for economic evaluation of AD interventions focus on pharmaceuticals and due to their limited scope and time-horizon are unsuitable for evaluation of screening and preventative strategies. It is proposed to develop a decision model to ascertain the most cost-effective 'mix' of preventative and screening methods for Denmark. The objective of this study is to develop and validate such a model for economic evaluation of non-pharmaceutical interventions for AD **METHODS:** A Markov model was developed, representing transitions of a hypothetical cohort of 65 year olds from 'no AD' to different stages of AD (Very Mild through to Severe). AD could either be 'identified' or 'not identified' to reflect the difference in costs associated with treatment and management. Due to absence of Danish data, the model utilised transition probabilities based on US data; AD-associated costs and utilities were obtained from Danish and Swedish data, respectively. The model was externally validated against an epidemiological study of AD in Denmark to predict prevalence and stage of AD by age. **RESULTS:** The model accurately predicted Danish age-specific prevalence of AD, although the prevalence for the 75-79 age group was overestimated by 3%. The model also produced accurate predictions of the distribution of AD severity. **CONCLUSIONS:** The model provides a simple and robust framework for economic evaluation of screening and other non-pharmaceutical interventions for AD. The lack of up to date epidemiological data on AD is a challenge for model validation and introduces uncertainty.

PRM74

CONTRASTING MODEL PREDICTED LIFE EXPECTANCY IN PATIENTS WITH TYPE 2 DIABETES ACROSS DIFFERENT MORTALITY RISK PREDICTION MODELS VERSUS DATA FROM THE CANADIAN CHRONIC DISEASE SURVEILLANCE SYSTEM

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OBJECTIVES: Diabetes is known to be associated with a considerable decline in life expectancy (LE). The aim of this study was to use a modelling approach to assess LE in low, intermediate and high-risk type-2-diabetes (T2D) populations and to compare these to observations from the Canadian-Chronic-Disease-Surveillance-System (CCDSS). **METHODS:** This study used the IMS-Core-Diabetes-Model (CDM), a validated diabetes simulation model, to project the LE of T2D individuals with a low-risk (age=55, diabetes duration=5, no CVD history), intermediate-risk (age=65, diabetes duration=15, moderate CVD history) and high-risk profile (age=80, diabetes duration=30, advanced CVD history). LE was predicted utilising three alternative mortality risk prediction models (RPMs) from the UKPDS 68 study (UK68), the UKPDS 82 study (UK82) and a risk equation based on Western Australia (WA) administrative data. Life-years-lost (LYL) in diabetes vs. no-diabetes populations was estimated based on the difference in age matching LE obtained from UK-national-life-tables subtracted by CDM projected-LE. Results were finally contrasted to LE and LYL estimations from the CCDSS study. **RESULTS:** When UK68 mortality RPMs were applied, LE projected was 23.29, 15.94 and 7.78 years for the low, intermediate and high risk cohort. This compared to 22.16, 14.88 and 7.29 years utilising UK82 RPMs and 25.94, 18.11 and 9.05years when utilising the WA RPMs. Based on UK life table data, LYL in diabetes vs. no-diabetes populations were 4.76, 3.61 and 1.11 (UK68), 5.89, 4.67 and 1.60 (UK82) and 2.11, 1.44 and -0.15 (WA) years. The CCDSS study reported outcomes for the low risk (age 55) and high risk (age 80) profile at 24.5 and 8.3 years (LE) and 5.5 and 2.25 years (LYL), respectively. **CONCLUSIONS:** UKPDS based models predicted LE and LYL very closely to CCDSS study findings. The Western Australian RPM seems not to be applicable to a UK and Canadian population.

PRM75

THE EFFICIENCY PATH: AN ESTIMATION OF COST-EFFECTIVENESS THRESHOLDS FOR 185 COUNTRIES BASED ON PER CAPITA HEALTH EXPENDITURES AND LIFE EXPECTANCY

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OBJECTIVES: Cost-effectiveness (CE) is increasingly used for resource allocation worldwide. One key hurdle for its widespread use is the lack of a widely accepted methodology to derive thresholds at the healthcare system (HS) or country level. The objective is to propose a methodology and derive local CE thresholds based on per capita health expenditures (pcHE) and life expectancy (LE). **METHODS:** Our approach is based on the relationship between pcHE and LE; assuming that the increase in expenditures reflects the CE of the interventions added to reach current LE. For HS willing to maintain or increase their secular trend of raising pcHE in order to improve health, the threshold (measured in units of pcHE) will be: Threshold=(LE+1)*i-LE; where LE is measured in life-years (LY) or QALYs; and "i" is the ratio of increase in pcHE that the HS is willing to accept to increase LE by one unit (eg i=1.09 for a 9% increase). For HS with cost-containment mandates: Threshold=LE-((LE-1)/i), where "i" represents the past increase in pcHE to gain the last unit of LE. We used OLS to predict "i" for 185 countries, following both a cross-sectional (2013) and a longitudinal approach (2003-2013) using World Bank data. **RESULTS:** Depending on income strata and LE, countries can expect to increase pcHE by 7-10% for an additional LY and between 10-13% for an additional QALY. This represent cost per QALY thresholds ranging from 9-11 pcHE in High-Income to 5-8 in Low-Income countries, which translates to thresholds of 32-40 thousands US dollars in UK; 83-101 in USA; 6-7 in Mexico and 0.5 in Uganda (around 0.9, 1.8, 0.6 and 0.7 GDP per capita respectively). **CONCLUSIONS:** This approach, based on widely available data, can be useful to inform decisions in all countries using economic evaluations. Our results show thresholds usually lower than those promoted by WHO.