# Ai3 development of a decision-aid for patients with depression considering treatment options

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asthma/COPD and to describe the reasons for non-adherence. ***Methods:*** Data from the 2018 National Health and Wellness Study, a self-administered, annual, internet-based cross-sectional survey of US adults was used. Respondents who self-reported taking daily prescription medication(s) to treat asthma/COPD were given the MAR-Scale, a 20-item comprehensive scale. The scale has 19 items/reasons for non-adherence and one global item, that measures non-adherence "in the past 7 days", on an 8-point scale ranging from 0 days to 7 days. Scale reliability was estimated using Cronbach's alpha and confirmatory factor analysis. Frequencies were used to identify the reasons for non-adherence. ***Results:*** The Cronbach's alpha for the MAR-Scale in asthma (N = 2,810) was 0.880 and 0.932 in COPD (N = 1,632). The Goodness of Fit Index (0.982, 0994) and Standardized Root Mean Square Residual (0.048, 0.036) was acceptable for asthma and COPD respectively. The medication non-adherence rate in asthma was 38.4% and 28.4% in COPD. The most common reasons for non-adherence for both conditions were "simply missing" and "skipping medication to see if still needed"; and cost for COPD. ***Conclusions:*** The MAR-Scale demonstrated acceptable reliability with both asthma and COPD medications and provided an overall estimate for non-adherence.

## Artificial Intelligence Studies

### AI1
### PREDICTORS OF HIGH HEALTHCARE UTILISERS AMONG PATIENTS WITH CHRONIC HYPOPARATHYROIDISM Â€" APPLICATION OF MACHINE LEARNING METHODOLOGY

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***Objectives:*** To identify patient characteristics that predict high healthcare utilisers among adult patients with chronic hypoparathyroidism. ***Methods:*** A retrospective cohort study of patients with chronic hypoparathyroidism was conducted using a US claims database (Q1 2007-Q2 2017). Patients who had received parathyroid hormone were excluded. The index date was a randomly selected date of hypoparathyroidism diagnosis ≥6 months after the initial hypoparathyroidism diagnosis to follow patients at various hypoparathyroidism disease duration and stages. A decision tree model and a balanced random forest model were built to identify patient baseline characteristics that may predict the highest 10% of healthcare utilisers in the year following the index date. For both algorithms, the candidate patient characteristics entered into the models included demographics, comorbidities, and treatments during the year before the index date. The area under the receiver operating characteristics curve (AUC) with 10-fold cross-validation was estimated. ***Results:*** Among the 4,674 patients included in the study (mean±SD age 59.3±16.18 years; 77% women), 461 represented the highest 10% of healthcare utilisers (age 62.2±14.73 years; 71% women). The decision tree model selected kidney diseases (chronic kidney disease, dialysis, infection), cardiovascular diseases (atrial fibrillation, heart failure, hypertension, tachyarrhythmia), sepsis, respiratory infection, type 1 diabetes, bone fracture, hypocalcemia, cataracts, and gout as patient characteristics predictive of high healthcare utilisers (AUC=0.68). The random forest model ranked patient characteristics predictive of high healthcare utilisation by importance as kidney diseases, cardiovascular diseases (coronary artery disease, hypertension, heart failure, and peripheral vascular disease), sepsis, cerebrovascular disease, diabetes (type 1 and type 2) and bone fracture (AUC=0.71). ***Conclusions:*** Recent studies showed that chronic hypoparathyroidism is associated with increased risk of infections, renal or cardiovascular complications, or diabetes. Improved treatment may reduce risks of these complications predictive of high healthcare utilisation that may lead to high medical care expenditure in the coming year. Funding: Shire, a Takeda company

### AI2
### GEO-SPATIAL RISK ASSESSMENT OF ASTHMA HEALTH RESOURCE USE AT THE MUNICIPAL LEVEL IN THE GREATER HELSINKI METROPOLITAN AREA OF FINLAND

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***Objectives:*** To characterize and compare asthma risk associated with select municipalities in the greater Helsinki metropolitan area (GHMA) of Finland, utilizing a unique geo-informatics risk assessment tool. ***Methods:*** The geo-informatics Risk Assessment (RAS) tool links relevant data sources by using a common geographical marker (e.g. municipal code), which is available in publicly accessible data (such as public health data, census data, environmental data, etc.) to compute asthma risk based on asthma medication use intensity across the municipalities of GHMA in Finland. Asthma risk was represented as a total risk score, which is a composite aggregation of three components: demographic risk (age, sex, etc.); socio-economic risk (income, unemployment rate, etc.); and health behavior risk (smoking, obesity, etc.). These risks scores were derived from a statistical analysis, followed by a machine learning predictive analytics approach using the asthma medication intensity risk as the outcome measure. The composite risk score as well as the component scores were rescaled to a range of 0-100. These risk scores were computed for each municipality in the GHMA and displayed as heat maps for better visualization. ***Results:*** GHMA municipalities [Etelä-Vuosaari (EV) and Helsinki Keskusta/Etu-Töölö (HKET)] with similarly sized populations were chosen to demonstrate the differences in asthma risk. EV (pop. 22,616; average age:40.0; 46.3% males) had a total asthma risk score of 33.0, whereas HKET (pop. 18,035; average age: 40.0; 47.3% males) had a total asthma risk score of 9.7. The national average is 43.5. EV total asthma risk was 3.4 times that of HKET. It appears that the % highly educated persons [21.90% (EV) vs. 52.20% (HKET)] and average income [22,321 Euros (EV) vs. 35,952 Euros (HKET)] may be driving this difference in risk. ***Conclusions:*** The RAS tool provides deep insight into asthma risk, by utilizing relevant data sources linked by a common geographical marker.

### AI3
### DEVELOPMENT OF A DECISION-AID FOR PATIENTS WITH DEPRESSION CONSIDERING TREATMENT OPTIONS: PREDICTION OF TREATMENT RESPONSE USING A DATA-DRIVEN APPROACH

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***Objectives:*** Many different treatment options for major depressive disorder (MDD) are proven effective. However, it remains a challenge to determine the optimal choice of treatment for each individual patient. Studies show that patients need treatment (response) information to enable shared decision-making (SDM). We developed a decision-aid that predicts treatment response stratified by patients' personal characteristics and informs about patient relevant outcomes. ***Methods:*** Focus group interviews with patients and semi-structured interviews with clinicians were carried out to identify gaps in clinical practice, relevant components of the decision-aid, preferences regarding treatment outcomes, and preferences regarding the interface. All interviews were audio recorded, transcribed verbatim, and analyzed using the thematic approach. Additionally, a literature search identified predictors of treatment response. Data from GGZ Drenthe, a regional mental health care institution, served as a training set for developing prediction models. It contained 143 potentially predictive variables on patient characteristics, clinical variables, treatment data and outcome data. Data of 449 patients were used for variable selection and model development. A SuperLearner algorithm was developed, fitting and weighting different machine learning models (e.g., lasso, random forest, gradient boosting) to obtain an optimal hybrid prediction model. This was done for all relevant outcomes (e.g. clinical recovery, social functioning) identified in the qualitative research. Analyses were performed in R. ***Results:*** A weighted lasso (0.59) and random forest (0.41) model showed an overall AUC of 0.90 for the outcome of remission (OQ45<55) in the validation set (n=112). Similar models for all outcomes were combined with the qualitative results and literature review to develop the decision-aid. The decision-aid was then integrated in an existing electronic health record system. ***Conclusions:*** A decision-aid for depression, based on statistical learning to show personalized predicted treatment response, has the potential to assist patients and clinicians in personalized treatment choice for MDD, simultaneously enhancing SDM.

### AI4
### GENERAL PAIRWISE COMPARISONS TO SUPPORT QUANTITATIVE MULTIPLE CRITERIA DECISION ANALYSIS

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Multiple Criteria Decision Analysis (MCDA) refers to a collection of formal methods which seek to take explicit account of multiple criteria in helping individuals or groups exploring decisions in health-related matters. Quantitative MCDA models involves measurement to determine weights for criteria. Recently, generalized pairwise comparisons (GPC) have been proposed as a flexible statistical method to analyze multiple outcomes simultaneously for the comparison of a treatment group and a control group (e.g. in randomized trials). One specific implementation of GPC requires outcomes to be prioritized, which circumvents the difficulty of defining weights for the outcomes of interest (Buyse M, Stat Med 2010). The outcomes can be of any type (binary, categorical, continuous, or time to event), and can include efficacy, toxicity, quality of life and cost-related data. All pairs of patients are formed by taking one patient from the treatment group and one patient from the control group. Each of these pairs is a "win" if the prioritized outcomes favour the patient in the treatment group, a "loss" if the reverse is true, and a "tie" if the prioritized outcomes favour neither. In this talk we discuss the advantages of GPC to support quantitative MCDA: (1) the number of outcomes is unlimited; (2) the outcomes can be arbitrarily complex; (3) prioritizing outcomes is easier than assigning weights to them; (4)