Analysis Group health outcomes professionals have extensive experience helping clients quantify product value in a dynamic and rapidly changing marketplace.

Drawing on our in-depth knowledge of a range of relevant data sources, we undertake U.S. and international pharmacoconomic and health outcomes research and epidemiologic studies across a wide spectrum of therapeutic areas. Our work frequently results in publication in peer-reviewed journals. Together with prominent scholars from leading universities, we translate state-of-the-art academic theories into compelling results for our clients.

Analysis Group has 18 posters, one workshop presentation, and one issue panel at the 2016 ISPOR conference.

Please visit our team at Booths #36/37
### ISPOR 2016 Analysis Group Issue Panels Session

**MAY 25, ISSUE PANEL SESSION IV**

<table>
<thead>
<tr>
<th>Panel ID</th>
<th>Topic</th>
<th>Panelists</th>
<th>Abstract</th>
</tr>
</thead>
</table>

### ISPOR 2016 Analysis Group Workshop Presentation

**MAY 25, WORKSHOP SESSION V**

<table>
<thead>
<tr>
<th>Number</th>
<th>Topic</th>
<th>Discussion Leaders</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>W29</td>
<td>The Health Economics and Outcomes Research Applications and Valuation of Digital Health Technologies and Machine Learning</td>
<td>Duh MS, Yuen-Reed G, Rose S, Pashko S</td>
<td>Page 4</td>
</tr>
</tbody>
</table>

### ISPOR 2016 Analysis Group Poster Presentations

**MAY 23, POSTER SESSION I**

<table>
<thead>
<tr>
<th>Number</th>
<th>Topic</th>
<th>Authors</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCV40</td>
<td>Real-World Costs of Ischemic Stroke by Discharge Status</td>
<td>Mu F, Hurley D, Betts K, Messali A, Paschoalin M, Wu EQ</td>
<td>Page 6</td>
</tr>
</tbody>
</table>

**MAY 23, POSTER SESSION II**

<table>
<thead>
<tr>
<th>Number</th>
<th>Topic</th>
<th>Authors</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRM166</td>
<td>Measuring Opportunities to Improve Health Outcomes via Individualized Treatment Assignment</td>
<td>Patterson-Lomba O, Signorovitch J</td>
<td>Page 7</td>
</tr>
</tbody>
</table>

**MAY 24, POSTER SESSION III**

<table>
<thead>
<tr>
<th>Number</th>
<th>Topic</th>
<th>Authors</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCN33</td>
<td>Patient Characteristics and Overall Survival (OS) in the Post-Docetaxel Metastatic Castration-Resistant Prostate Cancer (mCRPC) Community Setting</td>
<td>Oh WK, Miao R, Duh MS, Vekeman F, Sung J, Cheng WY, Gauthier-Loiselle M, Fortier J, Dhawan R</td>
<td>Page 8</td>
</tr>
<tr>
<td>Number</td>
<td>Topic</td>
<td>Discussion Leaders</td>
<td>Page</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
<td>---------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>PCN64</td>
<td>Real-World Analysis of Medical Costs and Healthcare Resource Utilization in Elderly Women with HR+/HER2- Metastatic Breast Cancer Receiving Everolimus-Based Therapy or Chemotherapy</td>
<td>Hao Y, Li N, Fang A, Koo V, Peeples M, Kageleiry A</td>
<td>9</td>
</tr>
<tr>
<td>PIH2</td>
<td>Comorbidities and Symptoms among Endometriosis Patients: A Systematic Literature Review</td>
<td>Soliman AM, Yang H, Du EX, Wu EQ, Castelli-Haley J, Winkel C</td>
<td>9</td>
</tr>
<tr>
<td>PIH56</td>
<td>Rates of Subsequent Endometriosis-Related Surgeries Following an Initial Laparoscopy or Hysterectomy: A Longitudinal Analysis of Commercially Insured Endometriosis Patients in the United States</td>
<td>Soliman AM, Yang H, Du EX, Wu EQ, Castelli-Haley J, Winkel C</td>
<td>11</td>
</tr>
<tr>
<td>PMH82</td>
<td>Treatment Patterns in Medicaid Beneficiaries with Schizophrenia Reaching Stabilized Maintenance with Once-Monthly Paliperdone Palmitate Therapy</td>
<td>Pilon D, Muser E, Emond B, Xiao Y, Amos T, Lefebvre P, Benson C</td>
<td>11</td>
</tr>
<tr>
<td>PDB7</td>
<td>Real-World Evaluation of Weight Loss in Patients with Type 2 Diabetes Mellitus Treated with Canagliflozin – An Electronic Health Record-Based Study</td>
<td>Lefebvre P, Chow W, Pilon D, Emond B, Lafeuille M, Pfeifer M, Rupnow MF, Duh MS</td>
<td>12</td>
</tr>
<tr>
<td>PSY11</td>
<td>Maintenance of Weight Loss or Stable Weight in Subjects with Obesity: A Retrospective Longitudinal Analysis of Electronic Medical Record Data</td>
<td>DerSarkissian M, Bhak R, Huang J, Buchs S, Vekeman F, Ganguly R, Duh MS</td>
<td>12</td>
</tr>
<tr>
<td>PSY24</td>
<td>Economic Model to Examine the Cost Benefit Associated with Resolution or Improvement of Carcinoid Syndrome Symptoms Following Treatment with Above-Standard Dose of Octreotide-LAR in Patients with Neuroendocrine Tumors Based on Data from a Retrospective Chart Review Study at Three Large Tertiary Oncology Centers in the United States</td>
<td>Huynh L, Totev T, Vekeman F, Neary M, Duh MS, Kulke M, Benson A</td>
<td>13</td>
</tr>
</tbody>
</table>
ISSUE PANEL SESSION IP16
ARE ALTERNATIVE FINANCING APPROACHES NEEDED FOR INNOVATIVE THERAPIES?

Issue: Biopharmaceutical innovation has the potential to bring significant value to payers, patients, and society. However, despite being cost-effective, these therapies may place financial burden on payers due to switching of patients between payers and a time lag between the most significant costs and benefits. The recent media coverage on hepatitis C highlights this point. Are the challenges presented by hepatitis C unique or is there a need for a broader policy approach on alternative financing such as long-term financing by a third party? Dr. Kirson will moderate and discuss the reimbursement challenges for transformative therapies in the face of patient switching across payer types over time, and will summarize recent research on the distribution of costs and benefits among payers for several distinct disease archetypes – including hepatitis C, beta thalassemia, Alzheimer’s disease, familial hypercholesterolemia, and patients with prior cardiovascular disease. Jonathan Blum will discuss whether alternative financing approaches are needed from the commercial insurance perspective, and Jeff Myers will examine the issue from the Medicaid perspective. Michael Ciarametaro will provide the industry perspective.

Overview: Financial risk in the U.S. healthcare system is divided among three main payer types: commercial, Medicare, and Medicaid. The result is that no single payer has clinical and financial responsibility for the entirety of a patient’s life. At the same time, the chronic disease burden in the U.S. is growing, as approximately 50% of the U.S. population over 18 has one or more chronic conditions. For many chronic conditions, the most significant outcomes occur well after disease onset. However, treatment often begins closer to the disease onset. The separation between treatment start and key outcomes creates the potential for one payer to bear treatment costs, while a different payer benefits from the savings. The division of benefits and costs contributes to affordability concerns. For example, would the affordability of hepatitis C treatments be a concern if the majority of benefits occurred within one or two years of treatment?

WORKSHOP W29
THE HEALTH ECONOMICS AND OUTCOMES RESEARCH APPLICATIONS AND VALUATION OF DIGITAL HEALTH TECHNOLOGIES AND MACHINE LEARNING

Purpose: The value of digital health technologies and machine learning (ML) methods are cutting-edge issues in health economics and outcomes research (HEOR). Digital health technologies use dynamic communication and information technology to improve patient health. ML explores pattern recognition and computational learning to construct algorithms that learn from data for classification and prediction purposes. Compared to traditional statistical methods, ML techniques are advantageous in high-dimensional “big data” that digital health technologies can amass. While the use of digital health technologies seems promising, issues of their economic valuation, data ownership, end-user values, and their ability to be linked to existing data have not yet been tackled.

Description: The workshop will consist of five topics. First, background on traditional statistical methods vs. ML methods will be introduced. Second, ML algorithms for predicting HEOR outcomes will be explained in easy-to-understand terms. Their comparisons to traditional methods in analyzing HEOR data where high-dimensionality, complex interactive effects, and large sample sizes are a concern will be highlighted. Third, the added value of ML to the end user due to its increased speed, accuracy, and ability to provide incremental new insights will be discussed. The challenges surrounding security, accessibility, and analysis of digital data (e.g., patient-managed device data connected to cloud-based platforms) will be presented. Fourth, market access issues of digital health technologies, such as the net economic benefit, reimbursement, and value proposition to payers, will be explored. Finally, case examples of ML and digital health solutions that enable personalized insights generation and delivery will be presented. Audience members will be invited to participate in case discussions.
**INCOME GROWTH TRAJECTORY FOR PARENTS OF CHILDREN WITH DOWN SYNDROME IN THE UNITED STATES**

**Objectives:** Expectant parents who receive a prenatal diagnosis of Down syndrome (DS) may be inclined to consider their future income trajectories when making pregnancy decisions. Given limited evidence on the impact of having a child with DS on parents' income growth, this study aimed to determine whether the rate of income growth among parents of children with DS differs from that among parents of children without chromosomal conditions.

**Methods:** This retrospective observational study included individuals identified as the parent of a child with a diagnosis of DS (ICD-9-CM code 758.0x) enrolled as employee subscribers in their health plans who had income data for at least two consecutive years while their child was under 18 years old from the OptumHealth Reporting and Insights administrative claims database. These parents were matched to control parents of children without chromosomal conditions using propensity scores. The difference in mean log annual income between parents of children with DS and their matched controls was calculated for each period of two consecutive years and compared using Wilcoxon signed-rank tests.

**Results:** After matching, parents of children with DS were similar to their matched controls on baseline covariates (N=13,492 per matched cohort). Parents of children with DS had a lower mean annual income growth rate compared to their matched controls (3.9% vs. 4.2%; p<0.001), with the difference significant among fathers (-0.32%; N=6,908 per matched cohort; p<0.001) rather than mothers (-0.35%; N=6,584 per matched cohort; p=0.179).

**Conclusions:** Parents of children with DS experience lower mean annual income growth compared to parents of children without chromosomal conditions. Based on the 2013 U.S. median income of $50,033 and $39,157 among yearly full-time working men and women, respectively, this difference in income growth translates into $160 reductions in annual income growth for fathers and $137 reductions for mothers of children with DS.

**HEALTHCARE COSTS AMONG PATIENTS DIAGNOSED WITH DEEP VEIN THROMBOSIS IN THE OUTPATIENT SETTING AND TREATED WITH RIVAROXABAN VERSUS LOW-MOLECULAR-WEIGHT HEPARIN AND WARFARIN**

**Objectives:** The anticoagulant rivaroxaban has advantages such as simplified care compared with low-molecular-weight heparin (LMWH) and warfarin that may be easily managed in outpatient (OP) settings and lead to lower healthcare costs. The objective of this study was to compare costs among deep vein thrombosis (DVT) patients treated with rivaroxaban or LMWH/warfarin in the outpatient setting.

**Methods:** A retrospective propensity score matching analysis was conducted using the Truven Health Analytic MarketScan Claims database from 1/2011-12/2013. Adult patients with a primary diagnosis of DVT during an OP/emergency room (ER) visit after November 2012, and who initiated treatment on the same day with rivaroxaban or LMWH/warfarin (index date) were identified. All-cause and VTE-related healthcare costs were evaluated over 1, 2, 3, and 4 weeks after their DVT diagnosis. Mean healthcare costs were evaluated using Lin's method and compared using non-parametric bootstrap procedure methods.

**Results:** All of the 512 rivaroxaban patients were well-matched with LMWH/warfarin patients. Mean all-cause total cost was significantly lower for rivaroxaban users compared to LMWH/warfarin users over 1 week ($2,332 vs. $3,428; P<.001) and over 2 weeks ($3,108 vs. $4,524; P<.001), and numerically lower over 3 weeks ($4,551 vs. $5,468; P=0.167) and 4 weeks ($5,140 vs. $6,394; P=0.102); all-cause hospitalization costs followed similar trends. Pharmacy costs were statistically lower by $432, $461, $418, and $366 within 1, 2, 3, and 4 weeks for patients in the rivaroxaban vs. the LMWH/warfarin cohort (all P<.001). ER and OP visit costs were similar between cohorts within the first 4 weeks (all P>0.05). VTE-related costs followed similar trends as all-cause costs over the first 4 weeks.

**Conclusions:** Patients diagnosed with DVT during an OP/ER visit and treated with rivaroxaban had lower total healthcare costs, hospitalizations costs, and pharmacy costs during the first weeks, mostly during the first week, compared to matched LMWH/warfarin users.
PCV40
REAL-WORLD COSTS OF ISCHEMIC STROKE BY DISCHARGE STATUS

Objectives: The objective of this study was to estimate the acute healthcare costs of ischemic stroke during hospitalization and the quarterly all-cause healthcare costs for the first year after discharge by discharge status.

Methods: Adult patients with a hospitalization with a diagnosis of ischemic stroke (ICD-9-CM: 434.xx, 436.xx) between January 1, 2006, and March 31, 2015, were identified from a large U.S. commercial claims database. Patients were classified into three cohorts based on their discharge status from the first stroke hospitalization. Specifically, patients were categorized as discharged with disability, discharged without disability, or dead at discharge. Total costs included third-party medical (inpatient, outpatient, emergency room, and other) and pharmacy costs, and were adjusted to 2015 USD using the medical services consumer price index.

Results: A total of 45,695 patients discharged with disability, 153,778 patients discharged without disability, and 7,919 patients dead at discharge were included in this analysis. The overall average age was 59.7 years, and 52.3% were male. Mean total costs during the initial hospitalization were $67,861 for patients discharged with disability, $19,267 for patients discharged without disability, and $63,605 for patients dead at discharge. The total costs for patients discharged with disability were $19,116 during days 0-90 after discharge, $10,236 during days 91-180, $8,241 during days 181-270, and $6,875 during days 271-360. The total costs for patients discharged without disability were $19,116 during days 0-90 after discharge, $10,236 during days 91-180, $8,241 during days 181-270, and $6,875 during days 271-360. Total costs among patients discharged with disability were 3.5 times the costs among patients discharged without disability during the initial hospitalization and 1.3-1.7 times over quarters of the year after discharge.

Conclusions: The results demonstrated the high burden of ischemic stroke, especially among patients discharged with disability, with the highest costs incurred during the inpatient stays.

PND6
CAN INDIRECT COMPARISON METHODS MITIGATE EVOLVING TRIAL POPULATIONS IN ADJUNCTIVE ANTIEPILEPTIC DRUG (AED) TRIALS? A PROPENSITY-SCORE MATCHED INDIRECT COMPARISON OF BRIVARACETAM AND LEVETIRACETAM

Objectives: Baseline characteristics of patients with focal seizures recruited into adjunctive AED trials have evolved over time, becoming more refractory and severe. Concurrently, placebo responses have increased. This analysis used propensity-score matched patient-level data in an indirect comparison of brivaracetam and levetiracetam to account for potential sources of heterogeneity.

Methods: Patient-level data from randomized placebo controlled trials of brivaracetam (recruited 2007-2014) and levetiracetam (recruited 1993-1998) were pooled. Consistent inclusion/exclusion criteria were applied. Potentially confounding baseline characteristics were matched using propensity score weighting, and outcomes were defined consistently, thus reducing the potential for bias. Placebo response was used to benchmark matching success.

Results: After applying inclusion/exclusion criteria, 707 and 473 active drug and 399 and 253 placebo patients comprised the brivaracetam and levetiracetam groups respectively. Before weighting, there were significant differences between groups for demographics, seizure type and frequency, epilepsy history, number of concomitant AEDs, comorbidities, and etiology. Median percent seizure frequency reduction in the brivaracetam-placebo arm was 21.7%, and 3.9% in the levetiracetam-placebo arm. After weighting, the patient groups were balanced on all observed baseline characteristics; however, median seizure frequency reduction was still 15.0% in the brivaracetam-placebo arm and 6.0% in the levetiracetam-placebo arm.

Conclusions: The propensity-score matching did not successfully adjust for placebo response differences, though there was a minor improvement. Since patients were matched on observed potential confounders, this would indicate the presence of unobserved confounding factors associated with placebo response. As such, adjusted or unadjusted indirect comparisons between
brivaracetam and levetiracetam using available trials remain problematic. Previous research has indeed found that variation in placebo response over time in AED trials is not fully explainable by observed baseline characteristics. Future trials, and subsequent indirect comparisons, should better account for the heterogeneous nature of epilepsy and the need for individualized care, to have greater value in healthcare decision making.

PND51
A LIFE-COURSE ASSESSMENT OF MEDICATION USE AND MEDICAL COSTS OF LENNOX–GASTAUT SYNDROME (LGS)

Objectives: LGS is a childhood-onset epilepsy that can persist into adulthood. Its infrequent diagnosis in adults is often linked to suboptimal management. This study quantified medication use and medical costs of LGS patients over the life-course.

Methods: Health insurance claims for epilepsy patients (≥2 claims for ICD-9 345.xx) of all ages were obtained from six state Medicaid programs. LGS patients were identified using a claims-based classifier with random forest methodology and categorized into age cohorts based on observation periods. Medication use and medical costs were assessed and plotted against time-series panels.

Results: The proportion of epilepsy patients with LGS peaked at 8.4% around age 10 years and declined linearly thereafter. Regardless of age, the majority of LGS patients received ≥1 antiepileptic drug (AED) (range: 62.6%–82.3%), although the use of LGS-specific AEDs (clobazam and rufinamide) was uncommon. Their greatest use peaked at ages 0–5 years (maximum rate: 17.5% [clobazam], 7.4% [rufinamide]), and declined to <1.0% at 60. In contrast, the use of antipsychotic and SSRI medication increased sharply during childhood (0 to 18 years old, antipsychotics: 0.0% to 18.9%; SSRI: 0.0% to 11.2%), to reach maximum rates during adulthood (antipsychotics: 24.6%, SSRI: 21.5%). Mean total medical cost was consistent over time ($28,830–$44,435 per patient per year [PPPY]), although its component differed across life stages. Home-based care was the main cost driver among children ages 0-18 years, totaling $19,723 to $31,349 PPPY, but decreased sharply during adulthood to $8,214 PPPY at age 60. Long-term care (LTC) costs ranged between $1,742 to $5,999 PPPY in children, increasing to $15,999 PPPY at age 60.

Conclusions: Despite the availability of LGS-specific AEDs, LGS is often inappropriately treated, leading to long-term disease burden and the need for LTC. Increased clinical attention to LGS, including use of appropriate LGS-specific treatment early on, is warranted.

PRM166
MEASURING OPPORTUNITIES TO IMPROVE HEALTH OUTCOMES VIA INDIVIDUALIZED TREATMENT ASSIGNMENT

Background: Individualized use of available treatments (i.e., matching patients to treatments based on biomarkers or other characteristics) holds great promise for improving health outcomes and cost-effectiveness. However, significant resources are required to identify opportunities for such improvements and to change practice when appropriate. When prioritizing these investments, it is important to ask “what is the maximum benefit that could be achieved via individualization?” We developed methods to estimate this maximum possible benefit from the results of standard (non-individualized) randomized trials.

Method: Previous methodological work has allowed researchers to estimate the efficiency frontier for individualized treatment assignment – i.e., the best population health outcomes that could be achieved with treatment assignments based on available biomarkers. We derived estimators for an upper bound on this efficiency frontier. This upper bound describes the maximum benefit that could be achieved with treatment assignments based on an optimal yet unobserved biomarker. Methods are illustrated with simulated and real clinical trial data examples.

Results: Upper bounds were found to depend on the distribution of outcomes in each treatment arm and on their associations with available baseline biomarkers. In general, the stronger the association between outcomes and baseline biomarkers, the tighter the upper bound on the value of individualized care. Examples are given in which tightened bounds are over 40% lower than bounds that do not incorporate baseline characteristics. Examples are also given in which upper bounds suggest substantial room for improvement and, separately, in which available
biomarkers nearly achieve the upper bound, indicating limited opportunity for further improvement.

**Conclusions:** The results of existing randomized clinical trials can be used to estimate the maximum possible benefit achievable by individualizing treatment assignment. Such findings can help benchmark the performance of available biomarkers and prioritize investment in new biomarker discovery.

**PCN17**

**REAL-WORLD TREATMENT PATTERNS OF EVEROLIMUS PLUS ENDOCRINE THERAPY IN PATIENTS WITH HORMONE RECEPTOR-POSITIVE, HUMAN EPIDERMAL GROWTH FACTOR RECEPTOR-NEGATIVE ADVANCED BREAST CANCER BY LINE OF THERAPY: A GLOBAL CHART REVIEW**

**Background:** EVE+ exemestane (EXE) is efficacious among postmenopausal women with HR+ HER2− aBC after failure of a non-steroidal aromatase inhibitor (NSAI). We aimed to describe real-world treatment patterns of EVE-based therapy in this population.

**Methods:** This retrospective chart review included postmenopausal patients with HR+/HER2− aBC previously treated with an NSAI who later received EVE+ET, ET alone, or chemotherapy (the index treatment) from 17 sites in 6 countries (Canada, the Netherlands, France, Italy, Russia, and Argentina). This planned subset analysis describes treatment patterns with additional stratification by dosing (<10 mg/day [low dose] vs. 10mg/day [regular dose]) for all patients receiving EVE as the index treatment. Time on treatment (TOT) was estimated with Kaplan-Meier analysis.

**Results:** Index treatment in the EVE+ET group (n=119) was first or second-line in 77 patients (65%) and third or fourth-line in 42 patients (35%); 98% of patients received EVE+EXE. Physicians most frequently cited treatment efficacy as the primary reason for prescribing EVE (75%). The initial EVE dose was low for 13 patients (11%; all 5 mg/day), regular for 103 patients (87%), and unknown for the remaining patients. Dose interruption (31% vs. 29%) and median TOT (7.7 vs. 9.1 months) were similar for low-dose vs. regular-dose EVE. Overall, 48 patients (40%) had dose reductions/interruptions due to adverse events (AEs), but only 15 (13%) discontinued EVE due to AEs. The most common AE leading to dose reduction/interruption in the low-dose vs. regular-dose groups were pneumonitis (50%) and stomatitis (43%), respectively. AE-related discontinuations occurred in 13% of all patients. 68/85 patients with prior aBC treatment received ET. 50/72 patients with subsequent treatment received chemotherapy.

**Conclusions:** Most patients received regular-dose EVE, as labeled. Low-dose vs. regular-dose EVE had similar treatment patterns; tolerability-related discontinuation was not prevalent. EVE+ET could be an option for patients seeking a more efficacious treatment with manageable tolerability.

**PCN33**

**PATIENT CHARACTERISTICS AND OVERALL SURVIVAL (OS) IN THE POST-DOCETAXEL METASTATIC CASTRATION-RESISTANT PROSTATE CANCER (mCRPC) COMMUNITY SETTING**

**Objectives:** The mCRPC treatment landscape has evolved significantly with the approval of new therapies. This observational study assessed treatment sequences, patient characteristics, and OS in post-docetaxel mCRPC patients.

**Methods:** mCRPC patients (N=629) receiving docetaxel, cabazitaxel, abiraterone, or enzalutamide, following first-line docetaxel, between May 2011 and October 2014 were identified using electronic medical records obtained from U.S. community oncology practices. OS, evaluated from second-line therapy initiation, was assessed using Cox regressions adjusting for site of metastasis, prostate-specific antigen (PSA), hemoglobin, alkaline phosphatase (ALP), albumin levels, and a year of second-line therapy initiation.

**Results:** After first-line docetaxel, 123 patients (20%) received second-line cabazitaxel (median age: 72 years), and 506 (80%) received second-line androgen receptor-targeted therapy (ART) (abiraterone: 330, enzalutamide: 173, combination: 3; median age: 73 years). Subsequently, 54 and 141 patients received additional treatment lines following cabazitaxel or ART, respectively. Although patients receiving second-line cabazitaxel vs. ART had similar disease prognosis profiles at first-line therapy initiation, at second-line therapy initiation they had higher mean PSA (387 vs. 234 ng/mL) and ALP (182 vs. 167
lower mean hemoglobin (10.8 vs. 11.5 g/dL), and more presented with an intermediate or high Halabi risk score (62% vs. 48%; JCO 2014;32;671–7); all p<0.05. Although not statistically significant, a trend suggested longer OS for patients receiving second-line cabazitaxel (hazard ratio [HR] for cabazitaxel vs. ART: 0.79, 95% CI: 0.59–1.06). Among selected patient subgroups, cabazitaxel was associated with significantly longer OS: Halabi high-risk (HR 0.48, 0.24–0.93, p=0.0296); albumin < lower limit of normal (HR 0.43, 0.23–0.80, p=0.0077); hemoglobin <11 g/dL (HR 0.60, 0.40–0.90, p=0.0135).

Conclusions: Most patients (80%) received ART post-docetaxel. Although patients receiving cabazitaxel post-docetaxel had more poor-prognosis characteristics, for patients with Halabi high-risk scores or low albumin or hemoglobin, cabazitaxel may be associated with longer OS compared with ART. Funding: Sanofi.

PCN64
REAL-WORLD ANALYSIS OF MEDICAL COSTS AND HEALTHCARE RESOURCE UTILIZATION IN ELDERLY WOMEN WITH HR+/HER2- METASTATIC BREAST CANCER RECEIVING EVEROLIMUS-BASED THERAPY OR CHEMOTHERAPY

Objectives: To analyze medical costs and healthcare resource utilization (HRU) associated with everolimus-based therapy or chemotherapy among elderly women with hormone-receptor-positive, human-epidermal-growth-factor-receptor-2-negative (HR+/HER2-) metastatic breast cancer (mBC).

Methods: Elderly women (≥65 years) with HR+/HER2-mBC who failed a non-steroidal aromatase inhibitor and subsequently began a new line of treatment with everolimus-based therapy or chemotherapy for mBC (index therapy) were identified from two large commercial claims databases spanning from 1/1/2002 to 6/30/2014. All-cause, BC-, and adverse event (AE)-related medical costs (2014 USD), and all-cause and AE-related HRU per patient per month (PPPM), were compared between patients treated with everolimus and chemotherapy across their first four lines of therapy for mBC. Adjusted costs and HRU differences were estimated by pooling all lines and using multivariable models adjusted for differences in patient characteristics.

Results: In total, 925 elderly patients (mean age ~73 years) with HR+/HER2- mBC met the inclusion criteria; 230 received everolimus (240 lines) and 737 received chemotherapy (939 lines). Compared with chemotherapy, everolimus was associated with significantly lower total all-cause PPPM medical services costs (adjusted mean difference: $4,007), driven by lower inpatient ($1,994) and outpatient ($1,402) costs; lower BC-related medical services costs ($3,129), driven by both BC-related inpatient ($1,883) and outpatient costs ($913); and lower AE-related medical services costs ($1,873; all p<0.01). Additionally, compared to patients treated with chemotherapy, patients treated with everolimus had fewer all-cause outpatient visits (adjusted IRR=0.69), BC-related outpatient visits (0.66), other medical service visits (0.65), and AE-related HRU (0.59), which was driven by significantly fewer AE-related outpatient visits (0.56; all p<0.01).

Conclusions: This retrospective claims database analysis of elderly women with HR+/HER2- mBC in the United States showed that everolimus-based therapy was associated with significantly lower all-cause, BC-related, and AE-related medical services costs and less use of healthcare resources compared with chemotherapy.

PIH2
COMORBIDITIES AND SYMPTOMS AMONG ENDOMETRIOSIS PATIENTS: A SYSTEMATIC LITERATURE REVIEW

Objectives: Endometriosis patients could experience a myriad of comorbidities. This study aimed to systematically review comorbidities and symptoms reported by endometriosis patients in the medical literature.

Methods: MEDLINE and EMBASE databases were searched for articles reporting comorbidities and/or symptoms among endometriosis patients, published in English between 2000 and 2013. The following search terms were used in the search process: “endometriosis, or endometrioses, or endometrioma$ ($ for truncation), or endometrial lesion$” and “comorbid$ or risk factor$ or multimorbid$”.

Results: Thirty-nine articles met study criteria and were reviewed. Study populations included women with clinically or surgically diagnosed endometriosis, women
undergoing laparoscopy for endometriosis, and women self-reporting endometriosis. Twenty-two of the 39 studies included control groups. Higher rates of depression/anxiety disorders (6.5%-51.4%), migraine (4.7%-78.8%), chronic fatigue (0.3%-6%), and digestive diseases like irritable bowel syndrome, ulcerative colitis, and dyschezia were reported among endometriosis patients. Endometriosis patients experienced higher rates of infectious diseases, pelvic inflammation disease, multiple sclerosis, lupus, and fibromyalgia compared to controls as well. Endometriosis patients also reported higher rates of ovarian, breast, endometrium, and cervix cancers but differences between endometriosis and controls were not significant in all studies. Rates of uterine fibroids were 16.1% to 50.7% but results were mixed when comparing those rates between endometriosis patients and controls. Thirteen studies reported fertility or pregnancy-related comorbidities. Infertility rates varied from 1.3% to 63.6%; most studies observed higher infertility rates in women with endometriosis than in controls. Rates of pre-eclampsia, cesarean section, induced and spontaneous preterm birth, and spontaneous abortion were also higher among women with endometriosis. Pelvic, abdominal, ovarian, and lumbar pain were among the most commonly reported symptoms among endometriosis patients.

Conclusions: Endometriosis patients reported higher frequency of gynecologic and non-gynecologic comorbidities and symptoms. Economic burden of comorbidities and mechanisms that link them to endometriosis remain to be examined.

PIH3
A SYSTEMATIC LITERATURE REVIEW OF COMORBIDITIES AND SYMPTOMS AMONG UTERINE FIBROIDS PATIENTS BETWEEN 2000 AND 2013

Objectives: Uterine fibroids (UF) is a chronic gynaecological disorder that could be associated with substantial comorbidity burden. This systematic review examined the existing literature on comorbidities and symptoms among UF patients.

Methods: MEDLINE and EMBASE were queried for articles published in English between 2000 and 2013 using the following key words: “uterine fibroid/fibroids or leiomyoma/leiomyomas or leiomyomata” and “comorbidity/comorbidities, comorbid, risk factor, risk, multimorbidity, multimorbidities”. Studies where the population was limited to uterine fibroids patients with specific comorbidities were excluded. Review articles were reviewed to capture studies that did not appear in initial searches.

Results: A total of 37 articles were reviewed. UF populations included women diagnosed with UF, symptomatic UF patients, UF patients that had been undergoing surgery, hospitalized patients with a UF diagnosis, and pregnant women with UF whereas control populations included women with normal uterine morphology, women undergoing surgeries for benign conditions other than UF, pregnant women without UF, or women with other conditions like adenomyosis or endometriosis. Most commonly reported gynecological conditions among UF patients were abdominal pain/discomfort (15.9%–24.2%), pelvic pain (11.2%–22.5%), painful intercourse (8%), menstrual cramps/painful menses (29%–37.3%), and pelvic pressure (2.2%–27%). Pregnancy-related complications were more frequent among UF patients compared to controls. UF patients also reported higher rates of non-gynecological conditions like anemia (1.26–22.97%) and constipation or gas (0.3%-2.71%) compared to controls, but rates were not always significantly different. Ethnicity also had a role in comorbidity burden. Two studies found that African-American patients had a higher rate of UF-related comorbidities than white women and were more likely to have higher rates of infertility, abdominal and pelvic pain, menorrhagia, fatigue, and anemia. Most common UF symptoms reported were abnormal bleedings related to menstruation.

Conclusions: UF is associated with significant symptomatic and comorbidity burden. Future population-based studies are needed to validate these findings.
**PIH56**

**RATES OF SUBSEQUENT ENDOMETRIOSIS-RELATED SURGERIES FOLLOWING AN INITIAL LAPAROSCOPY OR Hysterectomy: A LONGITUDINAL ANALYSIS OF COMMERCIAL INSURED ENDOMETRIOSIS PATIENTS IN THE UNITED STATES**

**Objectives:** To quantify rates of subsequent endometriosis-related surgeries following an initial laparoscopy or hysterectomy among endometriosis patients.

**Methods:** This retrospective cohort analysis used MarketScan Commercial Claims and Encounters database between 2004 and 2013 to identify endometriosis patients (ICD-9-CM: 617.xx) aged 18-49 who had undergone laparoscopy (cohort 1) or hysterectomy (cohort 2) and had 12-month continuous health plan enrollment before and after index date (designated as first surgery date with an endometriosis code recorded on the same date). Rates of subsequent surgeries, defined as the rate of (i) having a different endometriosis-related procedure (laparoscopy, oophorectomy, laparotomy, or salpingectomy) any time after an initial hysterectomy or (ii) having another endometriosis-related laparoscopy 14 days after an initial laparoscopy or (iii) having a different endometriosis-related procedure (e.g., hysterectomy, oophorectomy, laparotomy, or salpingectomy) any time after an initial laparoscopy, were examined using Kaplan-Meier curves. Multivariate cox regression models that controlled for age, index year, geographic region, baseline comorbidities, and treatments were used to compare adjusted risks of subsequent surgery between study cohorts.

**Results:** The final sample included 24,915 endometriosis patients who had undergone hysterectomy and 37,308 who had undergone laparoscopy. At 12, 24, and 36 months post-index date, the estimated rates of receiving any type of surgeries were 9.4%, 15.8%, and 20.6% in the laparoscopy cohort compared to 2.6%, 3.3%, and 3.9% in the hysterectomy cohort, respectively. Multivariate cox regression showed that the hazard ratio of undergoing subsequent surgery was significantly lower in the hysterectomy cohort compared to the laparoscopy cohort (HR: 0.157, 95% CI: 0.146-0.169; p<0.0001).

**Conclusions:** Our analysis showed that some endometriosis patients undergo a subsequent endometriosis-related surgery following an initial surgery, which could occur in the 12 months following the initial surgery. Women who have undergone a laparoscopy were more likely to receive additional surgical procedures.

**PMH82**

**TREATMENT PATTERNS IN MEDICAID BENEFICIARIES WITH SCHIZOPHRENIA REACHING STABILIZED MAINTENANCE WITH ONCE-MONTHLY PALIPERIDONE PALMITATE THERAPY**

**Objectives:** With the FDA approval (05/19/2015) of a once-every-3-month paliperidone palmitate formulation (PP3M), this study aimed to describe treatment patterns among once-monthly paliperidone palmitate (PP1M)-treated patients with schizophrenia reaching stabilized maintenance therapy that may be candidates for PP3M.

**Methods:** Medicaid data (07/2008-03/2014) from FL, IA, KS, MO, MS, and NJ were used to identify adult beneficiaries initiated on PP1M with schizophrenia. Reaching stabilized maintenance therapy was defined as having ≥3 consecutive PP1M claims with the same dose strength beyond the first two initiation doses and ≤60 days between claims. Treatment patterns from the first (index date) to the last available PP1M claim were assessed using descriptive statistics and compared using the Wilcoxon test.

**Results:** Among 4,482 PP1M users that met study inclusion criteria, 2,012 (45%) reached stabilized maintenance. Of those reaching stabilized maintenance, 868 (43%) and 510 (25%) had ≥8 and ≥12 consecutive PP1M claims, respectively, with the same dose strength beyond the first two initiation doses. The most frequently observed first and second claim dose combination for PP1M patients reaching stabilized maintenance was 234 mg followed by 156 mg (28%), consistent with the FDA-approved initiation regimen. The most common stabilized maintenance dose was 156 mg (40%), followed by 117 mg (33%) and 234 mg (24%). Mean time from PP1M initiation to reaching stabilized maintenance was 118 days (standard deviation [SD]=28, median=114), and mean duration on stabilized maintenance therapy was 282 days (SD=246, median=191). Patients receiving the initiation regimen of 234 mg followed by 156 mg had a shorter mean time to reach stabilized maintenance (105 days [SD=30, median=98] vs. 123 days [SD=25, median=118] for all other dose combinations, P<0.001).
Conclusions: Forty-five percent of schizophrenia patients initiated on PP1M reached stabilized maintenance, and time to reach stabilized maintenance therapy was faster when the FDA-approved initiation regimen was followed.

PDB7
REAL-WORLD EVALUATION OF WEIGHT LOSS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS TREATED WITH CANAGLIFLOZIN – AN ELECTRONIC HEALTH RECORD-BASED STUDY

Objectives: Weight management remains a challenging goal for most patients with T2DM. However, CANA has been shown to improve glycemic control and body weight (BW) in T2DM patients. This study leveraged EHR data to evaluate BW over time among patients with T2DM receiving CANA in a real-world setting.

Methods: Adult patients with ≥1 T2DM diagnosis and ≥12 months of clinical activity (baseline) before first CANA prescription (index) were identified in the Cegedim Strategic Data U.S. EHR dataset. Paired t-tests were used to compare baseline BW to BW at 3 and 12 months post-index. Proportions of patients with a weight loss ≥5% from baseline were reported overall and in patients with baseline BMI ≥30 kg/m².

Results: A total of 16,163 CANA users were identified (35% CANA 300 mg users, 48% female, mean age: 59 years, 76% white, mean Charlson Comorbidity Index: 1.4, mean Diabetes Complications Severity Index: 0.7). At baseline, 90% of patients used ≥1 antihyperglycemic agent and 35% used insulin. Mean exposure to CANA was 155.6 days. Among patients evaluated at 3 months (N=6,811; mean baseline BW=102.9 kg), BW decreased from baseline by 1.8 kg (P<0.001), and 13.3% of patients had a weight loss ≥5%. At 12 months (N=1,288; mean baseline BW=110.3 kg), BW decreased from baseline by 2.6 kg (P<0.001), and 25.8% of patients had a weight loss ≥5%. Among patients with a baseline BMI ≥30 kg/m², at 3 months (N=5,155; mean baseline BW=110.3 kg) BW decreased by 2.1 kg (P<0.001), and 13.6% of patients had a weight loss ≥5%; at 12 months (N=995; mean baseline BW=110.8 kg), BW decreased by 3.0 kg (P<0.001), and 27.5% of patients had a weight loss ≥5%.

Conclusions: Patients with T2DM treated with CANA in a real-world setting experienced statistically significant weight loss over time, in both the overall population and in patients with BMI ≥30 kg/m².

PSY11
MAINTENANCE OF WEIGHT LOSS OR STABLE WEIGHT IN SUBJECTS WITH OBESITY: A RETROSPECTIVE LONGITUDINAL ANALYSIS OF ELECTRONIC MEDICAL RECORD DATA

Objectives: To describe patterns of weight change in subjects with obesity after an initial period of weight loss or maintenance.

Methods: A retrospective longitudinal study was conducted using electronic medical records data from the General Electric Centricity database. Subjects age ≥18 years old, with BMI ≥30 kg/m² (the first defining the index BMI), without comorbidities related to unintentional weight loss, and with ≥4 BMI measurements/year for ≥5 years were included. Subjects who had stable weight (within <5% of index BMI) or weight loss (modest: ≥5 to <10% of index BMI; moderate: ≥10 to <15% of index BMI; high: ≥15% of index BMI) in the six months after the index date were evaluated for weight change over the next two years (observation period).

Results: Of the 177,743 subjects included in the analysis, 85.1% of subjects had stable weight at the start of the observation period, 9.3% had modest weight loss, 2.3% had moderate weight loss, and 3.3% had high weight loss. The proportion of subjects who maintained their weight during the first three months of the observation period significantly decreased by the end of the two-year observation period in all weight change groups: from 93.6% to 39.7% in the stable weight, 84.6% to 23.1% in modest weight loss, 72.8% to 14.1% in moderate weight loss, and 65.3% to 19.4% in high weight loss groups (all p<0.05). Most subjects experienced weight cycling (did not continue to lose, gain, or maintain weight throughout the observation period relative to its start), with significantly more weight cycling in the modest and moderate weight loss groups (71.5% and 74.1%, respectively; p<0.001) compared to the stable weight group (58.3%) but not the high weight loss group (58.3%; p=0.917).

Conclusions: Few subjects with obesity maintained their initial weight loss, with most subjects experiencing weight cycling over a two-year period.
**PSY24**

**ECONOMIC MODEL TO EXAMINE THE COST BENEFIT ASSOCIATED WITH RESOLUTION OR IMPROVEMENT OF CARCINOID SYNDROME SYMPTOMS FOLLOWING TREATMENT WITH ABOVE-STANDARD DOSE OF OCTREOTIDE-LAR IN PATIENTS WITH NEUROENDOCRINE TUMORS BASED ON DATA FROM A RETROSPECTIVE CHART REVIEW STUDY AT THREE LARGE TERTIARY ONCOLOGY CENTERS IN THE UNITED STATES**

**Objectives:** A retrospective chart review study was performed (NET 3-Center) that included 239 neuroendocrine tumor (NET) patients who received above-standard dose of octreotide-LAR for carcinoid/hormonal syndrome. Administration of 40mg/4 weeks (51%), 30mg/3 weeks (18%), and 60mg/4 weeks (18%) were the most common above-standard doses. Patients who had reported carcinoid syndrome symptoms (CSS; diarrhea/flushing) experienced resolution/improvement (diarrhea: 79%, flushing: 81%) ≤1 year. A cost model was developed to examine economic savings associated with CSS resolution/improvement observed in NET 3-Center study and assess model robustness.

**Methods:** CSS and treatment data came from NET 3-Center. Resource utilization and cost for another sample of patients came from claims database analysis. For NET 3-Center patients, the period after initiation of octreotide-LAR (index date) was divided into days with/without CSS; costs were calculated for each period. Total healthcare costs included inpatient, outpatient, emergency department, and pharmacy services. Annual total healthcare costs post-index date were compared for patients with CSS resolution/improvement vs. those without. Sensitivity analysis included indirect cost for patients <65 years.

**Results:** 136 patients had diarrhea/flushing ≤3 months prior to index date; 108 (79%) patients experienced CSS symptom resolution/improvement ≤12 months of index date. Patients with CSS resolution/improvement had lower mean annual total healthcare costs/patient by $18,740 (P=0.01) than patients with diarrhea. Including indirect cost for patients <65 years old brought additional cost savings of $273/patient (mean difference: $15,039; P=0.033) among patients with diarrhea/flushing and $358/patient (mean difference: $19,098; P=0.012) among patients with diarrhea.

**Conclusions:** The cost model was robust and showed statistically significant mean annual total healthcare cost savings in patients having CSS resolution/improvement. Future studies using alternative data sources for costs are needed to further validate the model’s assumptions.

---

**PSY36**

**PROJECTING THE COST, UTILIZATION, AND PATIENT CARE IMPACT OF PRESCRIBING EXTENDED-RELEASE (ER) NON-ABUSE-DETERRENT OPIOIDS (ADO) TO CHRONIC PAIN PATIENTS**

**Objectives:** To estimate healthcare resource utilization, associated costs, and number needed to harm (NNH) from a physician’s decision to prescribe extended-release (ER) non-abuse-deterrent opioids (ADO) as compared to ER ADOs in a chronic pain population.

**Methods:** A 12-month probabilistic sampling TreeAge model was developed to estimate the reduction of misuse and/or abuse from a physician’s decision to prescribe ER non-ADOs instead of ER ADOs in 10,000 patients. Model inputs included monthly probabilities for opioid misuse and/or abuse-related events, death from misuse and/or abuse, opioid discontinuation, and switching from ADO to non-ADO. Estimated reductions in abuse associated with ADOs were obtained from positive subjective measures using human abuse liability studies. The model was run separately using inputs for commercial, Medicare, Medicaid, and Veterans Health Administration (VHA) populations. The difference in healthcare resource utilization and associated costs between the ADO and non-ADO simulations was calculated. NNH for non-ADO was also calculated. Prevalence, probabilities, and misuse and/or abuse-related event costs (2015 USD) were derived from literature.

**Results:** Misuse and/or abuse-related events for patients prescribed ER non-ADOs ranged from 199-1,305, and associated costs ranged from $18.55-$90.83 per patient.
for commercial and Medicare populations, respectively. Prescribing ER ADOs led to 69, 299, 318, and 405 fewer misuse and/or abuse-related events, saving $6.56, $36.94, $24.85, and $28.18 per patient in commercial, VHA, Medicaid, and Medicare populations, respectively. NNH ranged from 233 in the commercial population to 42 in the Medicare population. Results were sensitive to decreases in the probability of misuse and/or abuse events but showed reductions in most scenarios.

Conclusions: Based on the model, a physician’s decision to prescribe ER ADOs instead of ER non-ADOs led to large reductions in misuse and/or abuse-related events and associated costs in commercial, Medicare, Medicaid, and VHA populations, with the largest cost savings in a Medicare population.

PMD71
IMPACT OF THE INTRODUCTION OF NEWER LONG-ACTING REVERSIBLE CONTRACEPTIVE (LARC) METHODS ON LARC USE IN A COMMERCIALY INSURED POPULATION

Objectives: To assess the impact of the introduction of newer LARC methods on LARC use relative to all contraceptive users.

Methods: Using a U.S. insurance claims database (01/1999-03/2014), we studied women using LARC or short-acting reversible contraceptive (SARC) methods. The proportion of women using LARC relative to all contraceptives (LARC+SARC) was reported yearly. Four time periods corresponding with the approval of a new LARC method, that is, Jan-2001 (new intrauterine device [IUD]), Jul-2006 (new implant), and Jan-2013 (new IUD), were identified. Generalized estimating equation models were utilized to identify the impact of time periods and patient characteristics on the use of LARC over SARC methods.

Results: A total of 1,040,978 women met inclusion criteria. LARC use increased yearly from 0.6% (1999) to 16.6% (2013) among all contraceptive users. Time periods associated with the introduction of a newer LARC method were significant predictors of LARC use; women in 2006–2012 and 2013–2014 were respectively 3.7-fold (95%CI: 3.57-3.74) and 6.6-fold (95%CI: 6.43-6.80) more likely to use LARC over SARC relative to women in 2001–2006. The increase in LARC use was especially pronounced in young women. Compared to women aged 18 to 24 in 2001–2006, women aged 18 to 24 in 2006–2012 and in 2013–2014 were respectively 6.4-fold (95%CI: 5.91-6.86) and 14.7-fold (95%CI: 13.59-15.89) more likely to use LARC over SARC method.

Conclusions: This broadly representative commercial claim-based study showed that the proportion of women using LARC increased over time and that the introduction of newer LARC methods corresponded with significant increases in overall LARC use.
With more than 600 professionals, many with advanced degrees and expertise in health economics, health outcomes research, epidemiology, strategy, biostatistics, statistics, economics, market access and other quantitative disciplines, Analysis Group has established a leadership role in the science, economics, and business strategy of the global health care industry. The firm’s 11 offices are located in Boston, Chicago, Dallas, Denver, Los Angeles, Menlo Park, New York, San Francisco, and Washington, D.C.; and internationally in Montreal and Beijing.

For more information about Analysis Group’s Health Care Consulting practice, please contact:

**Howard Birnbaum**  Ph.D., economics, Harvard University  
617 425 8108 | howard.birnbaum@analysisgroup.com

**Mei Sheng Duh**  Sc.D., pharmacoepidemiology, Harvard School of Public Health  
617 425 8131 | mei.duh@analysisgroup.com

**Eric Qiong Wu**  Ph.D., pharmacoeconomics and policy, University of Southern California  
617 425 8254 | eric.wu@analysisgroup.com

For bios and further information, please visit www.analysisgroup.com