

### Background

- Adverse events (AEs) during oral oncology treatment are a known barrier to adherence and driver for discontinuations. Some patients may be at a higher risk for AEs due to concomitant medication usage and comorbidities, even beyond what is described in clinical trials.
- At CenterWell Specialty Pharmacy (previously Humana Specialty Pharmacy), we partnered with Humana's Pharmacy Analytics and Consulting (PAC) team to create risk stratification models, using machine learning practices, to predict which patients may have adverse events leading to early discontinuation of oral oncology therapy. The models also provided insights into the types of adverse events these patients might encounter.
- From these models, we hypothesized if CenterWell Specialty Pharmacy pharmacists could provide targeted counseling to patients based on anticipated AEs, then the patient may not discontinue therapy due to treatable or avoidable adverse events.
- This led to the creation of PREDICT, Predicting Real Events During Initiation of Cancer Treatment, a clinician-led program to educate model-identified patients to prevent AEs and early discontinuation. This direct patient intervention impacts drug discontinuation by increasing knowledge and management around potential events. These interactions also build rapport with specialty pharmacy clinicians leading to increased engagement, which aligns with Humana's goal of improving the health of our members.

### Objectives

- To explore the application of machine learning within the specialty pharmacy to understand if adverse events can be identified and mitigated using a hybrid of artificial intelligence and direct clinician intervention.
- To assess the impact of CenterWell Specialty Pharmacy's PREDICT program on oral oncology therapy discontinuation.
- To increase patient engagement through individualized clinician outreach

### Methods

- Utilizing retrospective claims data and available clinical resources focused on oral oncology drug cohorts, risk stratification models were created to identify patients at risk of discontinuation due to adverse events within the first 180 days of treatment. As figure 2 illustrates, patients scoring in deciles 8-10 are most likely to discontinue therapy. The model insights also provided key drivers of discontinuation, using a random forest plot and removing highly correlated features. These insights, which may be unique agents, drug classes or patient characteristics were used to drive counseling efforts by the participating clinicians (table 2). While some insights mirrored published literature, others were unanticipated. Once created, the models were trained using machine learning practices such as linear regression (Figure 1) and random forest.
- Patients identified as high risk (N = 40) were auto-enrolled into a targeted AE education program within CenterWell Specialty Pharmacy's Oncology Center of Excellence. Upon first fill of the medication, patients received standard AE counseling and additional counseling based off identified drivers of discontinuation. Those patients receiving intervention were followed at 30- and 90-day intervals to assess whether the patient continued or discontinued therapy.

### Results

Figure 1. Model Training via Linear Regression Model

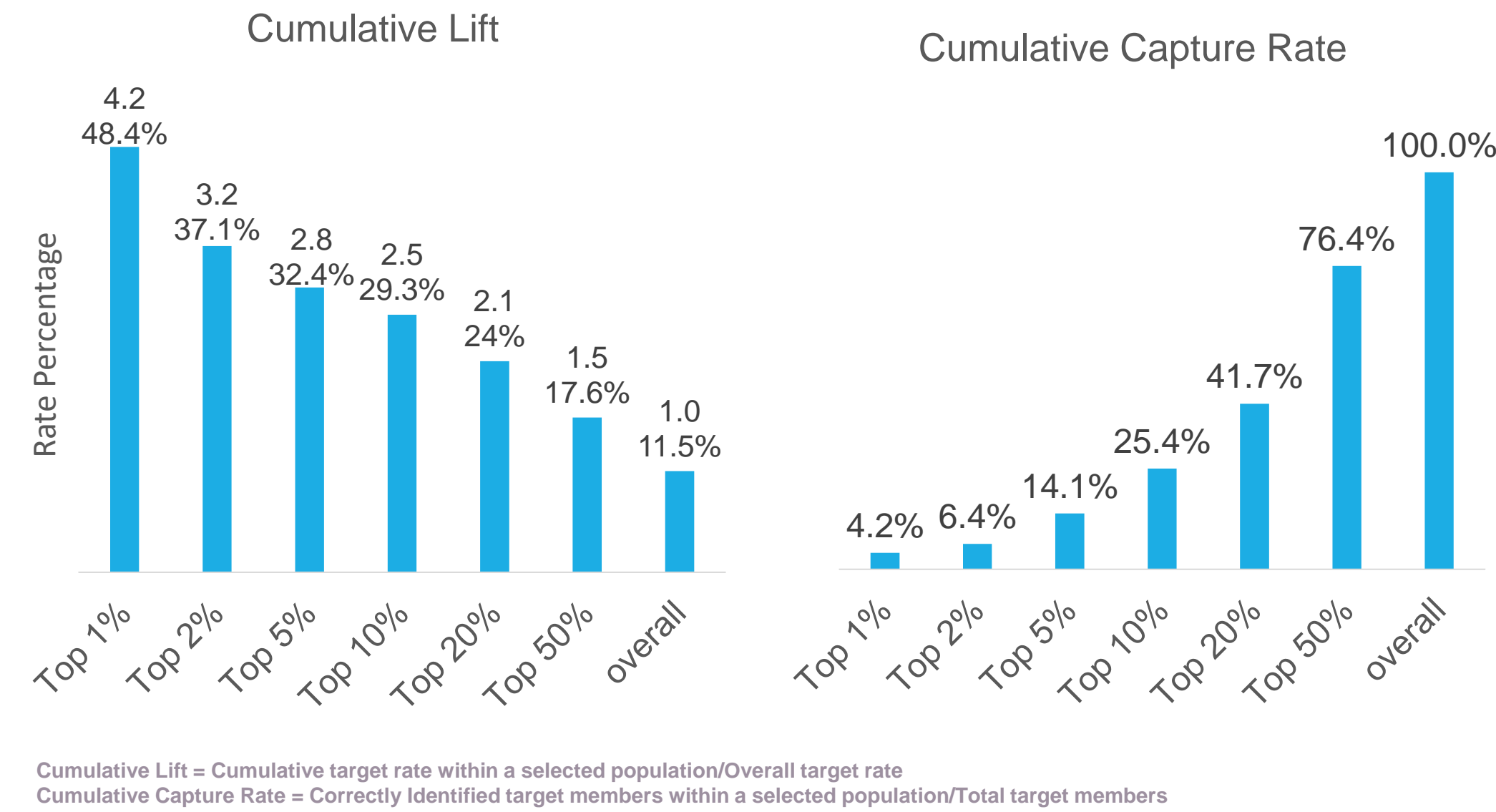


Table 1. Key Model Insights Driving Discontinuation

Insights
Use of Analgesic Pain Medication
Use of Constipation Medication
Use of Ophthalmic Allergy Medication
Gastrointestinal Disease
Gender
Recent Infection
Use of Migraine Medication
Physician Visit due to Diarrhea

Figure 3. Outreach Effectiveness: Discontinuation Rate

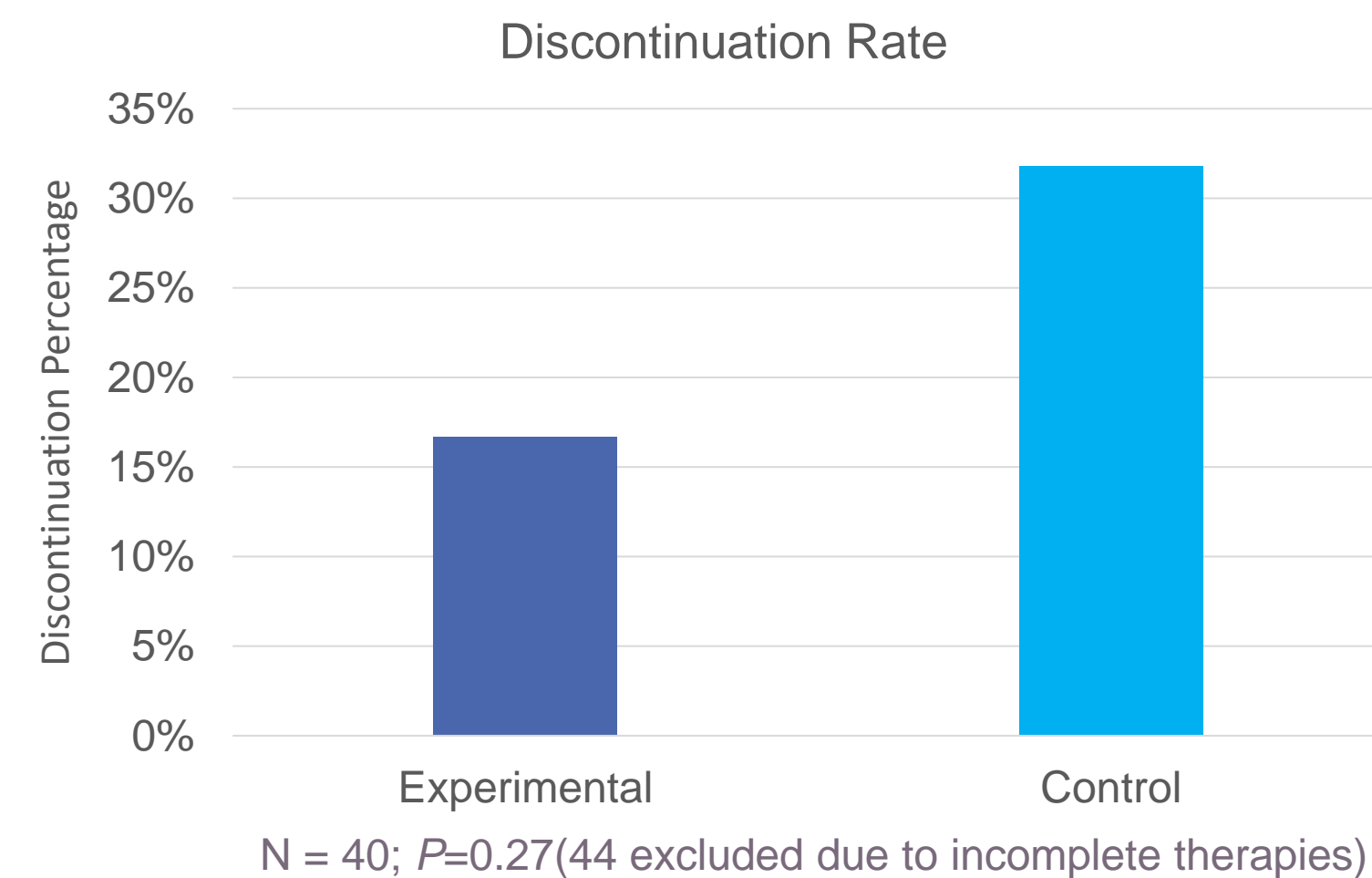


Figure 2. Production Model Accuracy: Discontinue Rate

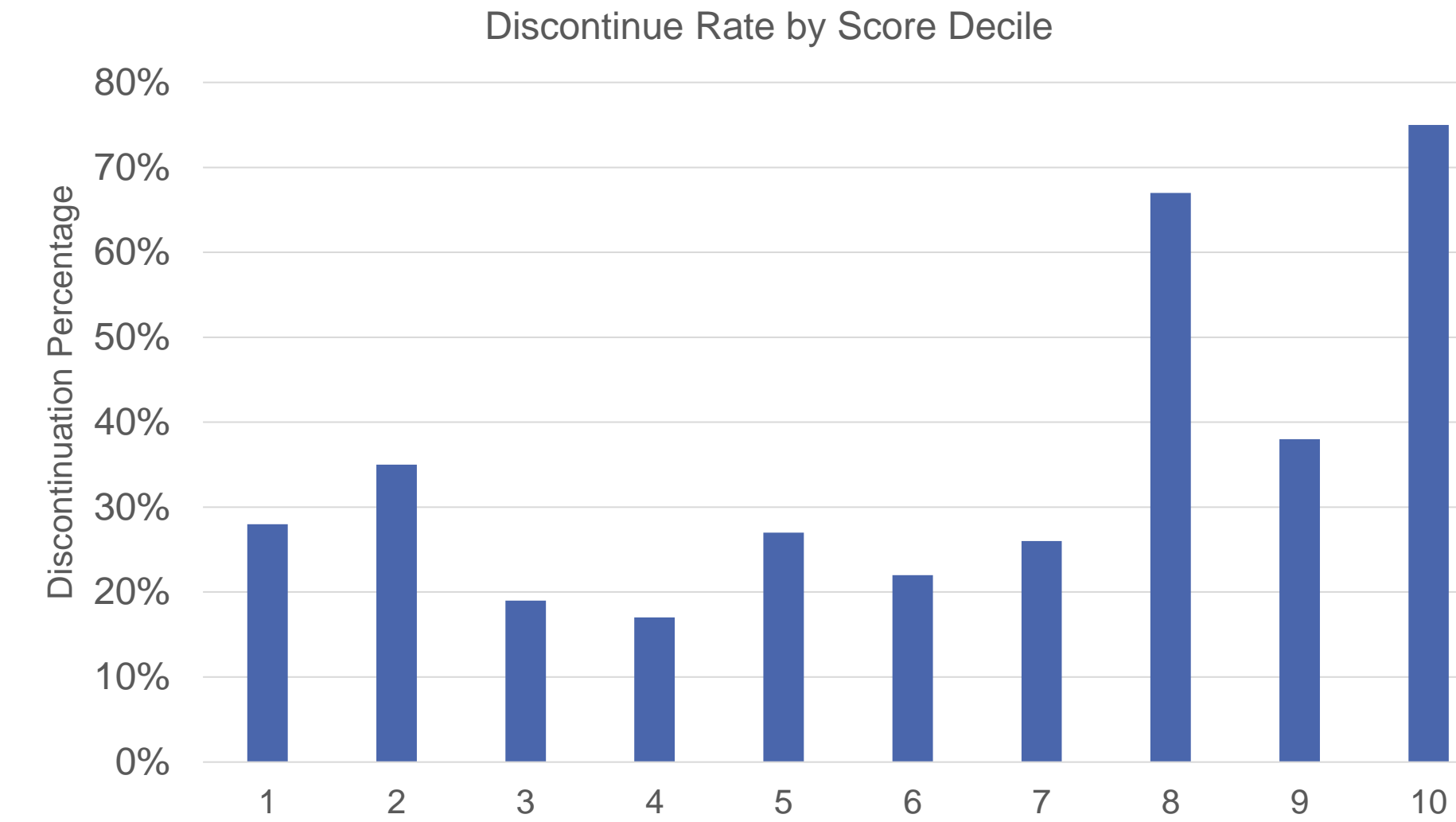
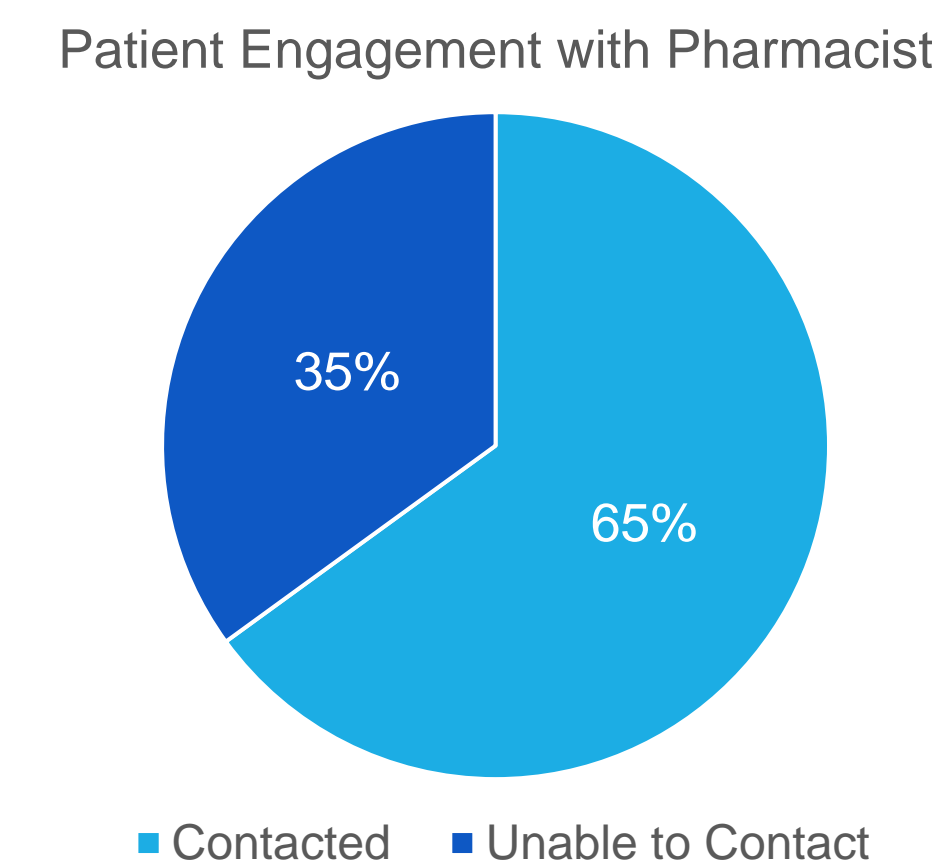


Table 2. Key Medication Classes Driving Discontinuation

Medication Class
Aromatase Inhibitors
Cyclin-dependent Kinase Inhibitors
Diarrhea Agents
Constipation Agents
Migraine Agents
Ophthalmology Allergy Agents
Analgesics
Narcotic Analgesics

Figure 4. Outreach Effectiveness: Patient Engagement



### Conclusions

- The marriage of clinical acumen with artificial intelligence provides real-world application of data and analytics to patient management. To achieve this, risk stratification models can be used to accurately predict discontinuation rates based on patient attributes and inputs.
- In our patient cohort, those patients receiving targeted counseling discontinued their oncology therapies 15% less often than their counterparts who received only general counseling, or no counseling at all. In addition to less discontinuations, patients were also willing to interact with a pharmacist within the program, with 65% of eligible patients choosing to participate.
- This approach shows that targeted, clinician guided approach to adverse event management translates to decreased medication discontinuation and high patient participation rates.

### Limitations

- The data utilized for risk stratification was for patients enrolled in Humana's Medicare Advantage Prescription Drug plans.
- Current models limited to only oral oncology medications.

### Future Applications

- Partnerships with manufacturers to decrease drug discontinuations in targeted patients.
- Expansion of model inputs to include non-Humana membership
- Additional applications to non-oncology medications are being explored.

### References

1. Accordino MK, Hershman DL. Time to Next Treatment, Disparities and Challenges in Adherence to Oral Antineoplastic Agents. *American Society of Clinical Oncology Educational Book 33* (May 16, 2013) 271-276.