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ral chemotherapeutic agents have been available for many years, and were traditionally cytotoxic drugs, such as cyclophosphamide, methotrexate, and mercaptopurine. In recent years, oral anticancer medications are being used more often in many types of cancer. Ongoing cancer research is focused on the development of new oral chemotherapeutics. Twelve new orally administered chemotherapeutic agents have been approved by the US Food and Drug Administration (FDA) in the past 22 months. The National Comprehensive Cancer Network (NCCN) has recognized the increasing use of oral chemotherapies as a growing concern, and has formulated a multidisciplinary task force consisting of oncologists, nurses, pharmacists, and payor representatives to discuss the impact of the increasing use of oral chemotherapy.

Because of their efficacy and general acceptance by patients, there has been an increase in the number of patients with cancer who have been receiving oral therapies in the past few years. Oral chemotherapies are perceived by patients to be easier to use and safer, although this may not necessarily be true. Many oral chemotherapeutic agents have side-effect profiles that are similar to intravenous treatments and can involve complicated regimens, and difficult administration instructions. For instance, capecitabine is an oral prodrug of the parenteral medication fluorouracil, and therefore has side effects similar to fluorouracil, including diarrhea and hand-foot syndrome. Capecitabine must also be taken within 30 minutes of a meal, and the most common regimen requires the patient to take it twice daily for 14 days, then 7 days off.

Newer targeted agents may not have the same side effects as cytotoxic agents; however, they do come with

**BACKGROUND:** Oral chemotherapeutic agents are being used in many types of cancer because of their efficacy and general acceptance by patients. Oral chemotherapies are perceived by patients to be easier to use and safer than intravenously administered chemotherapies; however, this may not necessarily be true. The St. Luke’s Mountain States Tumor Institute (MSTI) Oral Chemotherapy Service (OCS) monitors patients who are taking oral chemotherapies and evaluates patients for tolerability and adherence at least once per treatment cycle.

**OBJECTIVE:** To evaluate the duration of use of oral chemotherapies filled through the MSTI OCS compared with the duration as reported in clinical trials.

**METHODS:** We reported a retrospective chart review on all new prescriptions for capecitabine, temozolomide, lenalidomide, enzalutamide, or abiraterone filled at MSTI OCS between January 1, 2010, and December 31, 2013. Only prescriptions filled exclusively through the MSTI OCS and prescribed according to the US Food and Drug Administration indications for these medications were included. Prescriptions were evaluated for the length of time patients continued to use their medications and were compared with the duration of use reported in the clinical trials referenced in the prescribing information for each of these drugs.

**RESULTS:** A total of 367 new prescriptions were included in the final analysis. Patients who received treatment at MSTI OCS had similar or improved duration of use for capecitabine and temozolomide compared with the duration reported in clinical trials. By contrast, patients who received lenalidomide, enzalutamide, or abiraterone did not continue to use their therapy for as long as the durations reported in clinical trials.

**CONCLUSION:** Patients who filled their prescriptions through the MSTI OCS had durations of use similar to the durations reported in the clinical trials for 2 of the 5 medications evaluated in this study—capecitabine and temozolomide.

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their own side effects, and patients need to be aware of them. For example, enzalutamide and abiraterone may cause hot flashes, edema, diarrhea, and musculoskeletal pain, whereas the traditional parenteral chemotherapy could cause nausea, vomiting, hair loss, and diarrhea. Adherence to all medications used by patients at home tends to be higher than medication adherence in real-life outside of clinical trials because patients are aware that they are being observed during studies. In addition, clinical trials often use strict standards for medication adherence as inclusion criteria, which may overestimate real-life scenarios. It is very difficult to measure medication adherence, and it has been shown that the subjective measurements used by providers and nurses at clinic visits are not accurate for assessing adherence. In the general population, patients may not experience the same responses to therapy as those seen in clinical trials, because of a potential decrease in patient adherence to the treatment regimen. This has been shown in patients with chronic myeloid leukemia, a disease in which poor adherence to oral chemotherapy regimens leads to worse outcomes.

At St. Luke’s Mountain States Tumor Institute (MSTI), the Oral Chemotherapy Service (OCS) follows patients who are taking oral chemotherapies at home and communicates with them at least once at every treatment cycle. This follow-up is done by a telephone call, during which the pharmacists assess the patient’s medication adherence and side effects. The MSTI OCS process has been described previously. As a result of this additional monitoring, it is hypothesized that the patients who fill their prescriptions through the MSTI OCS may have increased adherence to oral chemotherapy regimens compared with other patients, and they more closely resemble adherence seen in clinical trials.

This review aimed to evaluate how long patients continued to use their therapy compared with the duration of therapy seen in clinical trials.

Methods

This retrospective chart review included all new prescriptions for adult patients with cancer who received capecitabine, temozolomide, lenalidomide, abiraterone, or enzalutamide through the MSTI OCS between January 1, 2010, and December 31, 2013. These 5 medications were chosen after an evaluation of the top medications prescribed at the center in 2014. The prescribing information for each drug was reviewed to obtain the duration of use for each drug. Prescriptions were excluded if they were written for off-label indications, had to be filled through a mail order or other pharmacies, or were never actually dispensed to the patient.

Data collected included the medication prescribed, the indication, dose, the date the prescription was written, the number of cycles received and the days per cycle, and the reason for discontinuation.

All the included prescriptions were reviewed to determine whether the medications prescribed were filled exclusively through the MSTI OCS, and if they were written for an FDA-approved indication. The duration of time patients continued to use the medication was then evaluated. In the case of temozolomide use in patients with glioblastoma who received concurrent radiation, the percentage of patients who completed therapy was compared.

Statistical Analysis

A Wilcoxon signed-rank test for a single sample was used to run statistical analysis for continuous data. The hypothesized median used in this analysis was the median duration reported in clinical trials for the drugs. For nominal data, a chi-square test was used. A power analysis was not completed, and therefore a sample size was not calculated; however, a P value of ≤0.05 was considered to be significant.

Results

During the review period, 1105 new prescriptions were identified. A total of 356 prescriptions were written for off-label indications, 149 were sent to a mail

![Figure: Prescriptions Filled Through the MSTI OCS](#)
order or other pharmacies, 152 were never dispensed to the patient, 45 patients received free medications from the manufacturer, and 36 prescriptions were found to not be initial treatments. This left 367 prescriptions that were prescribed according to FDA-approved indications and filled exclusively through the MSTI OCS (Figure).

The median durations of treatment reported in the clinical trials referenced in the prescribing information, and the median durations seen at MSTI during the review period are shown in the Table. The most common reasons for medication discontinuation were disease progression, treatment completion, side effects, and patients moving to hospice care or to comfort measures.

### Capecitabine
Capecitabine is FDA approved for the treatment of patients with metastatic colorectal cancer, metastatic breast cancer, or Duke’s C colon cancer. There were 54, 71, and 29 prescriptions, respectively, filled at the MSTI OCS for these indications. The only indication that showed a longer duration of therapy at MSTI compared with that reported in clinical trials was metastatic breast cancer. Patients receiving capecitabine for metastatic colorectal cancer showed no difference in treatment duration, and patients with Duke’s C colon cancer had a significantly shorter duration of treatment than those treated in clinical trials.

### Temozolomide
Temozolomide is FDA approved for use, concomitantly with radiation therapy, for the treatment of patients with glioblastoma multiforme; as maintenance therapy; and for patients with refractory anaplastic astrocytoma. There were 72 prescriptions written for glioblastoma—46 concurrently with radiation and 26 as maintenance regimens—and 1 prescription was written for anaplastic astrocytoma.

The only indication that had a longer duration of therapy than reported in clinical trials was glioblastoma, as maintenance therapy. Patients who received temozolomide for glioblastoma concurrently with radiation had no significant difference in the percent completing therapy compared with those reported in clinical trials. Only 1 prescription was for anaplastic astrocytoma, resulting in insufficient data for a statistical evaluation.

### Lenalidomide
Lenalidomide is FDA approved for the treatment of patients with multiple myeloma; transfusion-dependent anemia caused by myelodysplastic syndromes associated with 5q deletion; or mantle-cell lymphoma. There were 55 prescriptions written for lenalidomide for all indications—45 for multiple myeloma, 8 for myelodysplastic syndromes, and 2 for mantle-cell lymphoma.

Patients with multiple myeloma at MSTI did not continue lenalidomide therapy as long as patients in clinical trials. There were too few patients with myelo-
Adherence to oral medication regimens can be difficult to measure. This review showed that the additional monitoring and counseling performed by the MSTI OCS pharmacists resulted in similar or prolonged durations of therapy compared with those reported in clinical trials of capecitabine and temozolomide; however, this was not the case for lenalidomide, abiraterone, or enzalutamide. Because it is difficult to measure patient adherence in the real-world setting, if patients are continuing to use their medication for as long as or longer than patients in clinical trials, it is speculated that these patients will have similar outcomes as those included in the clinical trials. Further analysis of the utility of this type of measure for the success of a program is encouraged.

Author Disclosure Statement
Dr Mancini is on the Speaker’s Bureau of Millennium and a consultant for Taiho. Dr Hogue and Dr Ineck have no conflicts of interest to report.

References

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