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# Location and timing of care for colon cancer patients in the VA Health System

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## ABSTRACT

**Background:** We sought to identify colon cancer patients within the Veterans Affairs (VA) system who experienced lengthy wait times for surgery or chemotherapy. We looked specifically at the relationship between location of treatment and timing of care.

**Methods:** We performed a retrospective cohort study of 4635 patients diagnosed with colon cancer in the VA Health System during 2002–2010 and treated with surgery followed by chemotherapy. We used VA administrative databases, including the VA Outpatient Clinic, Patient Treatment, and Fee Basis inpatient and outpatient files. Time from diagnosis to surgery and time from surgery to initiation of chemotherapy were the primary outcome measures.

**Results:** Patients who required referral to a hospital different from their home VA facility for surgery experienced delays in surgical intervention compared with patients treated at their home VA medical center. For patients referred outside of the VA system, this delay was almost 2 wk (13.5 d,  $P < 0.001$ ). When these patients then went to another hospital for chemotherapy, they experienced further delays in care. Patients treated surgically outside the VA system who returned to the VA system for chemotherapy were more likely to initiate chemo  $>8$  wk following surgery (OR 1.69,  $P = 0.01$ ). The average adjusted time from surgery to chemotherapy for these patients compared with those treated wholly within the VA system was 11.4 d ( $P = 0.003$ ).

**Conclusions:** VA patients who require treatment at multiple hospitals for colon cancer, especially those who require surgery outside of the VA system, are more likely to experience delays in care compared with patients treated at a single hospital.

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## 1. Introduction

Colorectal cancer is the third most commonly diagnosed cancer and the third-leading cause of cancer death in both genders in the United States; in 2011, there were over 141,000 cases of and almost 50,000 deaths from colorectal cancer [1]. The Veteran's Affairs (VA) Health System treats approximately 3% of patients with cancer in the United States;

this includes almost 5000 new cases of colorectal cancer diagnosed and treated annually [2]. Given the large number of colorectal cancer patients treated within the VA, there has been a VA-wide focus on measurement of the quality of colorectal cancer care since 2005 [3–5].

Recent studies of the quality of nonmetastatic colorectal cancer care within the VA system indicate that, although the VA has performed well relative to general standards of

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care for colon cancer, delay in care is a possible concern. In one study, the average length of time from surgery for colon cancer to the start of chemotherapy was 65 d [2], which is longer than the 8 wk suggested by several studies as the optimal time frame for initiation of chemotherapy [6,7].

Similarly, a 2011 study evaluating wait times for cancer-directed surgery in the United States revealed that colon cancer patients were more likely to experience wait times for surgery >30 d at VA hospitals compared with community hospitals [8]. Among patients treated within the VA, those who were diagnosed and treated at different hospitals had longer waits than those diagnosed and treated at the same hospital (36 versus 27 d). However, this study did not look at time from surgery to chemotherapy, nor did it examine how delays were associated with treatment location.

We sought to evaluate, in more detail, the timing of care for VA patients treated for colon cancer between 2002 and 2010. We examined the differences in timing from diagnosis to surgery and from surgery to chemotherapy between VA patients treated within the VA system and those patients who received either surgery or chemotherapy at a non-VA hospital under the Fee Basis program. The Fee Basis program arranges and pays for non-VA medical care when a veteran's VA hospital cannot provide necessary care due to lack of available specialists, long wait times, or extraordinary distances from the veteran's home. We also examined differences in timing of care between patients treated entirely at their home VA facility and patients requiring surgical or medical treatment at other VA hospitals.

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## 2. Methods

We performed a retrospective cohort study of VA patients with colon cancer who were treated with surgery followed by chemotherapy during 2002–2010. We used existing VA administrative databases, including the VA Outpatient Clinic, Patient Treatment, and Fee Basis inpatient and outpatient files. The VA Outpatient Clinic files contain records for VA outpatient encounters such as clinic and outpatient procedure visits, while the Patient Treatment files contain records for all VA hospitalizations. Fee Basis files contain utilization information on non-VA-provided services authorized and paid for by the VA under the Fee Basis program.

From these data we constructed a cohort of colon cancer patients in a stepwise fashion. First, we identified patients who had records with an ICD-9 diagnosis code for colon cancer between January 1, 2002 and June 30, 2010 in the VA outpatient or patient treatment files. Next, we selected patients who had records with an ICD-9 or CPT code for colectomy within 6 mo of the date of diagnosis. Finally, we selected patients who also had records with an ICD-9 or CPT code for chemotherapy within 6 mo of the date of the index colectomy. We chose a limit of 6 mo after surgery to capture patients receiving primary adjuvant chemotherapy and to avoid those receiving delayed chemotherapy for recurrent or metastatic disease. The final cohort consisted of 4635 patients with a diagnosis code of colon cancer who were treated with surgery followed by chemotherapy during 2002–2010.

The dependent variables of interest were the time from diagnosis to surgery and the time from surgery to chemotherapy. We analyzed each as a continuous variable, defined as the number of days between events, and as a binary variable ( $\leq 8$  wk versus  $>8$  wk). This threshold was chosen based on literature indicating that chemotherapy should be given within 8 wk of surgery for optimal benefit [6,7].

### 2.1. Location of treatment

We identified patients who received surgery and/or chemotherapy at non-VA centers based on the presence of billing records for those treatments in the Fee Basis data. For patients receiving all care within the VA system, we used the three-digit VA identifier associated with the billing codes to ascertain whether surgery and chemotherapy occurred at the patient's home VA facility or another VA location.

### 2.2. Statistical analysis

Univariate associations between location of treatment and patient factors were assessed using  $\chi^2$  tests for categorical variables and t-tests for continuous variables. Linear regression models were used to assess the independent associations between location of treatment (within VA versus fee basis, or home VA versus non-home VA) and number of days between events. Both unadjusted and multivariate adjusted analyses were performed; the adjustment variables included patient age, race/ethnicity, gender, marital status, and Charlson comorbidity score, which was calculated based on ICD-9 codes recorded during the year prior to the date of colon cancer diagnosis [9]. Because the distribution of days between diagnosis and surgery was slightly right skewed, we also estimated negative binomial regressions as a robustness check.

Finally, we used multivariate adjusted logistic regression to assess the association between location of treatment and a binary indicator for delay in surgery or, separately, chemotherapy (defined as  $>8$  wk), for both the fee basis and non-home VA analyses. The adjustment covariates were age, race/ethnicity, gender, marital status, and Charlson scores.

All analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC). All P values were two-sided, with  $P = 0.05$  as the threshold of statistical significance. The study was approved by the Philadelphia VHA Medical Center Institutional Review Board.

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## 3. Results

We identified 4635 patients who were diagnosed with colon cancer and who underwent surgical resection followed by chemotherapy between 2002 and 2010. Of these patients, 295 (6.4%) received surgery or chemotherapy at a non-VA hospital under the Fee Basis program. Of the 4340 patients treated wholly within the VA, 1553 (35.8%) received surgery or chemotherapy at a VA hospital different from their home VA.

Patients treated at a fee basis hospital tended to be slightly younger than those treated entirely within the VA (63.6 versus

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