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Racial disparities in receipt and comparative effectiveness of oxaliplatin for stage III colon cancer in older adults

Christina D. Mack, MSPH[1], **William Carpenter, PhD, MHA**[1], **Anne-Marie Meyer, PhD**[1], **Hanna Sanoff, MD, MPH**[2], and **Til Stürmer, MD, MPH**[1]

[1]University of North Carolina, Chapel Hill, NC

[2]University of Virginia, Charlottesville, VA

Abstract

Background—African Americans (AA) in the United States have higher rates of colon cancer (CC) mortality than other races. This study examines the use of oxaliplatin, a novel chemotherapeutic agent approved in 2004, among AA and Caucasian Americans (CA) patients with stage III colon cancer to understand whether differential receipt or differential effectiveness of the drug may explain the racial disparity in CC mortality.

Methods—We conducted a population-based retrospective cohort study of stage III CC patients age 65 and older treated from 2004 through 2006 who initiated chemotherapy within 90 days of surgical resection (N=1162) using Surveillance, Epidemiology and End Results (SEER)-Medicare data. Patients receiving oxaliplatin (n=477) were compared with those receiving 5-Fluorouracil (5-FU) without oxaliplatin (n=685). We estimated prevalence ratios (PR) and hazard ratios (HR) using multivariable binomial regression and Cox models to evaluate racial differences in oxaliplatin receipt and survival.

Results—AAs were as likely as CAs to receive oxaliplatin (40.5 vs. 41.1%; PR=0.90; CI: 0.71-1.13). Oxaliplatin was associated with lower mortality compared with 5-FU (HR=0.76; CI: 0.58-1.00). This benefit appeared stronger among AAs (HR=0.31; CI:0.09-1.05) than CAs (HR=0.80; CI:0.60-1.06).

Conclusions—In Medicare-insured patients receiving chemotherapy, we observed no meaningful racial disparities in receipt of oxaliplatin and, among those receiving it, potentially better survival among AAs. Differential receipt and effectiveness of oxaliplatin-containing regimens does not appear to contribute to the previously documented racial disparities in colon cancer survival. Understanding reasons for potentially enhanced effectiveness among AAs may inform efforts to resolve racial disparities in colon cancer outcomes.

Keywords

Colon Cancer; Healthcare Disparities; Oxaliplatin; Comparative Effectiveness Research; aged; Colonic Neoplasms/mortality; Colonic Neoplasms/therapy

BACKGROUND

Colorectal cancer is the third most common cancer in the United States, with an age-adjusted incidence rate of 41.1 cases per 100,000 people per year[1]. In 2011, over 141,000 new cases are expected, approximately a third of which will be diagnosed as stage III.

Correspondence: Christina Mack, University of North Carolina at Chapel Hill, 2101 McGavran-Greenberg Hall, CB #7435, Chapel Hill, NC 27599-7435, T:574-276-7958,F:919-966-2089, cdmack@unc.edu.

Colorectal cancer is a leading cause of cancer mortality, with more than 51,000 people expected to die from it this year. Racial disparities in mortality are substantial – African Americans (AA) are approximately 44% more likely to die from colon cancer than Caucasian Americans (CA)[2]. Thanks to improved screening and the introduction of several innovative treatments, colon cancer (CC) mortality has declined since the 1980's, but has not declined equivalently among races[3,4]. This disparity may result from differential dissemination of the innovative treatments in different subpopulations, or differential effectiveness among them.

Many factors contribute to racial differences in access to care, care utilization, and outcomes. For example, AA mistrust of physicians, lack of a regular source of care, and poor continuity of care have been associated with lower use of preventive services, delays in treatment, and lower quality of follow-up, and subsequently worse outcomes[5,6,7,8,9,10,11,12]. In sum, real-world care may fall short of optimal patient management. Adjusting for socioeconomic status (SES) may account for some of the differences attributed to race; however, in studies controlling for these factors, the mortality gap between races remains[13,14]. After SES adjustment, AA patients are less likely to receive adjuvant chemotherapy for resectable colorectal cancer than CAs[15,16,17], suggesting that there may be disparities in the use of the more effective and/or innovative drugs. However, we do not have good data on racial differences in the receipt of specific chemotherapies among treated CC patients.

Innovative therapies might also have a heterogeneous effect on outcome in different races, as there is substantial evidence that an individual's genetic makeup may affect the effectiveness and toxicity of systemic chemotherapy (pharmacogenetics). In colorectal cancer, there are many examples of genotypic association with chemotherapy outcomes such as UGT1A1*28 allele and irinotecan toxicity, and thymidylate synthase TSER polymorphism and 5-FU benefit[18,19,20]. New evidence suggests that chemotherapy, and specifically oxaliplatin, may cause fewer side effects in AAs[21,22,23], which could lead to better drug delivery, adherence and persistence, and ultimately greater effectiveness. However, this would be expected to improve mortality in AAs and can therefore not explain the observed mortality gap.

The standard of care for stage III CC is surgical resection, followed by chemotherapy[24]. In 2004, oxaliplatin was FDA-approved for stage III CC and, used in combination therapy with 5-Fluorouracil (5FU) (i.e., the FOLFOX regimen), replaced 5-FU alone, the prior standard adjuvant therapy. At that time, FOLFOX was shown to improve disease-free survival over 5-FU (rate of 72.2% vs. 65.3%)[25] and subsequently to improve survival in patients with stage III CC (HR=0.86, 95% CI, 0.66, 1.11)[26]. However, potential racial differences in effectiveness were not adequately examined in the clinical trials, which had much less racially diverse populations than the general CC population. Moreover, differential access to care cannot effectively be examined in randomized clinical trials (RCTs).

To examine whether the racial disparity in CC mortality can be partially explained by either access to innovative treatments or differential treatment effectiveness, this study evaluated a heterogeneous population-based sample[27] for racial differences in the use and comparative effectiveness of FOLFOX, a combination chemotherapy including the novel drug oxaliplatin.

MATERIALS AND METHODS

Data source

A population-based retrospective cohort was drawn from the Surveillance, Epidemiology and End Results (SEER)- linked-Medicare data, which have been described extensively elsewhere[28]. Briefly, the National Cancer Institute's (NCI) SEER program collects clinical and demographic data on incident cancers and covers approximately 28% of the U.S. population. Medicare is U.S. public health insurance that insures approximately 97% of those aged 65 and older in the U.S. The linkage of Medicare claims with SEER provides critical information on patient demographics, cancer characteristics, health care utilization, and comorbidities, and has been used extensively to study cancer patterns of care and outcomes[29].

Patient Population and Sample

The study cohort included individuals diagnosed with primary stage III CC who were first treated between January 1, 2004 and December 31, 2006, the years immediately following determination of oxaliplatin efficacy and FDA approval. Included patients received surgical resection (colectomy or resection of colon or large intestine) within 180 days of diagnosis and initiated the first course of chemotherapy within 90 days of surgery. All patients received one of the two chemotherapies of interest: 5-FU without oxaliplatin (the previously standard therapy) or an oxaliplatin-containing regimen (the innovative therapy). Additional exclusion criteria (Figure 1) include: Incomplete claims or HMO coverage during the 12 months pre- and post-diagnosis or until death, to ensure attainment of treatment and procedure claims; age younger than 65, as these individuals may be systematically different or have incomplete claims as a function of Medicare eligibility requirements; diagnosis at autopsy; appendix or rectosigmoid junction cancer; death within 30 days of surgery, as these patients are unlikely to have received chemotherapy due to fragile health status; and race other than CA or AA. The sample was restricted to patients from SEER registry regions with 5% or greater AA populations.

Definition of Cohorts

FOLFOX was defined as the presence of an oxaliplatin claim, since oxaliplatin is the defining drug of the FOLFOX regimen and the innovative treatment of interest. The referent treatment group received 5-FU, the prior standard for chemotherapy, and had no claims for oxaliplatin. Those receiving other treatments with 5-FU (e.g. irinotecan) were included in the referent group. An exposure window of 150 days from diagnosis was used to ensure inclusion of all patients treated according to American Society of Clinical Oncology / National Comprehensive Cancer Network quality standards. These guidelines recommend administering adjuvant chemotherapy within 120 days of diagnosis for stage III CC[30], and a 30 day "buffer" was added because SEER-Medicare does not contain the specific diagnosis date (month/year only). Patients who received chemotherapy before surgery are likely stage IV patients misclassified as stage III and were not included.

Mortality Follow-up and Covariates

Mortality follow-up started 90 days after surgery irrespective of when chemotherapy was initiated. Date of death was ascertained from Medicare data, which is drawn from the U.S. Social Security Administration, and was available in these data through December 31, 2006. Race, the primary covariate of interest, along with other adjustment variables of age, sex, urbanity, tumor grade, tumor substage, site of tumor, SEER registry, median income, and radiation were obtained through SEER data. Race is considered an accurate variable in SEER for AA and CA[31]. Chemotherapy, comorbidities and procedures were identified

through Health Care Procedure Classification Codes (HCPCS), National drug codes (NDC), Current Procedural Terminology (CPT) and ICD-9 codes in Medicare claims. Comorbidity was adjusted for using the NCI-Combined Comorbidity Index, adapted from the SEER-Medicare program[32]. This index was constructed using claims for the 12 months prior to diagnosis[33].

Analytic methods

Frequency tables and comparisons of covariates by treatment group and race were examined as part of a descriptive analysis. Treatment proportions were compared to examine whether AAs were as likely to receive oxaliplatin-based treatments as CAs. Crude and adjusted binomial regression models were constructed to estimate prevalence ratios (PR) for treatment assignment by race. Crude all-cause 3-year mortality was computed for patients who had 3 or more years of follow-up or who died during the study time period to compare risk of death between CAs and AAs. Cox models including all patients were used to estimate crude and adjusted hazard ratios (HR) for overall mortality comparing AAs vs. CAs and the initiation of FOLFOX vs. 5-FU regimens in an intent-to-treat approach based on all available follow-up information. HR estimates for race as a predictor of death were then compared, first unadjusted and then adjusted for oxaliplatin receipt. Cox models were constructed in a subgroup analysis to examine differences in oxaliplatin effectiveness between races. We measured the interaction of race and oxaliplatin on mortality using the interaction contrast ratio (ICR)[34,35], as the additive scale (joint effects) is most appropriate when investigating biologic interactions and for clinical decision making[36]. Proportional hazard assumptions were tested and confirmed using log likelihood tests and graphical methods. To compare survival by race among those who received oxaliplatin, adjusted Kaplan-Meier survival curves were generated. All analyses were performed using SAS (version 9.2.; SAS Institute, Cary, NC).

Directed Acyclic Graph (DAG) methodology was used to identify potential confounders[37]. Independent variables identified as important for adjustment in all models were age, sex, urbanity, tumor grade, tumor substage, site of tumor, SEER registry, median income, radiation, and NCI-Combined Comorbidity Index. Race, the primary independent variable of interest in treatment receipt models, and year of treatment were considered important confounders in analyses looking at the association between treatment and mortality.

Sensitivity analyses

Three sensitivity analyses were performed to test assumptions and selection of the study cohort. First, inclusion criteria were expanded to include all races, and AAs were compared with all other races instead of CAs only. Second, we examined the timing of surgery after diagnosis by restricting the cohorts to surgery within 90 days after diagnosis instead of 180 days. Some patients with surgery more than 90 days after diagnosis could have been erroneously categorized as stage III when in fact they already have metastatic disease. Third, to examine potential biases in the manner that follow-up time was calculated in Cox models, analyses were rerun with an origin of 30 days after the first date of 5-FU receipt instead of using 90 days after surgery.

RESULTS

Study population and oxaliplatin use

In descriptive analyses (Table 1), treatment groups were similar. Those receiving oxaliplatin (n=477) were slightly younger, had less comorbidity, and were in higher income brackets that those receiving 5-FU without oxaliplatin (n=685). Oxaliplatin use was greater among those diagnosed in 2005 than in 2004 (56.4% vs. 43.6%) as the innovation diffused into

practice. AAs comprised 10% (n=116) of the study population. There was variation in racial distribution among SEER registries; additionally, AAs were more likely to be female and were generally in a lower income bracket than CAs. AAs were as likely as CAs to receive oxaliplatin (40.5% vs. 41.1%; adjusted PR, 0.90, 95% confidence interval [CI], 0.71-1.13).

Mortality and oxaliplatin effectiveness

Overall mortality among all cohort subjects was 28.8% (n=335) over a mean follow-up of 2.4 years. Oxaliplatin was protective in terms of lower mortality compared to 5-FU regimens, with adjusted HR, 95% CI of 0.76, 0.58-1.00.

Mortality among AA patients with stage III CC who were treated with chemotherapy tended to be lower than that of CA patients, with an adjusted overall HR, 95% CI of 0.84, 0.56-1.28 (Table 2) and three-year mortality risk of 32.5% vs. 39.3%, p=0.34. HR estimates did not appreciably change when adjusted for receipt of oxaliplatin (adjusted HR, 0.85, 95%CI, 0.56-1.28).

Fewer than 11 of 41 AAs on Oxaliplatin died, compared with 23 of 69 AAs who died on 5-FU (the exact number is suppressed due to SEER-Medicare confidentiality requirements). The protective effect from oxaliplatin compared with 5-FU was more profound in AA than CAs: adjusted HR, 95% CI estimates were 0.83, 0.62-1.09 for CAs and 0.31, 0.12-0.82 for AAs (Figures 2, 3). The formal examination of the race-oxaliplatin interaction on mortality (assessment of joint effects) also demonstrates a greater benefit of oxaliplatin among AAs (Table 3). The absolute difference in the benefit between races was estimated as 57% of the hazard rate among the CAs receiving 5-FU (ICR, −0.57, 95% CI, −1.19 to 0.05).

Sensitivity analyses

To assess if the inclusion of other races with CAs would change or bias the study results, a sensitivity analysis compared AAs (n=116) with CAs and all other races (n=1098), rather than with CAs alone (n=1046). The associations between race and mortality and between race and oxaliplatin receipt were essentially unchanged. The small sample size of other races (n=52 not CA or AA) precluded this group's independent examination in comparison to AAs. Narrowing the timing of surgery after diagnosis from 180 to 90 days excluded 42 additional patients but estimates were equal in magnitude to the main analysis. Similarly, using an origin of 30 days after the first date of 5-FU receipt instead of 90 days after surgery excluded 84 patients but yielded no meaningful change in mortality HRs.

DISCUSSION

In this study examining whether racial disparities in CC mortality may be partly attributed to differential receipt or effectiveness of oxaliplatin, we found that, among older individuals with resected stage III disease, not only were AAs and CAs equally likely to receive oxaliplatin, but oxaliplatin unexpectedly appeared to be more effective among AAs than CAs. Overall, oxaliplatin-treated patients had lower mortality than patients treated with non-oxaliplatin regimens, a finding consistent with RCTs and recent observational comparative effectiveness research results[38]. While the study findings do not explain racial disparities in CC mortality, the results overall are meaningful in our understanding of CC treatment and racial disparities.

Differential mortality

Our finding that AA patients experienced slightly lower mortality than CAs is contrary to the findings of other studies[39,40,41]. This may be due to the equal access to overall medical coverage experienced by those in the study, who were all Medicare subscribers. It could also

be that racial minorities enter at a later stage in the cancer care continuum[42], but that once engaged in the health care system, any differences in the care they receive have little effect on mortality. The resources made available through Medicare participation to individuals in this study, who have accessed the health care system and been diagnosed with cancer, may have essentially eliminated the disparity in access to care after diagnosis, and thus eliminated the disparity in mortality. Indeed, in a study of stage III colorectal cancer patients treated at Veterans Affairs hospitals where all patients have equal access to medical care, there were no racial differences in receipt of appropriate colorectal cancer therapies and minimal racial differences in all-cause mortality[43]. As it pertains to differential access among individuals not covered by Medicare, our data offer little utility; the SEER-Medicare data reflect a population with health insurance, although distance/access to providers, co-payments and deductibles can still be substantial barriers to receiving care among insured populations. This study used census-level measures of SES, which are limited in their ability to remove all SES-related confounding.

Possible racial differences in oxaliplatin effectiveness

The relatively equal receipt of oxaliplatin between races coupled with the better survival of AAs suggests that there could be differences in oxaliplatin effectiveness based on race. This is meaningful, given that the proportion of minorities in RCTs of oxaliplatin efficacy were substantially smaller than the overall population with CC, as well as younger and healthier, and that seminal reports of oxaliplatin efficacy have not reported race-specific outcomes[44,45,46]. Race-stratified HRs as well as the analysis of joint effects showed that oxaliplatin was potentially more protective among AAs as compared to CAs. This is a novel finding that has generally not been seen in clinical trials, although other possible differences in oxaliplatin effectiveness have been described. Within a subgroup analysis of a large RCT comparing bolus irinotecan/fluorouracil (FU)/leucovorin (LV) (IFL) with oxaliplatin/infusional FU/LV (FOLFOX) and bolus irinotecan and oxaliplatin (IROX)[47], AAs were found to be less likely to experience severe adverse events from chemotherapy compared with CAs. However, this trial also found that the response rate to oxaliplatin was lower among AAs compared with CAs, which is contrary to our finding. If AAs do have fewer side-effects during treatment, it is possible that they have greater treatment completion rates than CAs when taking oxaliplatin and are better able to maintain dose intensity and dose density. If true, this improved drug delivery might result in better outcomes in clinical practice.

Alternate explanations

Another plausible reason for a more pronounced mortality reduction in AAs receiving oxaliplatin is channeling away from oxaliplatin in frail patients, (i.e. unmeasured confounding), which could be stronger in AAs than CAs. This channeling could be due to different prescribing or different decision-making among AAs compared with CAs, which has been shown in previous studies[48,49]. Clinicians may be less likely to use a more aggressive treatment such as oxaliplatin among patients who are sicker and thus potentially more likely to experience the risks of treatment without its prospective benefit[50,51]. It is possible that AAs in this study were sicker than CAs but that we were unable to see this difference in the dataset used, because health status measures such as frailty and functional status are not available in Medicare data. We did adjust for comorbidities found within the 12 months before cancer diagnosis, but differences in health status may still exist and yield residual confounding, which could be problematic when looking at mortality.

It is also possible that by removing those not treated with any chemotherapy, we may have excluded the patients who contribute to the gap in mortality between races. A similar proportion of both races were excluded for not receiving any chemotherapy within 90 days

of surgery, however, so this is unlikely. As in all analyses, chance could also account for our results. In our final patient population, there were small numbers of AAs who died while on oxaliplatin, which limited our ability to construct precise estimates; future studies with more events are warranted.

Limitations and sensitivity analyses

Use of claims data has potential limitations that have been well described[52,53,54]. We employed state-of-the art methods to minimize these acknowledged biases. In the overall analyses, we excluded races other than AA or CA, and then performed sensitivity analyses which suggested that results would not appreciably differ if we had compared AAs to all races. In SEER, there is an estimated 80% concordance with diagnosis date and timing of claims for CC[55] but only month and year of diagnosis are provided; therefore, index dates must be estimated. We built a time buffer to take this into account by adding 30 days to the recommended treatment window and using the first day of the previous month as an index date for finding surgeries and chemotherapies. We also took a conservative approach for inclusion, allowing patients who received surgery up to 180 days after diagnosis in the study. Sensitivity analyses suggest that results would be similar if surgery timing after diagnosis was restricted to 90 days.

Because Medicare is estimated to have 75% sensitivity for picking up 5-FU[56], we may have missed a proportion of the referent group. To avoid missing a considerable proportion of FOLFOX users, we used evidence of treatment with oxaliplatin to define our exposure rather than requiring evidence of all medications in the FOLFOX regimen. Exposure misclassification would be possible for those that started 5-FU toward the end of the 150-day claims window defined by this study and started oxaliplatin after the 150 days window. This misclassification is likely small and would tend to bias results toward the null. Within the referent group, few patients were on other chemotherapeutic agents in addition to 5-FU: 5.8% received irinotecan and 1.2% received bevacizumab. Sensitivity analyses excluding these patients from the referent group demonstrated no difference in findings (data not shown).

To ensure comparability of our results with previous work, mortality follow-up began 90 days after surgery irrespective of when chemotherapy was initiated. All included patients had started chemotherapy by this landmark. Primary results were essentially unchanged in sensitivity analyses beginning follow-up closer to chemotherapy start (30 days after first date of 5-FU).

Overall findings

This is the largest population-based study assessing race-specific channeling and comparative effectiveness of oxaliplatin to-date. Our findings of potential heterogeneity of effect in different races highlight the need for additional comparative effectiveness research on these therapies[57]. Using the SEER-Medicare data set, we have been able to demonstrate that oxaliplatin retains its effectiveness among an unselected group of elderly CC patients to a similar degree as seen in clinical trials. Furthermore, we have shown that elderly AA colon cancer patients, who are markedly underrepresented in clinical trials, derive as much if not more benefit from the addition of oxaliplatin.

CONCLUSIONS

In Medicare-insured stage III colon cancer patients receiving chemotherapy, we observed no meaningful racial disparities in receipt of oxaliplatin, the more effective treatment, and potentially better survival among AAs. Differential receipt or effectiveness of oxaliplatin-

containing regimens does not appear to contribute to previously reported racial disparities in CC survival. Rather, our findings suggest that oxaliplatin may act more effectively in AAs, although small numbers and other limitations require confirmatory research. This, combined with new evidence that oxaliplatin effectiveness may vary with biological differences, highlights the importance of future studies examining oxaliplatin effectiveness by race.

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Condensed abstract

Medicare-insured African Americans with stage III colon cancer are not less likely to receive the novel recommended chemotherapy, oxaliplatin, than Caucasian Americans. African Americans may even benefit more than Caucasian Americans from this treatment.

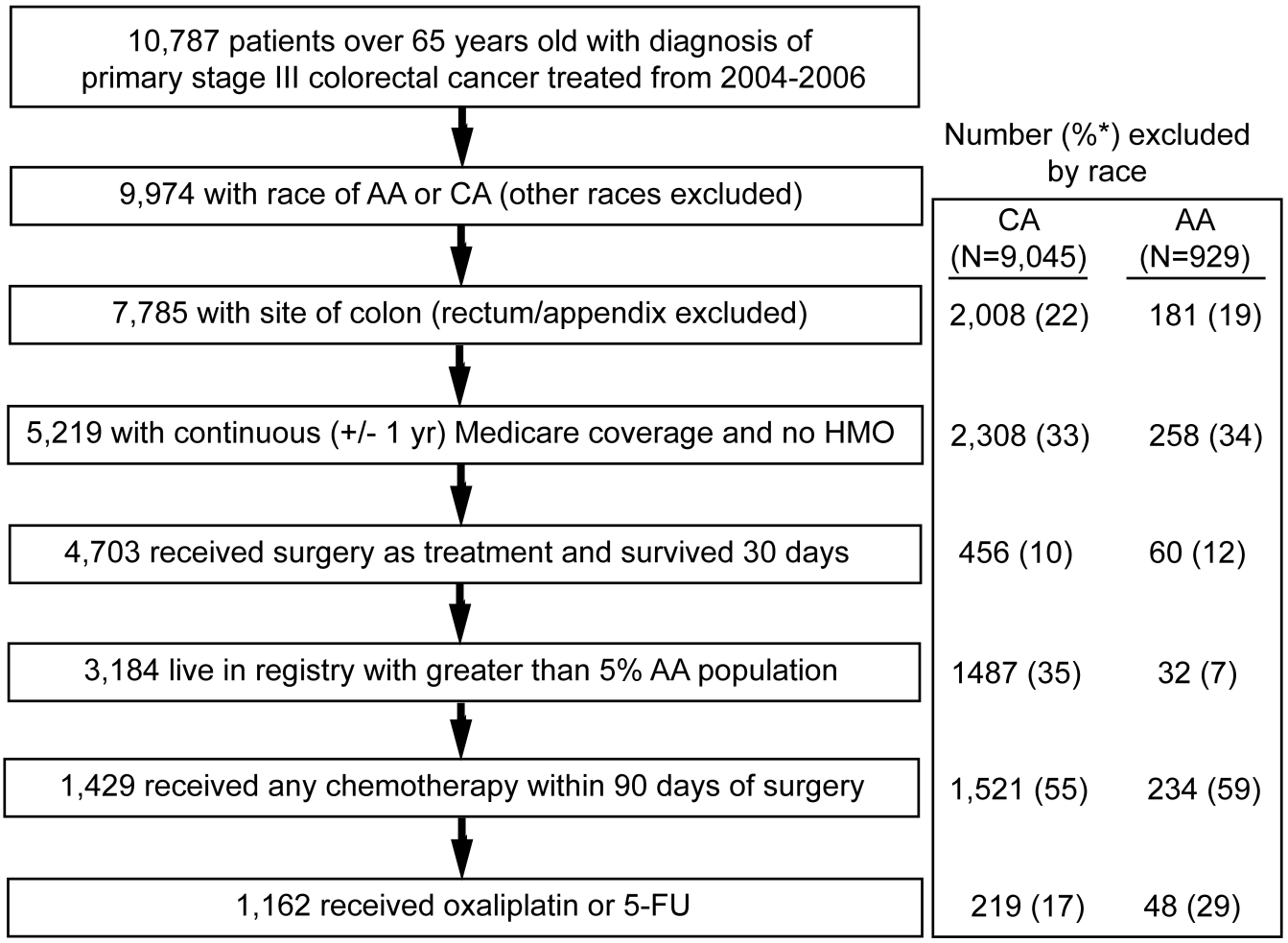

Figure 1. Selection of study population from SEER-Medicare data

* Percentages shown are the proportion within the racial group excluded based on each selection criteria. CA=Caucasian American, AA=African American

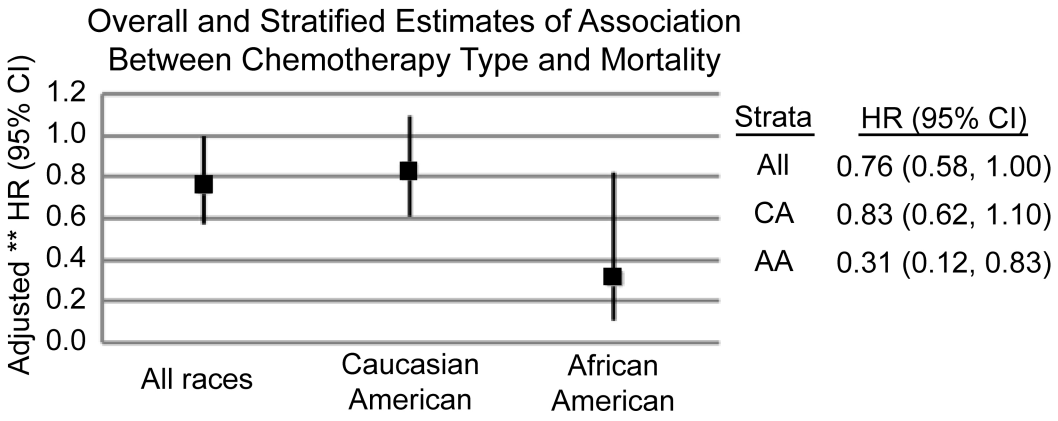

Figure 2. Effectiveness of Oxaliplatin over 5-FU in Preventing Mortality Stratified by Race*

* N= 1162; data ascertained via NCI SEER Registry and Medicare claims files.

** Adjusted for age, sex, urbanity, tumor grade, tumor substage, site of tumor, SEER registry, median income, radiation, NCI-Combined Comorbidity Index, year of treatment.

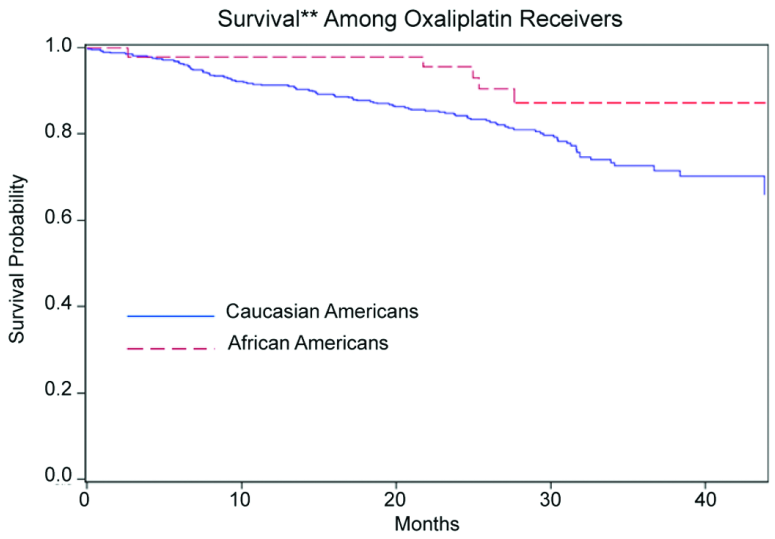

Figure 3. Comparison of Kaplan-Meier Survival by Race among Stage III Colon Cancer Patients on Oxaliplatin

* N= 477; data ascertained via NCI SEER Registry and Medicare claims files.

** Adjusted for age, sex, urbanity, tumor grade, tumor substage, site of tumor, SEER registry, median income, radiation, NCI-Combined Comorbidity Index, year of treatment.

Table 1

Characteristics of Stage III Colon Cancer Patients in Study Population by Treatment and Race

Characteristic (N=1162)	**5-FU**	**oxaliplatin**	**CA**	**AA**
	N (%)	**N (%)**	**N (%)**	**N (%)**
Race				
Caucasian American	616 (89.9)	430 (90.1)	-	-
African American	69 (10.1)	47 (9.9)	-	-
Sex				
Male	312 (45.5)	218 (45.7)	487 (46.6)	43 (37.1)
Female	373 (54.5)	259 (54.3)	559 (53.4)	73 (62.9)
Urbanity *				
Metro	581 (84.8)	421 (88.3)	902 (86.2)	100 (86.2)
Non-Metro	104 (15.2)	56 (11.7)	144 (13.8)	16 (13.8)
Age (years)				
Mean (sd)	75.8 (5.6)	72.7 (4.5)	74.6 (5.5)	73.4 (4.7)
Primary Site of Cancer *				
Cecum, Ascending colon	347 (50.7)	254 (53.2)	550 (52.6)	51 (44.0)
Flexures, Transverse colon	162 (23.6)	98 (20.5)	228 (21.8)	32 (27.6)
Sigmoid colon, Large Intestine, NOS	176 (25.7)	125 (26.2)	268 (25.6)	33 (28.4)
Income (thousands, US Dollars)				
Mean (sd)	48.5 (23.2)	55.4 (29.1)	53.2 (26.1)	34.5 (17.2)
SEER Registry *				
San Francisco, San Jose	84 (12.3)	82 (17.2)	146 (14.0)	20 (17.2)
Connecticut, New Jersey	288 (42.0)	173 (36.3)	435 (41.6)	26 (22.4)
Detroit	70 (10.2)	54 (11.3)	107 (10.2)	17 (14.7)
Rural Georgia, Atlanta, Kentucky	139 (20.3)	106 (22.2)	229 (21.9)	16 (13.8)
Louisiana	104 (15.2)	62 (13.0)	129 (12.3)	37 (31.9)
New Jersey	204 (29.8)	125 (26.2)	311 (29.7)	18 (15.5)
NCI Combined Comorbidity Index				
≤ 0	510 (74.5)	382 (80.1)	809 (77.3)	83 (71.6)
> 0	175 (25.5)	95 (19.9)	237 (22.7)	33 (28.4)

Characteristic (N=1162)	5-FU N (%)	oxaliplatin N (%)	CA N (%)	AA N (%)
Tumor Grade *				
Well differentiated, NOS	41 (6.0)	17 (3.6)	53 (5.1)	<11
Moderate differentiation	428 (62.5)	302 (63.3)	653 (62.4)	77 (66.4)
Poorly differentiated	191 (27.9)	132 (27.7)	297 (28.4)	26 (22.4)
Undifferentiated, anaplastic, not determined	25 (3.6)	26 (5.5)	43 (4.1)	<11
Diagnosis year				
2003	83 (12.1)	19 (4.0)	89 (8.5)	13 (11.2)
2004	403 (58.8)	180 (37.7)	526 (50.3)	57 (49.1)
2005	199 (29.1)	278 (58.3)	431 (41.2)	46 (39.7)

* Due to SEER-Medicare confidentiality requirements, categories are combined or ranges are presented to suppress cell sizes of ten or less.

CA=Caucasian American, AA=African American, sd=standard deviation

Table 2

Study Results: Comparison of Treatment Receipt and Mortality by Race and Chemotherapy (N=1162)

	Crude Analysis		Adjusted* Analysis	
Comparison of treatment receipt	**PR**	**95% CI**	**PR**	**95% CI**
Received FOLFOX by race (AA vs. CA)	0.99	0.78, 1.24	0.90	0.71, 1.13
Comparison of mortality	HR	95% CI	HR	95% CI
Mortality by treatment (FOLFOX vs. 5-FU)	0.73	0.57, 0.93	0.76	0.58, 1.00
Mortality by race (AA vs. CA)	0.83	0.56, 1.22	0.84	0.56, 1.28
Mortality by race (AA vs. CA), treatment adjusted	0.83	0.57, 1.23	0.85	0.56, 1.28

*Adjusted for age, sex, urbanity, tumor grade, tumor substage, site of tumor, SEER registry, median income, radiation, NCI-Combined Comorbidity Index for all models; race, year of treatment for models looking at treatment and mortality.

PR=Prevalence Ratio, HR=Hazard Ratio, CI=Confidence Interval, CA=Caucasian American, AA=African American

Table 3

Strata-Specific Estimates and Interaction of Treatment and Race (N=1162)

	Stratified		Individual/Joint effects	
Exposure	**HR***	**95% CI**	**HR***	**95% CI**
Caucasian American				
5-FU without oxaliplatin	1.0 (referent)		1.0 (referent)	
Oxaliplatin	0.83	0.62 to 1.10	0.83	0.62 to 1.09
African American				
5-FU without oxaliplatin	1.0 (referent)		1.08	0.68 to 1.71
Oxaliplatin	0.31	0.12 to 0.83	0.33	0.13 to 0.83

* Adjusted for age, sex, urbanity, tumor grade, tumor substage, site of tumor, SEER registry, median income, radiation, NCI-Combined Comorbidity Index and year of treatment.

HR=Hazard Ratio, CI=Confidence Interval