



## Examining the role of access to care: Racial/ethnic differences in receipt of resection for early-stage non-small cell lung cancer among integrated system members and non-members

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### ABSTRACT

**Objectives:** To examine the role of uniform access to care in reducing racial/ethnic disparities in receipt of resection for early stage non-small cell lung cancer (NSCLC) by comparing integrated health system member patients to demographically similar non-member patients.

**Materials and methods:** Using data from the California Cancer Registry, we conducted a retrospective cohort study of patients from four racial/ethnic groups (White, Black, Hispanic, Asian/Pacific Islander), aged 21–80, with a first primary diagnosis of stage I or II NSCLC between 2004 and 2011, in counties served by Kaiser Permanente Northern California (KPNC) at diagnosis. Our cohort included 1565 KPNC member and 4221 non-member patients. To examine the relationship between race/ethnicity and receipt of surgery stratified by KPNC membership, we used modified Poisson regression to calculate risk ratios (RR) adjusted for patient demographic and tumor characteristics.

**Results:** Black patients were least likely to receive surgery regardless of access to integrated care (64–65% in both groups). The magnitude of the black-white difference in the likelihood of surgery receipt was similar for members (RR: 0.82, 95% CI: 0.73–0.93) and non-members (RR: 0.86, 95% CI: 0.80–0.94). Among members, roughly equal proportions of Hispanic and White patients received surgery; however, among non-members, Hispanic patients were less likely to receive surgery (non-members, RR: 0.93, 95% CI: 0.86–1.00; members, RR: 0.98, 95% CI: 0.89–1.08).

**Conclusion:** Disparities in surgical treatment for NSCLC were not reduced through integrated health system membership, suggesting that factors other than access to care (e.g., patient-provider communication) may underlie disparities. Future research should focus on identifying such modifiable factors.

### 1. Introduction

Patients diagnosed with early-stage (I-II) non-small cell lung cancer (NSCLC) who undergo surgery experience substantially better outcomes than those who do not. Five-year survival rates range from 60 to 80% for resected stage I disease and from 30 to 50% for resected stage II disease, compared to 15% for non-resected stage I and II disease [1]. A multitude of previous studies have concluded that black patients are less likely than white patients to receive surgery [2–9], likely contributing to documented disparities in NSCLC survival [2]. It is crucial

to understand the current extent of, and factors underlying racial/ethnic differences in receipt of surgical treatment for early stage NSCLC, with the goal of informing strategies to improve the equity of care.

The pathway from lung tumor detection to surgery can be complex, requiring sequential coordination of multiple providers [10–12] who may be distributed across systems. Previous research has suggested that disparities in receipt of recommended lung cancer treatment may result at least in part from racial differences in patients' ability to access specialty care services along this pathway. For example, black patients with NSCLC are less likely than white patients to be evaluated by a

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surgeon [13]. This may be due in part to differences in where black and white patients receive their routine care, as primary care providers whose patient panels consist primarily of minorities report greater difficulties accessing high-quality specialty care for their patients [14].

Patients who are members of integrated health care delivery systems experience more uniform access to local primary and specialty care services that are well-coordinated through the use of common information systems and referral networks [15,16]. Prior research suggests that, as a result, in integrated systems, cancer care delivery may be more equitable [17–19]. However, no studies have examined the role of uniform access to care in potentially reducing lung cancer treatment disparities by directly comparing racial/ethnic differences in initial treatment among members of an integrated health care delivery system to those among non-members. To address this gap, we analyzed data from the California Cancer Registry (CCR) on a contemporary and diverse cohort of patients diagnosed with early stage NSCLC. We hypothesized that racial/ethnic differences in the receipt of surgical resection would be minimized among members, compared to non-members, of an integrated health care system.

## 2. Methods

### 2.1. Study setting and population

Kaiser Permanente Northern California (KPNC) is a fully integrated health care delivery system currently serving approximately four million members at 21 medical centers across 23 counties in Northern California. The system serves a diverse membership largely representative of the insured population in Northern California, except at extremes of the socioeconomic spectrum [20]. As mandated by law, KPNC reports all verified cancers to the CCR and the U.S. Surveillance, Epidemiology, and End Results (SEER) Program. Following SEER Program standards, the KPNC Cancer Registry has captured data on all patients diagnosed or treated with any primary cancer, except non-melanoma skin cancer, at KPNC facilities since 1988.

Patients of known race/ethnicity with a first primary diagnosis of stage I or II NSCLC at ages 21 to 80 from 2004 to 2011 were identified from the KPNC Cancer Registry and the CCR. NSCLC was defined using the Surveillance, Epidemiology, and End Results (SEER) site code 22030, including morphology codes 8012–8040 and 8046–8576; histologic subgroups were defined as proposed by Lewis and colleagues [21]. Tumor stage was based on the American Joint Commission on Cancer TNM Staging System, 6th edition, for the entire study period. Patients older than age 80 were excluded to minimize potential differences in treatment associated with age. Patients were also excluded if they were not classified as White, Black, Asian/Pacific Islander (API), or Hispanic; diagnosed at autopsy; or resided in a county not served by KPNC at NSCLC diagnosis.

KPNC member patients were distinguished from non-member patients according to whether they were first diagnosed with NSCLC at KPNC or elsewhere. Identification of KPNC member versus non-member patients who met study inclusion criteria involved probabilistic linkage of records from the KPNC Cancer Registry to the CCR using unique personal identifiers: first and last name, alias, gender, social security number, dates of birth and diagnosis, and residential address and zip code at diagnosis. This linkage process encompassed six blocking passes, by which all eligible patients identified from the KPNC Cancer Registry were matched to CCR records with high confidence. The November 2014 extract of the CCR was used, with patient follow-up data complete through 2012.

Institutional review boards of both KPNC and the California State Committee for the Protection of Human Subjects approved conduct of this study under a waiver of informed consent.

### 2.2. Data sources and variables

All data on demographic and clinical characteristics, including an area-level measure of socioeconomic status (SES) [22], along with initial treatment (up to six months post-diagnosis) for KPNC members and non-members were ascertained from the CCR. The outcome of interest was receipt of surgery for lung cancer. The main independent variable in our analyses was race/ethnicity, as reported in patients' medical records and abstracted for the CCR (White, Black, Hispanic, or API). Race/ethnic categories were mutually exclusive.

### 2.3. Statistical analysis

Summary statistics for patient characteristics were tabulated separately by KPNC membership status. Given that all variables were categorical, percent distributions were calculated for each group and compared using the Pearson chi-square test. We used modified Poisson regression with robust standard errors [23] to assess the relationship between race/ethnicity and receipt of surgical resection, stratified by KPNC membership. Risk ratios (RRs) and 95% confidence intervals (CIs) were estimated adjusting for potential confounders, including patient demographic (gender, age, marital status, area-level socioeconomic status) and tumor characteristics (stage, size, histologic subtype). All analyses were conducted using SAS 9.3 (Cary, NC).

To assess the potential impact of differential death or loss to follow-up on our results, we calculated the proportions of patients in each racial group who died or were lost within one month and six months of NSCLC diagnosis, among KPNC members and non-members separately. In sensitivity analyses, we excluded patients who died or were lost within one month ( $n = 5$  KPNC members, 74 non-members) and within six months ( $n = 94$  KPNC members, 395 non-members) of diagnosis from our multivariate models. Additional sensitivity analyses excluded patients with a documented contraindication for surgery (44 KPNC members, 79 non-members). To facilitate comparison to previous studies of NSCLC treatment disparities, several of which have used SEER-Medicare data, we also restricted inclusion of KPNC members and non-members to those ages 65 and older (1053 KPNC members, 3801 non-members). Finally, because stereotactic body radiotherapy (radio-surgery) became available during our study period as an alternative treatment for early-stage NSCLC patients who are ineligible for surgery, we also considered a composite outcome of surgical resection or radiosurgery (28 KPNC members and 89 non-members in our sample received radiosurgery).

## 3. Results

### 3.1. Characteristics of KPNC members and non-members

Our final sample consisted of 5786 patients with stage I or II NSCLC, including 1565 KPNC members and 4221 non-members (Table 1). By race/ethnicity, a slightly greater proportion of KPNC vs. non-KPNC patients were black (8% vs. 6%) and Asian/Pacific Islander (15% vs. 12%). Compared to non-members, KPNC members were more likely to be female (58% vs. 53%) and married (59% vs. 56%). Nearly all non-members (99%) had insurance. Most (56%) were covered by Medicare; 27% had private insurance; 8% had Medicaid; and 9% had other/unknown insurance. KPNC members were also more commonly diagnosed with stage I vs. stage II disease (83% vs. 80%). Patients residing in the lowest SES areas were substantially more likely to receive care outside of KPNC (28% vs. 18%).

The distribution of patient characteristics by surgery receipt among KPNC members and non-members is displayed in Table 2. Across both groups, older patients, unmarried patients, and those living in lower SES areas were less likely to undergo surgery, as were those with larger tumors or stage II (versus stage I) disease. In addition, females were more likely to undergo surgery than males, although this difference was

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