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Authors

Green, Jonas B
Shapiro, Martin F
Ettner, Susan L
[et al.](#)

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Physician Variation in Lung Cancer Treatment at the End of Life

Running Head: Physician Variation in Lung Cancer

Jonas B. Green¹, MD, Martin F. Shapiro²,^{Error: Reference source not found}, MD, PhD Susan L. Ettner^{Error: Reference source not found},³, PhD Jennifer Malin^{Error: Reference source not found},⁴, MD, PhD Alfonso Ang^{Error: Reference source not found}, PhD, Mitchell D. Wong^{Error: Reference source not found}, MD, PhD

Precis: Patients receiving care for aNSCLC in small, independent oncology practices are more likely to receive chemotherapy in the last 30 days of life.

Take-away points and Implications: Treating Oncologists characteristics explain significant variation in patients' receipt of chemotherapy in the last 30 days of life:

- [Rates of chemotherapy administration at the end of life vary depending on characteristics of the patient and provider, and geographic location](#)
- [Oncologists in private — particularly smaller — practices are more likely to administer chemotherapy within 30 days of death](#)
- [Established inconsistencies between patient goals at the end of life and aggressive treatment may be influenced by who provides the care](#)
- ~~Patients should understand variation in practices among oncologists treating the same condition~~
- ~~Payers may wish to consider oncologist practice type in determining network participation~~
- ~~Awareness of variation may influence individual oncologist's practice decisions and eventually lead to consensus practices at end of life; practices may already have changed since the period under study~~

¹ Cedars-Sinai Medical Care Foundation, Beverly Hills, CA

² Division of General Internal Medicine and Health Services Research, Department of Medicine, David Geffen School of Medicine, University of California, Los Angeles

³ Department of Health Policy and Management, Fielding School of Public Health, University of California, Los Angeles

⁴ West Los Angeles Veterans Administration

- Less variation is likely to yield better alignment between patient goals and treatment received, and result in higher value care at the end of life

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Pages: 29; **Word Count:** 3056; **References:** 33; **Figures:** 1; **Tables:** 3

Corresponding Author: Jonas Green; Jonas.green@cshs.org; Ph: (310) 385-2997 Fax: (310) 858-7911

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- Patients should understand variation in practices among oncologists treating the same condition
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Abstract

Background

To determine whether treating oncologist's characteristics are associated with variation in use of chemotherapy for patients with Advanced non-small cell lung cancer (aNSCLC) at the end of life

Methods

Using the 2009 SEER-Medicare database, we studied chemotherapy receipt within 30 days of death among Medicare enrollees who were diagnosed with aNSCLC between 1999 and 2006, received any chemotherapy, and died within three years of diagnosis. A multilevel model was constructed to assess the contribution of patient and physician characteristics, and geography to receiving chemotherapy within 30 days of death.

Results

Among 21,894 patients meeting eligibility criteria, 43.1% received chemotherapy within 30 days of death. In unadjusted bivariate analyses, female sex, Asian or Black race, older age, and a greater number of comorbid diagnoses predicted lower likelihood of receiving chemotherapy at the end of life ($p \leq 0.038$ for all comparisons). Adjusting for patient and physician characteristics, physicians in small independent practices were substantially more likely than those employed in other practice models, particularly academic practices or non-government hospitals, to order chemotherapy for a patient in the last 30 days of life ($p < .001$ for all comparisons); female physicians were less likely than males to prescribe such treatment ($p = .04$).

Conclusions

Patients receiving care for aNSCLC in small, independent oncology practices are more likely to receive chemotherapy in the last 30 days of life.

Introduction

Despite a half century of treatment advances, lung cancer, the most common solid tumor in the United States, remains among the cancers least responsive to treatment.¹ A majority of patients are diagnosed at an advanced stage and, even with the newest therapies, barely one in ten are alive a year after diagnosis. In the final weeks of life many patients with advanced non-small cell lung cancer (aNSCLC) undergo aggressive treatment that can include repeated emergency visits, prolonged hospitalizations, intensive care, and even additional lines of chemotherapy that contravene guidelines.⁴⁻⁸ Attendant effects on quality of life are well documented, and the value of such expensive treatment is debated in lay, clinical, and policy realms.⁹⁻¹¹

Why aggressive end of life treatment occurs is not clearly understood. Regional variations in aggressiveness of cancer treatment are well documented and patient factors have been explored;¹²⁻¹³ however, the degree of variation between individual physicians is not known. We conducted this study to determine the extent to which physician characteristics explain receipt of chemotherapy in the 30 days prior to death among patients with aNSCLC .

Methods

Sources of Data

We used the 2009 SEER-Medicare database,¹⁶ which links population-based cancer registry data with Medicare claims, to identify patients and describe treatment patterns. SEER regions include 28% of the United States population. Approximately 68% of lung cancers diagnosed in SEER regions are in

Americans older than 65.² Using the Unique Physician Identification Number Registry, we linked the physician submitting a Medicare claim to that physician's characteristics in the AMA Masterfile.¹⁷

Study cohort

Figure 1 details the initial sample and number of patients dropped due to each exclusion criterion. We first identified all patients in the SEER registry diagnosed with lung cancer between 1999-2006. We selected 1999 due to changes in physician's unique identification codes that year, and 2006 to allow for up to 3 years of data after diagnosis. We limited the sample to those ages 65+ at diagnosis who were enrolled in traditional Medicare Part A and Part B from at least 12 months prior to a first diagnosis of lung cancer until 3 years after diagnosis, or until death. Patients with other incident cancers were excluded to avoid erroneously counting chemotherapy directed toward another cancer. Among 193,200 subjects satisfying all conditions (lung cancer, age 65 and over, continuous enrollment in Medicare A and B, no other cancer), we excluded 4,518 subjects who died on unknown dates and 123 subjects with charges for chemotherapy after their recorded date of death. Our cohort was then limited to 155,794 patients with advanced (stage IIIb or IV) NSCLC; a further 38,311 were excluded for diagnosis dates out of range. We excluded 89,069 who had not received chemotherapy within 3 years of initial diagnosis and compared their characteristics with those who received chemotherapy. To avoid insufficient data biasing interpretation of physicians' practice patterns, subjects were excluded if not treated by an identifiable oncologist who provided care to five or more patients in the sample. In sensitivity analyses we evaluated the impact of physician characteristics on receipt of chemotherapy in the last 30 days of life for (i) all physicians irrespective of number of patients seen and (ii) physicians with 10 or more patients. Our final analytic sample comprised 21,894 aNSCLC subjects.

Construction of the Dependent Variable

Chemotherapy use was established by Medicare charges in outpatient, inpatient, or physician claims for chemotherapy-related encounters (ICD-9 diagnosis codes V58.1, V66.2, and V67.2), chemotherapy administration (ICD-9 procedure code 99.25; Current Procedural Terminology codes 96400 - 96549; Health Care Common Procedure Coding System codes J8530, J8560, J8600, J8610, J8999, Q0083 - Q0085 and G0921 - G0932; and revenue center codes 0331, 0332, and 0335) or chemotherapy agents (J-codes other than Diethylstilbestrol and Leuprolide). The primary outcome was whether a patient who ever received chemotherapy received a final dose during the last 30 days of life.

Patient-Physician Link

Administration of chemotherapy at the end of life was attributed to the oncologist submitting a Medicare claim with the latest date of service rendered prior to a patient's death. Sensitivity analysis was performed attributing the patient to the oncologist with the most visits. Physicians were considered oncologists if the billing physician's specialties in either Medicare claims or American Medical Association-linked physician files included oncology, hematology-oncology, or hematology.

Independent variables

Patient were classified by race (white, black, Hispanic, Asian, other), sex, age at diagnosis (65-69, 70-74, 75-79, 80-84, 85+), last known marital status, median income by zip code (by quartile, as a proxy for socioeconomic status), and year of diagnosis. Time between diagnosis and last chemotherapy was calculated and grouped (<1, 1, 2-3, 4-5, 6-7, 8-9, 10-11, 12-23, 24-36 months) as it was hypothesized that recent diagnosis might be associated with receiving treatment at the end of life. We also included proportion of African Americans in the patient's residential zip code and birthplace outside of the United States.

We calculated a modified Charlson Comorbidity score for each patient using ICD-9 coded diagnoses from inpatient claims, carrier claims, and outpatient claims using the Wang method.¹⁸ In order to approximate patients' health leading up to death, comorbidity scores were calculated from claims for services provided during the 12 months prior to the month of death.

Physician characteristics included in the model were sex and year medical training was completed. Age was strongly correlated with year of training completion and thus excluded. We examined type of practice based on the present employer variable from the AMA Masterfile. We classified this variable into six categories: small independent (physician owned, 1-2 physicians), group practice (physician-owned, >2 physicians), government (employed by city, county, state, or federal government), academic (employed by medical schools), hospital (employed by non-government owned hospital) and other.

As there is good evidence supporting geographic variations in treatment practices, we sought to control for such variation based on SEER registry sites, but because of its size and previously demonstrated practice variation,¹² California was split by county into four zones: Los Angeles, non-LA Metro-South (San Diego, Riverside, San Bernardino, Orange, Ventura), Metro-North (San Francisco, Alameda, Santa Clara, Contra Costa, San Mateo, Marin), and Other. Rural Georgia with just 47 eligible cases was combined with Atlanta, yielding a single site for all of Georgia. SEER sites were otherwise categorized according to the SEER 17 registry.¹⁹

Statistical Analysis

Frequency distributions were calculated for patient, oncologist, and geographic variables. We used a multi-level logistic regression mixed model with dichotomous outcomes to estimate the probability of receiving chemotherapy treatment in the last 30 days of life. Patients were nested within physicians, who in turn were nested within geographic location (SEER site, modified as above) as a random intercept at the highest level. The model adjusted for the patient and physician covariates described above. To facilitate interpretation of the magnitude of the effects, adjusted relative risks are presented along with the coefficient estimates and p-values from the regression.

To calculate the marginal effect of physician's type of practice on receiving chemotherapy at the end of life, each patient's probability of receiving treatment was recalculated as if all received treatment under a uniform type of practice, adjusting for patient variables and other physician variables. This was repeated for each type of practice.

UCLA's institutional review board approved the study.

Results:

We identified 23,687 continuously enrolled Medicare (parts A & B) patients diagnosed with aNSCLC between 1999 and 2006. Table 1 shows the distribution of patient characteristics and associated probability of receiving chemotherapy within 30 days of death, among the 21,894 (92.4%) patients receiving chemotherapy within three years of diagnosis. Of these, 9447 (43.1%) received chemotherapy within 30 days of death.

In bivariate analyses, men were more likely than women to receive chemotherapy near the end of their lives (45.9% vs 39.5%, $p < 0.001$). (**Table 1**) Patients were less likely to receive chemotherapy at the end of life if they were Asian (33.3%) or black (40.0%) compared to whites (43.9%, $p < 0.001$), older (40.8% among ages 85+ compared to 44.4% among age 65-69, $p = 0.04$), had more comorbidities ($p = 0.001$), or were diagnosed in 2005 (37.8%) or 2006 (37.5%) as compared with 1999 (43.9%) ($p < .001$). Despite these differences in treatment, none of these variables were associated with a difference in survival (data not shown).

Characteristics of the 89,069 patients excluded for non-receipt of chemotherapy matched closely on race, sex, year of diagnosis, and SEER site categories. Younger patients and those with low comorbidity scores were more likely to have started chemotherapy than were older and sicker patients; females were slightly more likely than males to have never received chemotherapy.

Physician characteristics and the numbers of patients attributed to physicians with each characteristic are shown in Table 2. Oncologists were primarily male (77.4%) and in group practices (61.2%).

Physicians in small independent practices were significantly more likely to administer chemotherapy during the last 30 days of life. (**Table 2**) Adjusting for all patient and provider covariates, the predicted probability of receiving chemotherapy in the last 30 days of life was 1.4-fold greater (0.56) for patients receiving care in small independent practices relative to those seeing oncologists in academic centers, (0.40, $p < 0.001$) (**Table 3**). Predicted probabilities for patients receiving care in group practices, government, hospitals, and other types of practice, were 0.55, 0.46, 0.42, and 0.52 respectively. Female oncologists were significantly less likely to administer chemotherapy at end of life ($p < 0.001$). Magnitude

and direction of predictors were not meaningfully changed when analyses were repeated for patients of physicians treating at least 10 patients.

Adjusting for other patient and physician characteristics, the predicted probabilities of receiving chemotherapy in the last 30 days of life were lower for blacks, women, subjects age 75 or older, those diagnosed in 2005 or 2006 (vs. 1999), those for whom 2 or more months had elapsed since diagnosis, and those with comorbidity scores of 3-5 or 6-8. Even within these subgroups, at least one-third would have been predicted to receive chemotherapy in the last 30 days of life. (**Table 3**) Marital status and zip code level median income categories were not significant predictors of chemotherapy receipt at end of life.

Overall the model explained 28.9% of variation in chemotherapy use in the last 30 days of life among patients who were being treated for aNSCLC. Geographic location of care was a significant fixed-effects parameter ($p < 0.001$), and accounted for 16.0% of variation in chemotherapy use at the end of life. Patient characteristics accounted for 5.8%, while physician characteristics accounted for 7.1% of explained variation in chemotherapy use in the last 30 days of life.

Discussion

Advanced cancer is emotionally fraught and physically taxing, causing a great deal of suffering. While patients are concerned about both quality and quantity of life,²⁰ most prefer not to undergo aggressive treatment at life's end,²¹ making it particularly important that they understand expected clinical outcomes from treatment. Yet Weeks et al. found that 69% of patients with advanced lung cancer believed that they had some chance of cure.²² Physician guidance regarding goals of care, prospective benefits of therapy,

and helping weigh whether benefits are likely to outweigh expected side-effects are critical components of quality care.

Physician prognostication is inexact, however, and variations in practice may, to some extent, reflect this uncertainty. Healthcare practices are known to vary, sometimes substantially, by geographic region or hospital;¹² few studies have examined whether physician characteristics are associated with variation in difficult clinical decisions such as whether to continue therapy in the face of declining health.

While the optimal rate of chemotherapy use at the end of life is unknown, our data suggest that non-clinical factors may strongly influence treatment decisions. Forty-three percent of chemotherapy recipients in our study received final doses in the 30 days prior to death. Patients were much more likely to receive late chemotherapy if their physician was in a small independent practice or in a group practice. Of note, physicians in these types of practice were responsible for the care of almost three-quarters of all patients with advanced NSCLC. Since 2008, the ranks of community oncologists has dwindled,²⁹ and there has been a migration toward larger group practices;³⁰ chemotherapy use at the end of life has trended downward during this same period, though it is not known whether these events are correlated or coincidental.

The data does not allow us to conclude why type of practice is associated with the chemotherapy use at the end of life. Many factors are likely to be associated, including differences in practice style – such as attitudes toward aggressive treatment, perceptions of the benefit of treatment, and the desire to provide hope to patients – as well as financial incentives for providing more treatment. Physicians in different types of practice may also see patients with different expectations and preferences for care, perhaps because patients seeking more aggressive treatment self-select physicians willing to provide that care.

Even for patients desiring aggressive treatments, physicians have a duty to provide treatment only to patients who may reasonably be expected to benefit. Increased age and significant comorbid illness decrease the already limited benefits of late chemotherapy – our findings of lower likelihood of these populations initiating chemotherapy suggest that appropriate clinical factors are playing some role in treatment decisions. Aggressive treatment also comes at great financial expense. Treatment of stage IV NSCLC is associated with particularly low value: \$1.19 million per year of life saved.²³ While some commentators envision a ‘geriatric blast for oncologists’ as more Baby Boomers become Medicare-eligible,²⁴ humanistic and financial imperatives underline a need to reevaluate aggressive care for advanced cancers.²⁵

Our study confirms aspects of others’ work, generally conducted in a more heterogeneous group of cancers, while adding several important dimensions to the literature. Earle found that 15.7% of patients who start chemotherapy received a dose within 14 days of death.²⁶ We confirm even higher rates in the last 30 days of life, specifically among those with aNSCLC. We also reaffirm geographic variation previously noted. Our findings that physician characteristics predict patterns of care for aNSCLC patients at the end of life contribute a unique dimension to existing literature. Setoguchi, studying quality indicators in end-of-life care for lung, colorectal, breast and prostate cancers in New Jersey (a SEER site with high treatment rates at the end-of-life¹²) and Pennsylvania (not in SEER, average end-of-life rates), noted that oncologists in small group practices were more likely to administer chemotherapy and less likely to initiate hospice than those in large groups.²⁷ Our geographically broader study examined a specific cancer in advanced stage that responds only to a limited extent to chemotherapy. Controlling for geographic variation, we nonetheless found meaningfully higher rates in small independent practices and among male physicians. As others have noted, we found that chemotherapy receipt within 30 days of death decreased in 2005, corresponding with the substantial decline in reimbursement by Medicare for

providing outpatient chemotherapy, as well as FDA approval of an oral therapy (erlotinib), not included in our dataset.²⁸

This study has several limitations. Retrospective analysis of administrative data does not allow us to distinguish between aggressive treatment that is patient-driven from that which is physician-driven. It is possible that patients desiring aggressive treatment seek out physicians amenable to their demands, though this would not invalidate the observation that oncologists treating at higher rates gravitate to small independent practices. As our data are limited to Medicare patients living within SEER regions, and analysis limited to 1999 to 2006 diagnoses, results may not be generalizable to other populations or time periods. Data sources limited availability of physician demographics, practice characteristics, and the ability to distinguish among practices with more than two physicians. That so few measures explained more variation (7.1%) than the robust demographic data available for patients (5.8%) suggests that other physician characteristics may warrant exploration; parameters of interest might include physician wealth, marital status, and race, practice payer mix, and training environment. Assignment of responsibility to the last oncologist seen may incorrectly attribute final doses of chemotherapy, although this is unlikely to introduce bias regarding type of practice. Our study design did not permit inclusion of oral chemotherapeutic agents, e.g. erlotinib, possibly used by a subset of patients during later parts of the observation period, but whose inclusion could only have increased treatment rates near death.

The disconnect between how patients report preferring care at the end of life and how they actually die may have any number of causes including clinical uncertainty, poor prognostication, incomplete sharing of information with patients, misguided optimism, or physicians' failure to explore patients' preferences. Poor communication of information is notorious and pervasive. When two-thirds of patients with stage IV lung cancer are unaware that chemotherapy is unlikely to cure their cancer and therefore do not know they are approaching the end of life,²² surely fewer know that late aggressive therapy may actually foreshorten

life. Improved communication and early incorporation of palliative care can lead to care more consistent with patients' goals. Early enrollment in palliative care is associated with a significant decrease in receipt of chemotherapy close to death when chemotherapy's side-effects outweigh any potential benefit.³³ Better tools are needed to help oncologists determine how to communicate prognoses in ways that patients can understand, as well as how best to partner with patients in shared decision-making when a prognosis is poor. Together these would help determine when to advise a patient to avoid the risks and discomforts of chemotherapy, and enjoy what quality can be had during limited remaining life.

Prognosticative limitations notwithstanding, variable rates of late chemotherapy receipt signify inconsistency in how cancer is treated as death nears. As variations in practice are also a cost driver, evidence of variation between physicians suggests the need to improve physician acceptance of the responsibility to more judiciously steward resources, or, failing that, institute policies and practice guidelines to minimize variations in care.

When caring for people with advanced disease, an important aim of medicine includes helping patients experience death on their own terms. The present study provides some support for the common and long-held suspicion that our healthcare system may not always guide patients toward the best choices. Future efforts to improve experiences of patients with advanced disease may be dampened by the extent to which variation and potential overtreatment are due to the unintended and untoward effects of forces influencing physician decisions. For the time being, it is important for patients to be aware that characteristics of their physician and where they receive care might strongly influence the care they receive.

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