



# Narrative review of socioeconomic and racial disparities in the treatment of early stage lung cancer

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**Background:** To review and discuss the current literature regarding socio-economic and racial disparities in the treatment of early-stage non-small cell lung cancer (NSCLC).

**Background:** Lung cancer is the most lethal solid organ malignancy in the United States, with the second-highest incidence of new malignancies for both men and women. While overall survival for lung cancer is improving, significant socioeconomic and racial disparities in outcomes for lung cancer persist.

**Methods:** Narrative review of peer reviewed literature synthesizing findings retrieved from searches of computerized databases, primary article reference lists, authoritative texts and expert opinions.

**Results:** The current incidence of lung cancer appears to be similar between White and Black patients. However, Black patients are substantially less likely to receive curative intent surgery. Mitigation strategies do exist to narrow this inequity. Lower socioeconomic status (SES) is associated with a higher incidence of lung cancer, lower utilization of surgery and poorer outcomes after surgery.

**Conclusions:** Race and SES remain closely linked to outcomes in lung cancer. Outcomes are still worse when controlling for stage and specifically, in early-stage disease, surgical therapy is consistently underused in Black patients and patients of low SES.

**Keywords:** Disparity; inequity; race; lung cancer

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## Introduction

Lung cancer is the most lethal solid organ malignancy in the United States with more than 150,000 deaths in 2018 and accounting for approximately 25% of all cancer deaths (1). While, the majority of lung cancer patients present with metastatic disease, a third of patients present with locoregional disease and approximately fifteen percent present with localized disease only (1). Standard of care treatment for early-stage non-small cell lung cancer (NSCLC) is anatomic lung resection with a multi-station lymph node dissection. Survival after resection of early-

stage non-small cell lung cancer (ESNSCLC) can be greater than 85% at five years (2). For patients who are not surgical candidates, stereotactic ablative radiosurgery (SABR) provides high local control rates and improves survival, although surgical resection remains the standard of care (3).

While overall survival for lung cancer is increasing, significant disparities in outcomes for lung cancer persist. Socioeconomic and racial inequities are pervasive in lung cancer outcomes (4,5). Specifically, patients from lower socioeconomic status (SES) and of Black race have less favorable outcomes compared to those of high SES and non-Hispanic White race (6-9). As these two issues are

inextricably linked, both will be covered in this narrative review. We present the following article in accordance with the Narrative Review Reporting Checklist (available at: <http://dx.doi.org/10.21037/jtd-20-3181>).

## Methods

A literature search was conducted via PubMed and Medline databases using the following key words: Lung cancer, racial disparities, socioeconomic, race, Black and lung cancer screening. The inclusion criteria were (I) peer-reviewed academic journals published in English and between the years 1990 and 2020. (II) Research that focused on racial and socio-economic disparities in lung cancer treatment. (III) Research regarding racial and socio-economic differences in tobacco consumption. Manual searches of the reference lists of primary articles found from initial searches were also conducted. Editorials, commentaries and conference abstracts were excluded from the analysis. The impactful and salient articles in the author's opinion were reviewed and synthesized in this review.

## Discussion

### Racial inequities

#### Background

The incidence of lung cancer is currently similar between White Americans and Black Americans, with approximately 55 per 100,000 people (1). The rates for all new lung cancer cases have consistently decreased over the last two decades, mainly due to reduced rates of tobacco use. Historically, black men had the highest incidence of lung cancer of any racial and gender group (10). Some have suggested this was due to the high rates of smoking in black men in the southern United States and menthol cigarette smoking in the Black population (11). However, these differences have narrowed in recent years (12,13). Black patients still present with more advanced disease than their White counterparts (14,15). When accounting for the stage at presentation and other factors, Black patients still have lower five-year survival for local disease than their White counterparts. There is also data to suggest that Black patients receiving surgical resection are more likely to die during perioperative period (16).

There are many questions as to the origin of this disparity, as curative lung resection is a major operation with requisite pre-operative functional status and lung

function requirements. It has been postulated that disparity in early-stage cancer is due to poor preoperative functional status or lung function, though these assertions have limited support as the complete explanation for the inequity (17). Other more complex issues such as access to care, medical mistrust, disinformation, disparity in testing, disparity in lung function assessment and physician communication all likely play a part (18,19).

#### Utilization of surgery

Early reports demonstrate that Black patients were less likely to undergo curative intent surgical therapy (20). Bach *et al.* used the Surveillance, Epidemiology and End Results (SEER) Medicare database, to analyze patients with Stage I or Stage II NSCLC over the age of 65 for overall survival and the utilization of surgery. The five-year survival for Black and White patients who underwent lung cancer resection was similar at 39% and 43%, respectively. The five-year survival for patients who did not receive surgery was similar at 4% and 5%. However, 77% of White patients underwent surgery, while 64% of Black patients received surgery. Using hierarchical analyses controlling for age, stage, income, and comorbidities, Black race was still associated with receiving less surgery than White race. Thus, they concluded that race as a sole factor associated with the lower utilization of surgery and the disparity in overall survival between Black and White patients.

A more recent study by Dalwadi *et al.* used the SEER database in a more modern sample to look at the utilization of surgery by race (21). They analyzed patients aged 60 and over between 2004 and 2012 with Stage I and Stage II NSCLC. They report that Black patients received surgery at a 58 percent rate compared to 67 percent of White patients and had a two-year lung cancer-specific survival of 76 percent compared to 79 percent in White patients. When adjusting for stage, age, and treatment, the difference in survival was no longer significant.

Soneji *et al.* analyzed surgery utilization rates in early-stage cancer patients by race (9). Black patients were not recommended surgery at a 34% rate, while White and Asian patients had surgery not recommended at a rate of 24%. Overall survival for Black patients, including all causes, was lower for Black patients. When controlling for the receipt of surgery in patients with early-stage lung cancer, there was still worse overall survival for Black patients. This was found to be due to higher rates of death from other competing causes, including heart and kidney disease.

Our group recently chose to investigate this topic using the National Cancer Database (NCDB). We analyzed the utilization of local therapy (surgery and radiation) therapy (4). We found a similar trend with White patients receiving significantly more surgery than Black patients in our sample from 2004 to 2015 (67% *vs.* 60%,  $P < 0.001$ ). We also found that the rates of surgery for both Black and White patients improved dramatically from 2004 to 2015, with White patients increasing from 57% to 65% and Black patients increasing from 44% to 62%. When adjusting for the receipt of surgery, the survival difference between Black and White patients disappeared. In the most recent sample, Black patients who received surgery had improved survival compared to White patients, likely due to their younger age at diagnosis.

### Mitigation

As the studies above have clearly shown, there is a persistent inequity in the utilization of surgery between Black and White patients. Some groups have looked to determine the mechanism of the development of these inequities and how to mitigate them. Cykert *et al.* interviewed patients with newly diagnosed resectable lung cancer and asked them what factors influenced their decision to undergo or not undergo surgical resection (22). They found the same disparity in the utilization of surgery in Black patients as others found historically. Both White and Black patients' poor perception of patient-physician communication and negative perception of one-year survival after surgery were associated with deferring surgical therapy. Black patients with two or more comorbidities and no regular source of healthcare were very likely to defer surgery (22).

Multiple studies have shown that Black patients have complex views on the receipt of surgery. Studies have shown that poor physician-patient communication, misconceptions about cancer biology, and low trust all result in Black patients not choosing surgery when it is offered (23,24). A multi-site interventional study looked at eliminating the gap in utilizing surgery by using a three-pronged approach (25). The intervention was a real-time warning in the electronic medical record, feedback to the providers about the outcomes of early-stage lung cancer by race, and the utilization of a nurse navigator to manage the warning system. The intervention raised the level of local therapy for both races and equalized them from pre-intervention levels (25).

### Socioeconomic disparities

#### Background

Socioeconomic factors are broadly defined as a combination of income, education, area of residence, and insurance status. The Black population in America experiences a significantly lower SES than the White population in America. Specifically, Black people have lower levels of wealth, education and are more likely than White patients to live in urban areas (26-28). These inequities stem from the history of slavery, Jim Crow, and systemic racism in America.

Socioeconomic disparities in outcomes for all cancers have been widely noted (29). Specifically, for lung cancer, it has been demonstrated that the incidence of lung cancer increases as patients have lower SES (8,30). Based on race, patients of lower SES present with more advanced disease than those with higher status. Low SES is tied to tobacco use and is partially thought to be the driving force behind the high incidence of cancer in this group. However, environmental factors and exposures to other known carcinogens are likely to contribute (31,32). Some reports indicate that poor SES make it 70% more likely for men and 50% more likely for women to develop lung cancer (31).

#### Detection and management

Recently the National Lung Cancer Screening Trial and the NELSON trial in Europe have demonstrated improved lung cancer-specific survival for high-risk patients screened with CT scans (33,34). This benefit is most pronounced in women and racial minority patients. As in other areas in cancer care, disparities in screening exist based on SES (35). Specifically, uninsured patients are 72% less likely to get screened than insured patients. For patients with detected cancers, SES plays a role in their early management. Population-level data indicates that higher SES is associated with a higher likelihood of receiving the following indicated interventions: a brain MRI, lung resection, palliative radiation, and adjuvant chemotherapy. Lower SES is also closely associated with not receiving NCCN guideline-concordant care (36,37).

For ESNSCLC, the standard of care is anatomic lung resection with systematic lymph node sampling. Lower SES has not been associated with higher rates of refusal when surgery is offered (38). However, lower income and lower SES was associated with not receiving surgery or any local

therapy in several multivariable analyses using large datasets (4,39). These inequities in these studies persisted even when controlling for race. A recent meta-analysis of 46 studies showed that lower SES had an OR of 0.68 as compared to the highest SES for the receipt of surgery (40).

### Outcomes

Further compounding the inequities of SES and lung cancer are the outcomes of lower SES patients after surgery. First, even though patients with lower SES are diagnosed at a younger age, they are far more likely to suffer lung cancer mortality even when adjusting for stage at diagnosis (8). Even after pulmonary resection, lower SES was still associated with lower overall survival (41). Lower SES, specifically income and insurance status, on analysis of the National Cancer Database is associated with hospital readmission after surgical resection and readmission after surgical resection has been associated with decreased long-term survival (42,43). For patients who are found to have locoregional disease, it has been shown they are less likely to receive chemotherapy in the adjuvant setting, which improves survival (41,44,45).

### Conclusions

Race and SES remain closely linked to outcomes in lung cancer. It is likely that there many contributing factors as to why black patients are less likely to receive surgical therapy including racism, medical mistrust, suboptimal communication and nihilism. Though SES appears to be tied to the overall incidence of cancer, the incidence of lung cancer currently does not correlate with race alone. There seems to be a bias for patients to present with more advanced disease for both low SES and Black race. However, outcomes are still worse when controlling for stage. Specifically, in early-stage disease, surgical therapy is consistently underused in Black patients and patients of low SES. Our review does have limitations since we may not have included all the relevant published literature due to the limited electronic databases examined and the language criterion. However, our review attempts to summarize the empirical evidence concerning the disparities in the delivery of standard of care lung cancer treatment to patients of both low SES and Black race, and serves as a basis for future efforts to understand and attempt to remedy these disparities.

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### References

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. *CA Cancer J Clin* 2020;70:7-30.
2. Goldstraw P, Chansky K, Crowley J, et al. The IASLC

- lung cancer staging project: Proposals for revision of the TNM stage groupings in the forthcoming (eighth) edition of the TNM classification for lung cancer. *J Thorac Oncol* 2016;11:39-51.
3. Ball D, Mai GT, Vinod S, et al. Stereotactic ablative radiotherapy versus standard radiotherapy in stage 1 non-small-cell lung cancer (TROG 09.02 CHISEL): A phase 3, open-label, randomised controlled trial. *Lancet Oncol* 2019;20:494-503.
  4. Lutfi W, Martinez-Meehan D, Sultan I, et al. Racial disparities in local therapy for early stage non-small-cell lung cancer. *J Surg Oncol* 2020;122:1815-20.
  5. Williams CD, Salama JK, Moghanaki D, et al. Impact of race on treatment and survival among U.S. veterans with early-stage lung cancer. *J Thorac Oncol* 2016;11:1672-81.
  6. Teng AM, Atkinson J, Disney G, et al. Changing socioeconomic inequalities in cancer incidence and mortality: Cohort study with 54 million person-years follow-up 1981-2011. *Int J Cancer* 2017;140:1306-16.
  7. Islami F, Kahn AR, Bickell NA, et al. Disentangling the effects of race/ethnicity and socioeconomic status of neighborhood in cancer stage distribution in new york city. *Cancer Causes Control* 2013;24:1069-78.
  8. Yang R, Cheung MC, Byrne MM, et al. Do racial or socioeconomic disparities exist in lung cancer treatment? *Cancer* 2010;116:2437-47.
  9. Soneji S, Tanner NT, Silvestri GA, et al. Racial and ethnic disparities in early-stage lung cancer survival. *Chest* 2017;152:587-97.
  10. DeSantis CE, Miller KD, Goding Sauer A, et al. Cancer statistics for african americans, 2019. *CA Cancer J Clin* 2019;69:211-33.
  11. Park ER, Japuntich SJ, Traeger L, et al. Disparities between blacks and whites in tobacco and lung cancer treatment. *Oncologist* 2011;16:1428-34.
  12. Jemal A, Miller KD, Sauer AG, et al. Changes in black-white difference in lung cancer incidence among young adults. *JNCI Cancer Spectr* 2020;4:pkaa055.
  13. Haiman CA, Stram DO, Wilkens LR, et al. Ethnic and racial differences in the smoking-related risk of lung cancer. *N Engl J Med* 2006;354:333-42.
  14. Sineshaw HM, Sahar L, Osarogiagbon RU, et al. County-level variations in receipt of surgery for early-stage non-small cell lung cancer in the united states. *Chest* 2020;157:212-22.
  15. Schwartz KL, Crossley-May H, Vigneau FD, et al. Race, socioeconomic status and stage at diagnosis for five common malignancies. *Cancer Causes Control* 2003;14:761-6.
  16. Harrison MA, Hegarty SE, Keith SW, et al. Racial disparity in in-hospital mortality after lobectomy for lung cancer. *Am J Surg* 2015;209:652-8.
  17. Williams CD, Stechuchak KM, Zullig LL, et al. Influence of comorbidity on racial differences in receipt of surgery among US veterans with early-stage non-small-cell lung cancer. *J Clin Oncol* 2013;31:475-81.
  18. Berger M, Lund MJ, Brawley OW. Racial disparities in lung cancer. *Curr Probl Cancer* 2007;31:202-10.
  19. Hankinson JL, Odencrantz JR, Fedan KB. Spirometric reference values from a sample of the general U.S. population. *Am J Respir Crit Care Med* 1999;159:179-87.
  20. Ezer N, Mhango G, Bagiella E, et al. Racial disparities in resection of early stage non-small cell lung cancer: Variability among surgeons. *Med Care* 2020;58:392-8.
  21. Dalwadi SM, Lewis GD, Bernicker EH, et al. Disparities in the treatment and outcome of stage I Non-Small-cell lung cancer in the 21st century. *Clinical Lung Cancer* 2019;20:194-200.
  22. Cykert S, Dilworth-Anderson P, Monroe MH, et al. Factors associated with decisions to undergo surgery among patients with newly diagnosed early-stage lung cancer. *JAMA* 2010;303:2368-76.
  23. Margolis ML, Christie JD, Silvestri GA, et al. Racial differences pertaining to a belief about lung cancer surgery: Results of a multicenter survey. *Ann Intern Med* 2003;139:558-63.
  24. Gordon HS, Street RL Jr, Sharf BF, et al. Racial differences in trust and lung cancer patients' perceptions of physician communication. *J Clin Oncol* 2006;24:904-9.
  25. Cykert S, Eng E, Manning MA, et al. A multi-faceted intervention aimed at black-white disparities in the treatment of early stage cancers: The ACCURE pragmatic quality improvement trial. *J Natl Med Assoc* 2020;112:468-77.
  26. Ostrove JM, Feldman P. Education, income, wealth, and health among whites and african americans. *Ann N Y Acad Sci* 1999;896:335-7.
  27. Yeung WJ, Conley D. Black-white achievement gap and family wealth. *Child Dev* 2008;79:303-24.
  28. Pfeffer FT, Killewald A. Intergenerational wealth mobility and racial inequality. *Socius* 2019. doi: 10.1177/2378023119831799.
  29. Singh GK, Jemal A. Socioeconomic and racial/ethnic disparities in cancer mortality, incidence, and survival in the united states, 1950-2014: Over six decades of changing patterns and widening inequalities. *J Environ Public*

- Health 2017;2017:2819372.
30. Hastert TA, Beresford SA, Sheppard L, et al. Disparities in cancer incidence and mortality by area-level socioeconomic status: A multilevel analysis. *J Epidemiol Community Health* 2015;69:168-76.
  31. Mao Y, Hu J, Ugnat AM, et al. Socioeconomic status and lung cancer risk in Canada. *Int J Epidemiol* 2001;30:809-17.
  32. van Loon AJ, Goldbohm RA, Kant IJ, et al. Socioeconomic status and lung cancer incidence in men in the Netherlands: Is there a role for occupational exposure? *J Epidemiol Community Health* 1997;51:24-9.
  33. de Koning HJ, van der Aalst CM, de Jong PA, et al. Reduced lung-cancer mortality with volume CT screening in a randomized trial. *N Engl J Med* 2020;382:503-13.
  34. National Lung Screening Trial Research Team, Aberle DR, Adams AM, et al. Reduced lung-cancer mortality with low-dose computed tomographic screening. *N Engl J Med* 2011;365:395-409.
  35. Zgodic A, Zahnd WE, Miller DP Jr, et al. Predictors of lung cancer screening utilization in a population-based survey. *J Am Coll Radiol* 2020;17:1591-601.
  36. Shah M, Parmar A, Chan KKW. Socioeconomic disparity trends in diagnostic imaging, treatments, and survival for non-small cell lung cancer 2007-2016. *Cancer Med* 2020;9:3407-16.
  37. Obrochta CA, Murphy JD, Nara A, et al. Disparities in receipt of guideline concordant treatment for early-stage non-small cell lung cancer (NSCLC) patients in California. *JCO* 2019;37:160.
  38. Mehta RS, Lenzner D, Argiris A. Race and health disparities in patient refusal of surgery for early-stage non-small cell lung cancer: A SEER cohort study. *Ann Surg Oncol* 2012;19:722-7.
  39. Kærgaard Starr L, Osler M, Steding-Jessen M, et al. Socioeconomic position and surgery for early-stage non-small-cell lung cancer: A population-based study in Denmark. *Lung Cancer* 2013;79:262-9.
  40. Forrest LF, Adams J, Wareham H, et al. Socioeconomic inequalities in lung cancer treatment: Systematic review and meta-analysis. *PLoS Med* 2013;10:e1001376.
  41. Khullar OV, Gillespie T, Nickleach DC, et al. Socioeconomic risk factors for long-term mortality after pulmonary resection for lung cancer: An analysis of more than 90,000 patients from the national cancer data base. *J Am Coll Surg* 2015;220:156, 168.e4.
  42. Medbery RL, Gillespie TW, Liu Y, et al. Socioeconomic factors are associated with readmission after lobectomy for early stage lung cancer. *Ann Thorac Surg* 2016;102:1660-7.
  43. Hu Y, McMurry TL, Isbell JM, et al. Readmission after lung cancer resection is associated with a 6-fold increase in 90-day postoperative mortality. *J Thorac Cardiovasc Surg* 2014;148:2261, 2267.e1.
  44. Farrow NE, An SJ, Speicher PJ, et al. Disparities in guideline-concordant treatment for node-positive, non-small cell lung cancer following surgery. *J Thorac Cardiovasc Surg* 2020;160:261, 271.e1.
  45. Blom EF, Ten Haaf K, Arenberg DA, et al. Disparities in receiving guideline-concordant treatment for lung cancer in the United States. *Ann Am Thorac Soc* 2020;17:186-94.

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