

Lung cancer care: the impact of facilities and area measures

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Abstract: Lung cancer is the leading cause of cancer related mortality in the US, and while treatment disparities by race and class have been well described in the literature, the impact of social determinates of health, and specific characteristics of the treatment centers have been less well characterized. As the treatment of lung cancer relies more upon a precision and personalized medicine approach, where patients obtain treatment has an impact on outcomes and could be a major factor in treatment disparities. The purpose of this manuscript is to discuss the manner in which lung cancer care can be impacted by poor access to high quality treatment centers, and how the built environment can be a mitigating factor in the pursuit of treatment equity.

Keywords: Disparities; lung cancer; social determinates of health

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The reality of treatment disparities in lung cancer outcomes in the US has been well documented (1). Much of the research has focused on the individual effect of race and socioeconomic status in the attainment of stage appropriate therapies (2,3). Repeatedly, it has been shown that poorer patients of all races, and African Americans are less likely to receive stage-appropriate care, including surgery, radiation, and systemic therapy for their lung cancer (4-10). The reasons for treatment-based disparities are multifactorial, with contributions from patients, providers, and disease-related factors, which have garnered much of the research scrutiny (11). Along with race, ethnicity, and socioeconomic position, the role of access to care has been very important in the discussion of racial disparities (11-16). Given the importance of multidisciplinary team approaches and precision personalized treatment options, access to care takes on increased importance.

Referral patterns, residential segregation, institutional characteristics, and the overall ethos of the facility can drastically impact the ability of individual patients to obtain high quality treatment. Over 50 years of descriptive research

has focused on patient level variables in disparities, but the impact of area measures has been less well characterized.

The impact of surgery

For lung cancer, the greatest impact on survival has always been in surgically resectable disease, and for this reason the focus of this review will be on the impact of the institutional and area effects, on attaining high quality surgical resection. Although early stage lung cancer only comprises a small percentage of the total cases of lung cancer (17), not having the opportunity to obtain curative treatment in even a small subset of patients can have a major impact on survival. This can affect African-Americans, and patients of lower SEP disproportionately (18). Being self-identified as Black or African American, race is a negative predictor of obtaining surgery for early stage disease. Bach *et al.* (4) in their seminal paper used the SEER-Medicare database to evaluate surgery patterns, and discovered treatment disparities in surgery for early stage lung cancer by race in an equal access system. This suggested that differences in survival between

African-Americans and Whites could be explained by the difference in rates of surgery. When they did have surgery, however, similar treatment resulted in similar outcomes, with no difference in survival between the races (5).

Due to the results of these studies, patient preference has been considered as one factor in the lack of surgical attainment among ethnic minorities (19). Margolis *et al.* (20) evaluated beliefs about surgery, in African American men. The authors found that African American men at various hospitals believed that surgery for lung cancer caused the disease to spread. Some patients indicated that they would decline lung cancer surgery if offered for this very reason. While this could be a factor, in a SEER-Medicare data analysis of health care claims data in the US, review of the reasons that lung cancer surgery was not performed indicated that African-American patients had surgery recommended less often than Whites and also refused surgery slightly more than White patients (5). This has been replicated in state cancer registries (6).

Surgical volume and access to care

Expertise of the institution is often measured in volume of surgery. Surgical volume is one of the most studied variables in the literature. There is clearly a link between the volume of surgeries performed in a facility and the measured quality outcomes of the procedure (21). Work by Birkmeyer *et al.* examined this question in lung cancer, but also in cardiothoracic, and orthopedic surgery (22-27). The concentration of surgical oncology specialties in specific high volume centers reflects a pattern that can have deleterious effects on poor, and minority patient populations (28). If the hospitals that have the most expertise are also the least diverse, this could lead to an exacerbation of the known disparities in lung cancer.

Access to specialized cancer centers

A systematic review by Reade and Elit found survival and other patient outcomes in ovarian cancer were more favorable for patients treated by “specialized high-volume physicians at specialized high-volume centers” (29). Research by Onega *et al.* has further suggested that the effects of racial disparities on African Americans, particularly mortality risk for lung, breast, colorectal, and prostate cancers, were attenuated for patients at National Cancer Institute (NCI) cancer centers (28). A key challenge to increasing access to NCI cancer centers for underserved

populations is access to referral pathways. Typically, cancer-related care may be obtained through multiple pathways depending on: the presence and severity of symptoms, whether a patient has an established primary care provider, and subsequent evaluation findings. In each leg of each pathway, delays in diagnosis and treatment may occur due to missed appointments, time lags in appointments with specialists, lack of follow up by primary or specialist care providers, or lack of patient follow up. Delays and under-referral to these specialists are problematic given evidence that the care specialized cancer centers provide yields improved outcomes (30-33).

The idea that African-American patients refuse treatment more than White patients due to distrust of the medical system is prevalent, and is often attributed to the devastating effect of the Tuskegee experiments (13). While mistrust likely plays a role in health disparities, it is but one of the many factors that account for treatment choices.

In fact, the reason for lower rates of surgery for underrepresented patients with lung cancer is likely due to a combination of factors, similar to the reasons for underrepresentation in clinical trials, including: decreased access to trials, physician triage approaches and awareness of novel therapies, distrust of medical research, and structural barriers to trial entry (34-37). As noted by Ford *et al.*, “this lack of diversity in randomized study populations reduces opportunities for discovering effects that may be particularly relevant to underrepresented populations” (38).

Built environment

The impact of the neighborhood on public health has become a very important aspect of treatment. Area measures of socioeconomic status, including census tract, and county measures of poverty have been used to elucidate the effect of environment on disease outcomes. The use of this variable in lung cancer has been understudied. The next stage of cancer care disparities research involves combining the individual level data, with area level measures that can incorporate neighborhood effects. Work by Krieger *et al.* (39-42) has emphasized the importance of adding area-based socioeconomic measures to these types of analyses. The addition of area-based measures allows for further evaluation of neighborhood level factors that can cause disparities, as the built environment can affect all areas of the cancer continuum (43-45). Health behaviors, as well as the health of individuals, are a consequence of social, biological, and behavioral interactions (46,47). However,

the multilevel nature of these inter-relations makes them complicated to model in ways that can disaggregate the impact of environmental factors from individual factors (43,46). Recent advances in multilevel and systems analysis methods have led to a rapidly growing literature on the influence of environments on health behaviors and chronic disease risk factors (48). Studies examining neighborhood characteristics have found persistent associations, after adjustment for individual-level variables, with health-related characteristics such as smoking, physical activity, intake of healthy foods, self-reported health, as well as chronic disease and risk factors such as overweight/obesity (49-60), hypertension, dyslipidemia, insulin resistance, kidney disease, sub-clinical atherosclerosis, and type 2 diabetes (55,60-64).

Solutions

Delivery models incorporating collaborative care between oncology specialists and primary care providers offer the potential to improve patient care in several areas, including continuity of care, managing co-morbidities, and supportive care (65). A wide range of primary-specialist collaborative care models exist: affiliations between community health centers (CHCs) and specialty practices or hospitals; telephone and videoconference provider-provider consultations; visiting specialist services/outreach clinics in primary health care settings; co-locations of independent primary and specialty care practices; specialists from other institutions stationed at CHCs; specialists employed within a CHC; CHCs that provide primary and specialized care for specific patient populations (e.g., behavioral health, substance abuse); and specialty practices that employ primary care providers (66-72). Furthermore, co-location fosters effective communication and collaborations between primary care providers and specialists, especially in the case of interventions that include multiple opportunities for interactions such as educational sessions, seminars and joint consultations (66,68). Indeed, there are well-documented problems relating to incomplete transfer of medical information from primary care to specialists and back again, especially with respect to referral for oncology and hematology (73).

Collaborative care is increasingly being pursued within the patient-centered medical home (PCMH) context (71,74). The PCMH is a model for primary health care based on the following principles: (I) each patient has a personal physician who (II) leads a team responsible for

the patient's care and (III) is responsible for providing or arranging care to meet all of the patient's health care needs; (IV) patient care is coordinated within and across institutions; a framework provides guidelines for (V) quality and safety and (VI) appropriate payment structures; and (VII) patients receive enhanced access to care, such as expanded hours for appointments and multiple forms of communication channels with providers (75). Although review articles have noted the need for greater methodological rigor in PCMH evaluations (76-79), preliminary data have been favorable overall, with reported decreases in hospitalizations and improvements in health outcomes and patient satisfaction (77,79-81). Owing to the potential for PCMHs to improve healthcare quality, access and costs, many Federally Qualified Health Centers have decided to implement the PCMH model (82).

The literature on patient-centered medical homes, co-location, integrated care and coordinated care describes successful collaborations between specialist and primary care in other disease areas (71,83-86), and calls have been made for establishing such collaborations for oncology (65,87). A review of clinical innovations included in the Agency for Health Care Research and Quality (AHRQ) Health Care Innovations Exchange identifies several co-location models, including gynecological care co-located at an HIV clinic and a breast examination center located within a radiology department (88,89). The only AHRQ identified model that co-locates oncology and primary care (90) does not target underserved populations, but patients with comprehensive insurance, and is limited in providers, resources, and scope (91,92).

In order to alleviate some of the area based and facility based disparities in lung cancer care, collaborations with community centers are needed, and new models of care delivery are necessary to allow all patients to have access to the latest approaches and developments in lung cancer treatment. The lack of data on molecular targets in lung cancer for African Americans is a specific example of this problem (93). Without adequate access, as personalized medicine becomes standard, there is a possibility that cancer treatment outcomes could worsen for underrepresented populations, even as treatments improve for the general population (94).

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Footnote

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