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Evaluating Characteristics in Lung Cancer Screening Program Participants and Non-Small Cell Lung Cancer (NSCLC) Patient Populations

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Abstract

Objective. To assess and compare specific characteristics and identify any differences, gaps, and/or disparities among two population groups; Bayhealth Lung screening program participants and newly diagnosed non-small cell lung cancer patients. **Methods.** This study was conducted with 2019 data from the American College of Radiology (ACR) registry, 1st time Low Dose CT screenings (Group 1) and the Bayhealth Cancer registry, newly diagnosed non-small cell lung cancer patients (Group 2). **Results.** Group 1 has 615 participants and Group 2 has 140 participants. The groups are separated based upon who is a first-time participant in the Bayhealth Lung Screening program in 2019 compared to patients who were newly diagnosed with Non-small Cell Lung Cancer at Bayhealth Medical Center-Cancer Center in 2019. Groups 1 and 2 had a statistical difference in the number of packs per year of cigarettes smoked. In group 2 there is no association between smoking status and clinical stage of diagnosis. There is however an association between smoking experience and pathological stage. **Conclusion.** Smoking continues to be the main contributing factor in patients diagnosed with non-small cell lung cancer. In addition to prevention efforts, early detection through Lung Cancer screenings is vital to identify early stage cancer.

Introduction

Lung cancer is the most prevalent cause of cancer-related deaths in the United States.[1] The highest risk factor for developing lung cancer is cigarette smoking.[1] The National Lung Screening Trial (NLST) found that lung cancer detected at an early-stage (using low-dose computed tomography, or LDCT), when most treatable, can decrease mortality rates by 20 percent.[2] The American College of Chest Physicians (ACCP)[3] recommends annual LDCT for adults age 55-77 years (the U.S. Preventive Services Task Force (USPSTF) age range recommendation is 55-80 years based on study models[4]) who are asymptomatic and have

smoked at least 30 pack years (or more) and continue to smoke or have quit smoking within the last 15 years.[3,4]

Although cancer incidence, mortality, and smoking rates have declined overall in the United States, cancer health disparities continue to exist among certain population groups.[4–6] Cancer health disparities are differences in cancer measurements and outcomes among certain population groups.[6] Cancer measurement examples include cancer incidence, survivorship, mortality, morbidity, and screening rates.[6] Population group examples include; race/ethnicity, gender, socioeconomic status (SES), and geographic location.[6] Cancer health disparities have many contributing factors. For example, studies have shown that certain SES risk factors, such as income, education level, occupation and geographic location, can affect an individual's cancer risk behavior, such as tobacco use and cancer screening participation.[6,7] Certain population groups are more at risk for cancer health disparities than others. For example, minority ethnic/racial groups are more likely to have higher poverty rates and less access to health care.[6] In addition, lung cancer rates are higher among Black and American Indian/Alaska Native men compared to other race/ethnicity groups.[5] Overall, African Americans have higher cancer mortality rates compared to other race/ethnicity groups.[6] SES factors play a major role in healthcare access and education.[6,7] For example, studies have found that SES has more of an impact than race/ethnicity when predicting access to education and health care services.[6,7] A study by Singh and Jemal[5] analyzed census-based cancer data in the United States and found that men with less education and income had higher lung cancer mortality rates. Similarly, income and education levels inversely affected lung cancer mortality rates among females.[5] In addition, studies have found that medically underserved individuals in poverty, regardless of race/ethnicity, are less likely to participate in cancer screenings.[5] It is a national goal to assess, address, and decrease health disparities in cancer screening and outcomes.[7]

Background

The Low Dose Lung CT Screening program was initiated at Bayhealth Medical Center in 2015. The initiation of this program was in response to the Centers for Medicare and Medicaid Services (CMS) determination that national coverage on screening for lung cancer was an appropriate preventative service benefit and eligibility criteria had been established.[8] The initial roll out of Low Dose Lung CT's required shared decision making and lung cancer screening counseling. At the time of study, the referral source was primary care physicians and pulmonologist in Kent and Sussex Counties.

In 2018, the Bayhealth Cancer Institute initiated a Lung Cancer Screening Navigator to provide Lung Cancer Screening education, facilitate community-initiated screenings, and remove barriers so that individuals are able to complete lung screening based on recommendations by the US Preventive Services Task Force. Focused navigation and education across the community allowed for an increase in lung screening services over the course of 2018.

Methods

For this study the American College of Radiology Lung Cancer Screening Registry and the Bayhealth Cancer Center Oncology Cancer Registry was used for patient identification. Two groups were identified as meeting study qualifications.

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Group 1: Individuals who are first time participants in the Bayhealth Lung Screening Program in 2019.

Group 2: Patients who are newly diagnosed with NSCLC at Bayhealth Medical Center, Cancer Centers (Kent and Sussex campuses) in 2019.

For Group 1 the following information was collected (see Table 1):

- Age participated in the Bayhealth Lung Screening Program in 2019
- Gender
- Race
- Ethnicity
- Smoking Status

  Number of packs-years of smoking

  Number of year(s) since quitting
- Postal code (geographic location)

For Group 2 the following information was collected (see Table 1):

- NSCLC Stage
- Age newly diagnosed with NSCLC in 2019
- Gender
- Race
- Ethnicity
- Smoking Status

  Number of pack(s)-year(s) of smoking

  Number of year(s) since quit
- Postal code (geographic location)

Table 1. Patient Characteristics for Group 1 and Group 2

Variable	G1 (n=615)	G2 (n=140)	P value
Sex	338 (55.0)	72 (51.4)	0.51
Male	277 (45.0)	68 (48.6)	
Female			
Primary Race/Ethnicity	498 (81.0)	116 (82.9)	0.12
(G1_Q002)	5 (0.8)	5 (3.6)	
White 1	89 (14.5)	18 (12.9)	
Asian 2	0 (0.0)	0 (0.0)	
Black/African American 3	1 (0.2)	0 (0.0)	
Hispanic/Latin 4	9 (1.5)	1 (0.7)	
Native American 5	1 (0.2)	0 (0.0)	
Other 6			
Non-response NA 9			

Hispanic ethnicity Yes No Other (included decline to answer)	11 524 80	3 137 0	<0.0001
Age 50-54 1 55-59 2 60-64 3 65-69 4 70-74 5 75-79 6 80 and up 7	0 (0.0) 137 (22.3) 176 (28.6) 141 (22.9) 117 (19.0) 44 (7.2) 0 (0.0)	10 (7.1) 17 (12.1) 21 (15.0) 35 (25.0) 17 (12.1) 18 (12.9) 22 (15.7)	<0.0001
Number of packs per year Less than 30 PYH 1 30-34PYH 2 35-39 PYH 3 40-44 PYH 4 45-49 PYH 5 50-54 PYH 6 55-59 PYH 7 60-64 PYH 8 65-69 PYH 9 70-74 PYH 10 75-79 PYH 11 80-84 PYH 12 85-89 PYH 13 90-94 PYH 14 95-99 PYH 15 Greater than 100 PYH 16	28 (4.6) 165 (26.8) 47 (7.6) 154 (25.0) 55 (8.9) 57 (9.3) 8 (1.3) 32 (5.2) 5 (0.8) 3 (0.5) 11 (1.8) 16 (2.6) 4 (0.7) 4 (0.7) 3 (0.5) 23 (3.7)	42 (30.0) 5 (3.6) 7 (5.0) 8 (5.7) 6 (4.3) 6 (4.3) 5 (3.6) 1 (0.7) 1 (0.7) 0 (0.0) 2 (1.4) 7 (5.0) 0 (0.0) 10 (7.1) 0 (0.0) 40 (28.6)	<0.0001
Number of packs per year (Categorized differently) Less than 30 PYH 1 30-59 PYH 2 60-89 PYH 3 Greater than 90 PYH 4	28 (4.6) 486 (79.0) 71 (11.5) 30 (4.9)	42 (30) 37 (26.4) 11 (7.9) 50 (35.7)	<0.0001

PYH=pack year history

Results

Group 1 yielded six hundred fifteen (615) participants. Group 2 yielded one hundred forty (140) participants. Of the participants from Group 1 and Group 2, there was no statistical significance for sex or primary race reported. The Fisher Test indicated a statistical significance for age in comparison to number of packs per year smoked. Packs per year were consolidated to demonstrate the statistical difference with an increase in the amount of tobacco consumed.

In the study of Group 2, there is no relationship found between smoking status and clinical stage. Fisher Exact Test was used for this analysis. There is however an association between smoking

and pathological stage. The Fisher Exact Test was used, and the clinical significance was 0.04. Based on this information, patients who reported they are active smokers with greater than 30 pack per year smoking history all had confirmed Non-small cell lung cancer diagnosis.

The Group 2 study continued with an assessment of the relationship between age and clinical versus pathological stage. The Kendall Tau rank coefficient was used. The correlation coefficient tau between Age and clinical stage among smoking population is -0.12, showing low association. The correlation coefficient tau between Age and pathological stage among smoking population is -0.06, showing low association. While age remains a minimal factor in the equation, the data continues to determine continued smoking over time produces a lung cancer diagnosis. In the case for Group 2 the diagnosis was Non-Small Cell Lung Cancer. Group 2 findings also support the updated recommendation by the US Preventive Task Force, for adults who have a 20 pack-year smoking history to start annual screening for lung cancer with low-dose CT.[9]

Conclusion

There is a growing body of evidence supporting current and former smokers to participate in low-dose CT lung screening programs. Low-dose CT's are proven to increase the number of early stage lung cancer diagnosis, motivate smoking cessation, and thereby reduce mortality from late stage lung cancer diagnosis.[10] While identifying disparities in the patient population studied, it was discovered that no patients in Group 2 participated in the low-dose CT lung screening program. This points to a gap in access to screening. Additionally, key stakeholder education is needed across the community of primary care physicians, pulmonary physicians, and in the general patient population to help increase awareness of the benefits of low-dose CT lung screening programs. In addition to education, removing the stigma of a lung cancer diagnosis through early education and smoking cessation programs stand to benefits long term patient outcomes across the community and increase trust in the healthcare system. Future research should focus on patient barriers to access lung cancer screening programs and the utilization of smoking cessation programs.

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References

1. Centers for Disease Control and Prevention. (2022). Basic information about lung cancer. https://www.cdc.gov/cancer/lung/basic_info/

2. Aberle, D. R., Adams, A. M., Berg, C. D., Black, W. C., Clapp, J. D., Fagerstrom, R. M., ... Sicks, J. D., & the National Lung Screening Trial Research Team. (2011, August 4). Reduced lung-cancer mortality with low-dose computed tomographic screening. *The New England Journal of Medicine, 365*(5), 395–409. PubMed

3. Mazzone, P. J., Silvestri, G. A., Patel, S., Kanne, J. P., Kinsinger, L. S., Wiener, R. S., . . . Detterbeck, F. C. (2018, April). Screening for lung cancer CHEST guideline and expert panel report. *Chest*, *153*(4), 954–985. PubMed https://doi.org/10.1016/j.chest.2018.01.016

4. Krist, A. H., Davidson, K. W., Mangione, C. M., Barry, M. J., Cabana, M., Caughey, A. B., ... Wong, J. B., & the US Preventive Services Task Force. (2021, March 9). Screening for lung cancer: U.S. Preventive Services Task Force recommendation statement. *JAMA, 325*(10), 962–970. PubMed

5. Singh, G. K., & Jemal, A. (2017). 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. *Journal of Environmental and Public Health, 2017*, 2819372. PubMed

6. National Cancer Institute. (2022) Cancer disparities. https://www.cancer.gov/about-cancer/understanding/disparities

7. Office of Disease Prevention and Health Promotion. (2020). Cancer-topics and overviews. https://www.healthypeople.gov/2020/topics-objectives/topic/cancer

8. Centers for Medicare and Medicaid Services. (2015). Screening for lung cancer with low dose computed tomography (LDCT)-Decision summary. https://www.cms.gov/medicare-coverage-database/view/ncacal-decision-memo.aspx

9. US Preventive Services Task Force. (2021). Lung cancer: screening. https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/lung-cancer-screening

10. Moldovanu, D., de Koning, H. J., & van der Aalst, C. M. (2021, February). Lung cancer screening and smoking cessation efforts. *Translational Lung Cancer Research*, *10*(2), 1099–1109. PubMed https://doi.org/10.21037/tlcr-20-899