# Lung cancer statistics in the United States: a reflection on the impact of cancer control

**Jianrong Zhang[1]^, Partha Basu[2], Jon D. Emery[1], Maarten J. IJzerman[3], Freddie Bray[4]**

[1]Centre for Cancer Research and Department of General Practice, Faculty of Medicine, Dentistry and Health Sciences, University of Melbourne, Victorian Comprehensive Cancer Centre, Melbourne, Victoria, Australia; [2]Early Detection, Prevention & Infections Branch, International Agency for Research on Cancer, Lyon, France; [3]Centre for Cancer Research and Centre for Health Policy, School of Population and Global Health, Faculty of Medicine, Dentistry and Health Sciences, University of Melbourne, Melbourne, Australia; [4]Cancer Surveillance Branch, International Agency for Research on Cancer, Lyon, France

*Correspondence to:* Jianrong Zhang, MD, MPH, FRSPH. University of Melbourne, Victorian Comprehensive Cancer Centre, 305 Grattan Street, Melbourne VIC 3000, Australia. Email: jianrong.zhang@unimelb.edu.au.

*Comment on:* Siegel RL, Miller KD, Fuchs HE, *et al.* Cancer statistics, 2021. CA Cancer J Clin 2021;71:7-33.

Received: 13 April 2021; Accepted: 05 January 2022; Published: 10 February 2022.
doi: 10.21037/ace-21-5
**View this article at:** https://dx.doi.org/10.21037/ace-21-5

Lung cancer continues to be the leading cause of cancer death globally (1). The American Cancer Society updates cancer statistics in the United States of America (US) each year. In 2021, it reported declines in lung cancer incidence and mortality rates in both males and females (2). In this commentary we reflect on the status of implementing effective strategies for the prevention, early detection, and treatment in the US, including the current disparities and inequitable outcomes within the country.

## Lung cancer epidemiology in the United States

In 2021, an estimated total of 235,760 new lung cancer cases were diagnosed. These incident cases place lung cancer as the second commonest cancer (excluding non-melanoma skin cancers) in males (119,100 cases) and females (116,660 cases) (2). Fortunately, age-adjusted lung cancer incidence rates in both sexes have been decreasing from 2005 to 2017 (males: since 1980s). But despite this, lung cancer will remained the leading cause of cancer death (overall: 131,880 deaths; males: 69,410 deaths; females: 62,470 deaths); both estimates in males and females respectively accounted for 22% of deaths from all cancers. The age-adjusted mortality rates in both sexes have been decreasing as well (males: since 1990; females: since 2000), accounting for 46% of the decline in mortality for all cancers from 2014 to 2018 (2).

Consistent with previous reports, over half of lung cancer cases were diagnosed with distant metastasis (57%), rather than at localized (17%) or regional (22%) stages, based on the data from 2010–2016 (2). The 5-year relative survival estimate for lung cancer remained poor (21% in all stages, 59% in localized stage, 32% in regional stage and 6% in distant stage), compared to other cancers. Nevertheless, for non-small cell lung cancer (NSCLC), which accounts for nearly 80% of lung cancer, 2-year relative survival has been increasing from 34% in 2009–2010 to 42% in 2015–2016 in the US, with absolute gains of 5–6% in each stage (2).

Disparities between Black and White men and women were not evident in the overall lung cancer incidence rates. In both racial groups, the age-adjusted incidence rates (of 2013–2017) were 60.9 (Black males: 79.8; Black females: 47.9) and 62.6 (White males: 70.8; White females: 56.4) per 100,000 (all races: 58.4); the age-adjusted mortality rates (of 2014–2018) were 41.3 (Black males: 57; Black females: 30.6) and 41.7 (White: 49.4; Black: 35.6) per 100,000 (all races: 38.5) (2). Regardless of which racial group, over half of lung cancer cases were still diagnosed in distant stage (Black: 61%; White: 56%), rather than localized (Black: 14%;

^ ORCID: 0000-0003-4688-5222.

White: 18%) or regional (both: 22%) stages. Among Blacks, 5-year relative survival was 18%, 55%, 31% and 6% in all, localized, regional and distant stages respectively, compared with 21%, 59%, 31% and 6% in all, localized, regional and distant stages respectively among Whites (2).

## Implications for future cancer control policies in the United States

These lung cancer statistics in the US are encouraging given the statistics reflect the successful efforts over many years in primary prevention, secondary prevention and diagnosis, treatment, survivorship and supportive care, through to end-of-life care. Since lung cancer screening has been introduced only recently, most of the beneficial impact may be ascribed to tobacco control measures and advances in early diagnosis of symptomatic patients and treatment (1-4).

To further reduce the burden from cancer, primary prevention via risk factor mitigation should play a key role. Smoking has been the leading risk factor for mortality in the US and globally for decades (1990–2019) (1,4,5). In the US, smoking is also the leading risk factor for all cancer incidence; among all cancers, lung cancer accounts for the highest proportion (81.7%) of smoking-attributable cases (6). However, lung cancer mortality attributable to smoking decreased by 12.9% in countries with high socio-demographic index (SDI), including the US (1). Adult cigarette smoking prevalence reduced by 29.8% in males and 38.7% in females from 1990 to 19.9% in males and 15.3% in females in 2019 (5). The decrease reflects the success in the current control programs on smoking initiation and restriction, including an increased public awareness of the hazards due to smoking, smoking restrictions in public areas, reduced access to cigarettes and increases in cigarette excise taxes, since the US Surgeon General's first report on Smoking and Health in 1964 (7). Future control measures at the population level should focus on smoking cessation (8,9) although the US has signed but not yet ratified the Framework Convention for Tobacco Control (FCTC) treaty. Being a party to the FCTC will improve the fight against tobacco for public health. Another successful example in the US for primary prevention of lung cancer is related policies to address ambient particulate matter pollution and occupational exposure to asbestos, the second and the third leading risk factors for global lung cancer mortality (1).

Prevention via effective risk factor mitigation should continue to be integrated into national cancer control programs, especially given the potential doubling of the cancer incidence burden by 2070 relative to 2020 (10). Implementation research is necessary to investigate whether and how to scale up the control strategies on risk factors to a broader population level. Within the US, large disparities exist in exposure to tobacco-related risks. For example, individuals living below the poverty line and those having less formal education have a higher average smoking prevalence and higher exposure to second-hand smoke compared to those belonging to higher socio-economic and educational groups. This has resulted in a disproportionately higher incidence of lung cancer among the socio-economically deprived populations (11). Such social inequities need to be appropriately addressed for higher gains from primary prevention measures.

One of the important statistics from the report is that over half of all US lung cancer cases are still diagnosed with distant metastasis. This highlights the ongoing need to improve early diagnosis, through lung cancer screening for the asymptomatic population at increased risk, as well as timely diagnosis of symptomatic patients (1,4).

Lung cancer screening of high-risk populations with low-dose computed tomography (LDCT) could be a cost-effective strategy to reduce lung cancer mortality in some high-SDI countries where the lung cancer burden is high and there is health system capacity (including facilities and healthcare workforce) to implement screening and effectively manage the screen-positive patients (1,12,13). In the US, lung cancer screening has been recommended at the population level but so far suffers from relatively low participation rates (14). In 2021, the US Preventive Services Task Force recommended to expand the eligibility for lung cancer screening to age 50–80 years with a 20 pack-year smoking history from earlier criteria of 55–80 years of age with a 30 pack-year smoking history (15). This expansion will increase the eligible population by 81% from 6.4 million adults under the 2013 recommendations to 14.5 million adults under the 2021 recommendations (16). But concerns have been raised regarding implementation, such as how to effectively identify the screen-eligible population and improve screening uptake (14,16,17), how to meet the increasing assessment and treatment demands (13), and how to address the increasing costs while minimizing potential harms such as false positives, overdiagnosis, radiation exposure, invasive procedures, and psychological distress (15-17). An additional challenge for screening is the large proportion of lung cancer patients (especially female patients) are non-smokers (2); whether and how to screen non-smokers is lacking convincing evidence. To address these challenges, further research should focus on biomarker-driven, risk-based approaches based on clinical and population information, with advanced technologies such as machine learning.

Delay in diagnosis has become even a larger concern during the COVID-19 pandemic leading to an apparent decrease in new lung cancer cases (4,18). Diagnostic and treatment intervals are considered as important quality indicators for cancer control and healthcare system performance (19). Routinely collecting and quantifying diagnostic intervals, via, for example, linked datasets can be particularly relevant as a proxy for stage progression. Through mapping cancer stage distribution of new cases between two consecutive timepoints and relating this to diagnostic intervals, one may assume that less advanced stage tumors are a result of improvements in healthcare delivery and/or earlier patient presentation. Good examples can be found in studies investigating the shift of cancer stage at diagnosis due to the COVID-19 pandemic (20). Reducing diagnostic and treatment intervals for lung cancer, requires strategies that enhance access to health care, increase diagnostic capacity with clear diagnostic and treatment pathways, and improve public awareness about lung cancer symptoms and reasons to seek health advice (1,4).

The report discusses how improvements in treatment have contributed to the decline in lung cancer mortality (2). The discussion on the effectiveness of advanced treatments echoes a similar conclusion in a study evaluating lung cancer incidence-based mortality in the US (3). Specifically, advanced treatments include video-assisted thoracoscopic surgery, targeted therapies and immunotherapies for eligible patients (3,4). As more patients live longer due to these improvements, there is a need to upgrade the capacity in survivorship and supportive care (21).

There are significant health disparities in the access to and the quality of lung cancer treatment services. For example, in the US, 21.6% of lung cancer patients received no treatment, 16.3% received less intensive treatment than recommended by guidelines, and specifically, patients with older age, less education, lack of insurance and of Black ethnicity were less likely to receive guideline-concordant treatments (22,23). Disparities could occur at an institutional level as well, with different lung cancer survival outcomes between community, comprehensive community, integrated network, academic, and National Cancer Institute (NCI)-designated institutions (24). For patients with distant stage disease—the majority of lung cancer patients—advanced treatments such as targeted therapies and immunotherapies are biomarker-driven and have been used as the front-line treatment for eligible patients. Accordingly, biomarker tests have become standard with increasing demand within the treatment pathways. However, to date such tests in the real-world setting have been underutilized (25). This suggests the need for education based on regularly-updated guidelines as well as increasing biomarker test capacity to ensuring optimal and timely treatments for all patients. The increasing drug price in oncology has further led to health disparities. Specifically, we highlight financial toxicity, with large groups of patients unable to afford oncological treatments, including those not listed in social insurance schemes. The implementation of fairer methods for reducing costs in drug development and individual health expenditure should be a priority (4).

This commentary provides a brief reflection on the current status of lung cancer control in the US according to the lung cancer statistics reported in 2021. Specifically, we highlight the importance of mitigating lung cancer risk factors (especially tobacco control), improving the effectiveness of lung cancer screening, and addressing diagnostic delay. Across the cancer continuum, the current disparities in access that result in inequitable lung cancer outcomes in the population needs to be addressed.

## Acknowledgments

Some of the content presented in this paper was discussed in the Summer School 2021 of the International Agency for Research on Cancer/World Health Organization, and in the Journal Club of the Professional Development for Primary Care Research (PD4PC) Student Group in the Department of General Practice at the University of Melbourne. Where authors are identified as personnel of the International Agency for Research on Cancer/World Health Organization, the authors alone are responsible for the views expressed in this article and they do not necessarily represent the decisions, policy, or views of the International Agency for Research on Cancer/World Health Organization.

*Funding:* Dr. JDE is supported by an NHMRC Investigator grant (APP1195302).

## Footnote

*Provenance and Peer Review:* This article was a standard submission to the journal. The article has undergone

external peer review.

*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at https://ace.amegroups.com/article/view/10.21037/ace-21-5/coif). JZ serves as an unpaid Section Editor of *Annals of Cancer Epidemiology*. FB serves as an Editor-in-Chief of *Annals of Cancer Epidemiology*. MJI receives unrestricted research funding from Illumina, paid to his institution. The other authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



## References

1. GBD 2019 Respiratory tract cancers collaborators. Global, regional, and national burden of respiratory tract cancers and associated risk factors from 1990 to 2019: a systematic analysis for the global burden of disease study 2019. Lancet Respir Med 2021;9:1030-49.
2. Siegel RL, Miller KD, Fuchs HE, et al. Cancer statistics, 2021. CA Cancer J Clin 2021;71:7-33.
3. Howlader N, Forjaz G, Mooradian MJ, et al. The effect of advances in lung-cancer treatment on population mortality. N Engl J Med 2020;383:640-9.
4. Zhang J, Li J, Xiong S, et al. Global burden of lung cancer: implications from current evidence. Ann Cancer Epidemiol 2021;5:4.
5. GBD 2019 Tobacco Collaborators. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990-2019: a systematic analysis from the Global Burden of Disease Study 2019. Lancet 2021;397:2337-60.
6. Islami F, Goding Sauer A, Miller KD, et al. Proportion and number of cancer cases and deaths attributable to potentially modifiable risk factors in the United States. CA Cancer J Clin 2018;68:31-54.
7. Moolgavkar SH, Holford TR, Levy DT, et al. Impact of reduced tobacco smoking on lung cancer mortality in the United States during 1975-2000. J Natl Cancer Inst 2012;104:541-8.
8. Sheikh M, Mukeriya A, Shangina O, et al. Postdiagnosis smoking cessation and reduced risk for lung cancer progression and mortality: a prospective cohort study. Ann Intern Med 2021;174:1232-9.
9. Leventhal AM, Dai H, Higgins ST. Smoking cessation prevalence and inequalities in the United States: 2014-2019. J Natl Cancer Inst 2021. [Epub ahead of print]. doi:10.1093/jnci/djab208.
10. Soerjomataram I, Bray F. Planning for tomorrow: global cancer incidence and the role of prevention 2020-2070. Nat Rev Clin Oncol 2021;18:663-72.
11. Henley SJ, Thomas CC, Sharapova SR, et al. Vital signs: disparities in tobacco-related cancer incidence and mortality - United States, 2004-2013. MMWR Morb Mortal Wkly Rep 2016;65:1212-8.
12. Kovalchik SA, Tammemagi M, Berg CD, et al. Targeting of low-dose CT screening according to the risk of lung-cancer death. N Engl J Med 2013;369:245-54.
13. Blom EF, Ten Haaf K, Arenberg DA, et al. Treatment capacity required for full-scale implementation of lung cancer screening in the United States. Cancer 2019;125:2039-48.
14. Narayan AK, Gupta Y, Little BP, et al. Lung cancer screening eligibility and use with low-dose computed tomography: Results from the 2018 Behavioral Risk Factor Surveillance System cross-sectional survey. Cancer 2021;127:748-56.
15. US Preventive Services Task Force; Krist AH, Davidson KW, et al. Screening for lung cancer: US preventive services task force recommendation statement. JAMA 2021;325:962-70.
16. Henderson LM, Rivera MP, Basch E. Broadened eligibility for lung cancer screening: challenges and uncertainty for implementation and equity. JAMA 2021;325:939-41.
17. Passiglia F, Cinquini M, Bertolaccini L, et al. Benefits and harms of lung cancer screening by chest computed tomography: a systematic review and meta-analysis. J Clin Oncol 2021;39:2574-85.
18. Patt D, Gordan L, Diaz M, et al. Impact of COVID-19 on cancer care: how the pandemic is delaying cancer diagnosis and treatment for American seniors. JCO Clin Cancer

 

Inform 2020;4:1059-71.
19. Pearson C, Fraser J, Peake M, et al. Establishing population-based surveillance of diagnostic timeliness using linked cancer registry and administrative data for patients with colorectal and lung cancer. Cancer Epidemiol 2019;61:111-8.
20. Eijkelboom AH, de Munck L, Vrancken Peeters MTFD, et al. Impact of the COVID-19 pandemic on diagnosis, stage, and initial treatment of breast cancer in the Netherlands: a population-based study. J Hematol Oncol 2021;14:64.
21. Chan RJ, Crawford-Williams F, Crichton M, et al. Effectiveness and implementation of models of cancer survivorship care: an overview of systematic reviews. J Cancer Surviv 2021. [Epub ahead of print]. doi: 10.1007/s11764-021-01128-1.
22. 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.
23. 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.
24. Osarogiagbon RU, Sineshaw HM, Lin CC, et al. Institutional-level differences in quality and outcomes of lung cancer resections in the United States. Chest 2021;159:1630-41.
25. Smeltzer MP, Wynes MW, Lantuejoul S, et al. The international association for the study of lung cancer global survey on molecular testing in lung cancer. J Thorac Oncol 2020;15:1434-48.

doi: 10.21037/ace-21-5
**Cite this article as:** Zhang J, Basu P, Emery JD, IJzerman MJ, Bray F. Lung cancer statistics in the United States: a reflection on the impact of cancer control. Ann Cancer Epidemiol 2022;6:2.