Chapter 3: Ethical Spending in Addressing Cancer Treatment, Screening, and Prevention

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Focusing on the U.S., Arvind Kumar and Raja Flores discuss the economic aspects that accompany cancer spending in case of prevention, screening, and treatment. While these three facets are all important in promoting patient health and safety, screening and prevention have been shown to have much lower cost compared with cancer therapeutics or in eliminating the health hazards in low- and moderate-income housing in New York City. The distribution of healthcare funds, however, does not accurately reflect the differences in impact on survival and quality of life. Finally, by focusing on treatments, they critically discuss how the increasing use of robotic-assisted surgery—expensive for healthcare facilities—may not be to the benefit of patients.

Lung cancer continues to be the leading cause of cancer-related death worldwide, with 18.0 percent of cancer deaths attributable to this disease.[1] In the U.S. alone, it is estimated that 131,880 people will die from lung cancer in 2021.[2] In light of this vast disease burden, the national government has placed great importance on the treatment and eventual eradication of cancer. From President Richard M. Nixon's (1913–1994) historic signing of the National Cancer Act of 1971, which founded the National Cancer Institute (NCI) and declared the "war on cancer," to President Barack Obama's Cancer Moonshot Task Force in 2016, which projected a pathway to double the rate of progress in cancer prevention,

[1] See Hyuna Sung, Jacques Ferlay, Rebecca L. Siegel, Mathieu Laversanne, Isabelle Soerjomataram, Ahmedin Jemal, and Freddie Bray, "Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries," CA: A Cancer Journal for Clinicians 71, no. 3 (2021): 209–249.

[2] See Rebecca L. Siegel, Kimberly D. Miller, Hannah E. Fuchs, and Ahmedin Jemal, "Cancer Statistics, 2021," CA: A Cancer Journal for Clinicians 71, no. 1 (2021): 7–33.

diagnosis, and treatment, cancer research has consistently been a government priority. U.S. healthcare spending overall reached $3.8 trillion in 2019, accounting for 17.7 percent of the nation's gross domestic product (GDP), of which $6.56 billion was allotted specifically to the NCI.[3] Notably, this account excludes private sector funding and donations.

Cancer spending can be divided between three areas: treatment, screening (secondary prevention), and prevention (primary prevention). Balanced distribution of funding is crucial given the large sums of money that are invested, yet a number of external factors and competing interests—such as political agendas, private sector profits, and scientific goals—often dictate the direction of spending. This review analyzes the appropriation of funding to these three facets and assesses the cost effectiveness of these investments in the context of patient-related outcomes.

Treatment

Lung cancer treatment consists of a combination of surgery, chemotherapy, and/or radiation therapy, along with newer innovations such as targeted therapy and immunotherapy. For early-stage lung cancer, surgery alone can often be a curative treatment.[4] However, many cases are diagnosed at further stages of progression, requiring medical interventions that introduce associated costs.

Globally, sales of cancer drugs reached $145.4 billion in 2019, far surpassing diabetes drugs, the second highest market with $51 billion in sales. Furthermore, by 2026, this value is expected to more than double to $311.2 billion. The lung cancer drug market specifically is

[3] See Anne B. Martin, Micah Hartman, David Lassman, and Aaron Catlin, "National Health Care Spending in 2019: Steady Growth for the Fourth Consecutive Year," *Health Affairs (Millwood)* 40, no. 1 (2021): 14–24.

[4] See Vignesh Raman, Chi-Fu Jeffrey Yang, John Z. Deng, and Thomas A. D'Amico, "Surgical Treatment for Early Stage Non-Small Cell Lung Cancer," *Journal of Thoracic Disease* 10, Suppl. 7 (2018): S898–S904.

projected to generate $8.67 billion in 2021.[5] Cancer drug prices continue to become more expensive as initial list prices increase at an exponential rate and additional post-marketing costs are added on.[6] Between 2009 and 2019, the median price of cancer drugs in the U.S. increased by 152 percent, from $5,790 to $14,580, with certain cancer drugs costing as much as $35,000–$50,000 per month of treatment.[7]

While funds continue to be streamlined towards cancer therapeutics, and cancer drugs become increasingly expensive, we may be misrepresenting their benefit. A study of all cancer therapeutics that were approved by the Food and Drug Administration (FDA) over a five year period between 2008 to 2012 found that 67 percent (36/54) of drugs were approved based on a surrogate end point that was not overall survival, such as response rate or progression- free survival (PFS).[8] Similar findings were published by the *Milwaukee Journal Sentinel* based on an investigation that found 74 percent of cancer drugs over the past decade were approved without clear survival benefit.[9] Although there may be advantages to using

[5] See Evaluate Pharma, "Evaluate Pharma World Preview 2020, Outlook to 2026," *Evaluate,* July 16, 2020, www.evaluate.com/thoughtleadership/pharma/evaluatepharma-world-preview-2020-outlook-2026.

[6] See Michail Alevizakos, Apostolos Gaitanidis, and Leonard J. Appleman, "Quantification of the Financial Burden of Antineoplastic Agent Price Increases," Journal of Clinical Oncology 37, no. 15 (2019): doi.org/10.1200/JCO.2019.37.15_suppl.6519; Stacie Dusetzina, Haiden Huskamp, and Nancy Keating, "Specialty Drug Pricing and Out-of-Pocket Spending on Orally Administered Anticancer Drugs in Medicare Part D, 2010 to 2019," JAMA 321, no. 20 (2019): 2025–2027; "Monthly and Median Costs of Cancer Drugs at the Time of FDA Approval 1965–2016," Journal of the National Cancer Institute 109, no. 8 (2017): doi.org/10.1093/jnci/djx173.

[7] See Kerstin N. Vokinger, Thomas J. Hwang, Paola Daniore, ChangWon C. Lee, Ariadna Tibau, Thomas Grischott, Thomas J. Rosemann, and Aaron S. Kesselheim, "Analysis of Launch and Postapproval Cancer Drug Pricing, Clinical Benefit, and Policy Implications in the US and Europe," Jama Oncology 7, no. 9 (2021): doi.org/10.1001/jamaoncol.2021.2026.

[8] See Chul Kim and Vinay Prasad, "Cancer Drugs Approved on the Basis of a Surrogate End Point and Subsequent Overall Survival: An Analysis of 5 Years of US Food and Drug Administration Approvals," JAMA Internal Medicine 175, no. 12 (2015): 1992–1994.

[9] See John Fauber and Elbert Chu, "FDA Approves Cancer Drugs without Proof They're

surrogate end points for FDA approval, patients should be made aware that their new medication with a host of side effects has not been shown to extend their lives. Instead, extensive marketing campaigns use buzzwords such as "breakthrough," "game changer," "miracle," "cure," "revolutionary," "transformative," and "life saver," to promote these new therapeutics.[10]

Concurrently, treatment centers have also increased their direct public advertising, with the hope of increasing awareness and knowledge of available treatments and furthering patient-centered care. In 2014, $173 million was spent in advertising by cancer centers in the U.S. across television, magazines, radio, newspapers, billboards, and the internet, with 86 percent of the total advertising expenditure concentrated among twenty major cancer centers and 59 percent ($101.7 million) of the spending by Cancer Centers of America, a for-profit company with five hospitals.[11] Although such "direct-to-consumer" advertising encourages patient empowerment, research has shown that the advertisements focus on the benefits of therapies more often than the risks, and nearly half include curated patient testimonials that focus on survival or cures rather than typical results and potential disclaimers.[12]

One of the most heavily advertised innovations in cancer treatment is robotic surgery. New developments in minimally invasive surgery techniques in general have offered similar long-term survival, similar or decreased peri-operative mortality, and better patient experiences with complications, pain, hospital length of stay, and quality of life as compared

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Extending Lives," *Milwaukee Journal Sentinel*, October 26, 2014, archive.jsonline.com/watchdog/watchdogreports/fda-approves-cancer-drugs-without-proof-theyre-extendinglives b99348000z1-280437692.html/.

[10] See Matthew V. Abola and Vinay Prasad, "The Use of Superlatives in Cancer Research," *JAMA Oncology* 2, no. 1 (2016): 139–141.

[11] See Laura B. Vater, Julie M. Donohue, Seo Young Park, and Yael Schenker, "Trends in Cancer-Center Spending on Advertising in the United States, 2005 to 2014," JAMA Internal Medicine 176, no. 8 (2016): 1214–1216.

[12] See Laura B. Vater, Julie M. Donohue, Robert Arnold, Douglas B. White, Edward Chu, and Yael Schenker, "What Are Cancer Centers Advertising to the Public? A Content Analysis," *Annals of Internal Medicine* 160, no. 12 (2014): 813–820.

to traditional open approaches.[13] Over the last 15 years, rates of robotic-assisted minimally invasive surgery have rapidly increased and leading institutions and providers are evaluated based on their use and proficiency with the robot.

Nevertheless, much like many new cancer therapeutics, the emphasis on robotic surgery may not be due to patient benefits. Many studies that support the use of robotic surgery over video-assisted thoracoscopic surgery advocate for benefits in surgical technique including improved visualization of anatomy and easier lymph node dissection, but these factors tend to be surgeon- specific.[14] On the contrary, in 2019, the FDA published a communication that robotic-assisted surgery was not granted marketing authorization for any cancer-related surgery due to unclear survival benefits to patients over other surgical modalities. "We want doctors and patients to be aware of the lack of evidence of safety and effectiveness for these uses so they can make better informed decisions about their cancer treatment and care."[15] Nevertheless, robotic surgeries continue to be performed under "off-label" use, and while this technique can be useful for the properly trained surgeon, patients may not be experiencing additional benefits.

In addition to the lack of supporting evidence that robotic surgery benefits patients, it is quite expensive for healthcare facilities to invest in this technology. Market competition may eventually drive down costs, but

[13] See Jacob Klapper and Thomas A. D'Amico, "VATS Versus Open Surgery for Lung Cancer Resection: Moving toward a Minimally Invasive Approach," Journal of the National Comprehensive Cancer Network 13, no. 2 (2015): 162–164.

[14] See Pierluigi Novellis, Marco Alloisio, Elena Vanni, Edoardo Bottoni, Umberto Cariboni, and Giulia Veronesi, "Robotic Lung Cancer Surgery: Review of Experience and Costs," Journal of Visualized Surgery 3(2017): 39, doi.org/10.21037/jovs.2017.03.05.

[15] Stephanie Caccomo, "FDA in Brief: FDA Cautions Patients, Providers About Using Robotically-Assisted Surgical Devices for Mastectomy and Other Cancer-Related Surgeries," *U.S. Food & Drug Administration,* February 28, 2019, www.fda.gov/news-events/fda-brief/fda-brief-fdacautions-patients-providers-about-using-robotically-assisted-surgical-devices.

at present, the primary manufacturer of surgical robots internationally is Intuitive Surgical, which generates nearly $4.5 billion annually with a market cap of about $120 billion. Research has conflicted on the long-term cost benefit of robotic surgery, and while large tertiary care centers may have the volume to justify expenditures on robotic surgery, adequately sustaining a surgical robot continues to be too expensive for many public hospitals in low-income areas of the world.[16]

Screening

Current screening guidelines for lung cancer, as per the U.S. Preventive Services Task Force, encourage annual screening with low-dose computed tomography (LDCT) in adults aged 50 to 80 years who have a 20 pack-year smoking history and currently smoke or have quit within the past 15 years.[17] Symptoms of lung cancer often present at later stages, but regular screening can identify the disease well before the onset of symptoms and while it is still curable. These screening guidelines are based on the results of two longitudinal studies: the National Lung Screening Trial (NLST) and the International Early Lung Cancer Action Project (I-ELCAP).

The NLST was founded in 2002 by the NCI to compare mortality from lung cancer in patients screened by LDCT versus chest radiography (CXR). 53,454 participants between the ages of 55 and 74 with high-risk smoking history were screened with either LDCT or CXR once per year for three years. Results demonstrated higher rates of positive screening tests amongst the LDCT group, with 12.6 percent more lung cancers diagnosed and a 20.0 percent reduction in lung cancer specific mortality over 7 years.[18]

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[16] See Novellis et al., "Robotic Lung Cancer Surgery: Review of Experience and Costs."

[17] See U.S. Preventive Services Task Force, "Lung Cancer: Screening," *U.S. Preventive Services Task Force,* March 9, 2021, www.uspreventiveservicestaskforce.org/uspstf/recommendation/lung-cancer-screening#fullrecommendationstart.

[18] See National Lung Screening Trial Research Team, Denise R. Aberle, Amanda M. Adams, Christine D. Berg, William C. Black, Jonathan D. Clapp, Richard M. Fagerstrom, Ilana F. Gareen, Constantine Gatsonis, Pamela M. Marcus, and JoRean D. Sicks, "Reduced Lung-

Similarly, 31,567 asymptomatic at-risk participants were included in the I- ELCAP study and underwent LDCT screening for lung cancer between 1994 and 2005. Results demonstrated that 80 percent of patients with lung cancer diagnosed by screening CT had clinical stage I cancer. Early detection of the disease allowed the majority of these patients to be eligible for treatment, yielding a 10-year survival rate of 88 percent and an even higher 92 percent survival rate amongst the 91 percent of these patients who underwent surgical resection.[19]

The primary findings of these trials support the use of LDCT for lung cancer screening but acknowledge that screening may lead to additional costs for patients and the healthcare system. From the patient perspective, increased screening was shown to result in more frequent false positive results, which can lead to unnecessary further imaging and invasive testing for patients as well as increased anxiety and fear.[20] Studies have shown, however, that despite increased rates of incidental findings and false positives after LDCT screening, overall medical cost to patients remained similar to those screened with CXR.[21]

Medical institutions must also cross the barrier to entry for screening, requiring a well-equipped radiology department and the necessary budget to purchase and maintain CT machines. Funding for the NLST alone reached $250 million, creating hesitancy amongst many providers on the

Cancer Mortality with Low-Dose Computed Tomographic Screening," New England Journal of Medicine 365, no. 5 (2011): 395–409.

[19] See International Early Lung Cancer Action Program Investigators, Claudia I. Henschke, David F. Yankelevitz, Daniel M. Libby, Mark W. Pasmantier, James P. Smith, and Olli S. Miettinen, "Survival of Patients with Stage I Lung Cancer Detected on CT Screening," New England Journal of Medicine 355, no. 17 (2006): 1763–1771.

[20] See National Lung Screening Trial Research Team et al., "Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening."

[21] See Ilana F. Gareen, William C. Black, Tor D. Tosteson, Qianfei Wang, JoRean D. Sicks, and Anna N. A. Tosteson, "Medical Care Costs Were Similar across the Low-Dose Computed Tomography and Chest X-Ray Arms of the National Lung Screening Trial Despite Different Rates of Significant Incidental Findings," Medical Care 56, no. 5 (2018): 403–409.

value of screening.[22] Nevertheless, unlike with robotic surgery, many studies have shown that lung cancer screening can be performed in a cost-effective manner that also benefits patients, largely due to the proven survival benefit.

Current estimates for the cost effectiveness of CT screening vary but remain within the limits of conventionally accepted cost-effectiveness threshold of $50,000–$109,000 per quality-adjusted life years (QALY) gained.[23] In analysis conducted by the NLST, LDCT cost an additional $1,631 per person and $81,000 per QALY, with additional variability amongst subgroups.[24] One study by Andrea Villanti and colleagues found that the cost of annual screening for a hypothetical population of eighteen million adults at high risk for lung cancer was about $1.85 billion per year over fifteen years and yielded a cost- utility ratio of $28,240 per QALY. This compares with the $8.67 billion generated by lung cancer drugs in 2021 alone. Increasing overall survival and QALY amongst this population was also estimated to increase the national GDP by $10.6

[22] See National Lung Screening Trial Research Team, Denise R. Aberle, Christine D. Berg, William C. Black, Timothy R. Church, Richard M. Fagerstrom, Barbara Galen, Ilana F. Gareen, Constantine Gatsonis, Jonathan Goldin, John K. Gohagan, Bruce Hillman, Carl Jaffe, Barnett S. Kramer, David Lynch, Pamela M. Marcus, Mitchell Schnall, Daniel C. Sullivan, Dorothy Sullivan, and Carl J. Zylak, "The National Lung Screening Trial: Overview and Study Design," Radiology 258, no. 1 (2011): 243–253; Katherine Bourzac, "Diagnosis: Early Warning System," Nature 513, no. 7517 (2014): S4–S6.

[23] See Andrea C. Villanti, Yiding Jiang, David B. Abrams, and Bruce S. Pyenson, "A Cost-Utility Analysis of Lung Cancer Screening and the Additional Benefits of Incorporating Smoking Cessation Interventions," PLoS One 8, no. 8 (2013): e71379, doi.org/10.1371/journal.pone.0071379. In healthcare literature, the QALY (quality-adjusted life year or quality-adjusted life-year) is a generic measure of disease burden, which depends on the assessment of the quality and length of life lived, combined in a single number.

[24] See William C. Black, Ilana F. Gareen, Samir S. Soneji, JoRean D. Sicks, Emmett B. Keeler, Denise R. Aberle, Arash Naeim, Timothy R. Church, Gerard A. Silvestri, Jeremy Gorelick, Constantine Gatsonis, and National Lung Screening Trial Research Team, "Cost-Effectiveness of CT Screening in the National Lung Screening Trial," New England Journal of Medicine 371, no. 19 (2014): 1793–1802.

billion and recover $0.38 per every one dollar spent on lung cancer screening.[25]

Prevention

Environmental exposures are directly linked to the incidence of lung cancer, with cigarette smoking as the most important risk factor.[26] Smoking has been shown to explain almost 90 percent of lung cancer risk in men and 70–80 percent in women.[27] In patients who do not smoke, there is still a high risk of developing lung cancer after exposure to second-hand smoke, radon, asbestos, and other environmental toxins. In 1964, the U.S. Surgeon General published the *Smoking and Health* report, the first public health advisory on the impact of cigarette smoking.[28] Since then, smoking rates have fallen from about 43 percent to about 14 percent (as of 2019). Nevertheless, the Centers for Disease Control and Prevention (CDC) reports that each day, 3,200 new youth start smoking, and with the introduction of alternative smoking methods, such as vaping and flavored tobacco products, lung cancer risk continues to be a prominent public health issue.[29]

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[25] See Villanti, Jiang, Abrams, and Pyenson, "A Cost-Utility Analysis of Lung Cancer Screening and the Additional Benefits of Incorporating Smoking Cessation Interventions."

[26] See Tonya Walser, Xiaoyan Cui, Jane Yanagawa, Jay M. Lee, Eileen Heinrich, Gina Lee, Sherven Sharma, and Steven M. Dubinett, "Smoking and Lung Cancer: The Role of Inflammation," Proceedings of the American Thoracic Society 5, no. 8 (2008): 811–815.

[27] See Danny R. Youlden, Susanna M. Cramb, and Peter D. Baade, "The International Epidemiology of Lung Cancer: Geographical Distribution and Secular Trends," Journal of Thoracic Oncology 3, no. 8 (2008): 819–831.

[28] See United States, Surgeon General's Advisory Committee on Smoking and Health, Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service, Public Health Service Publication No. 1103 (Washington, DC: U.S. Department of Health, Education, and Welfare, Public Health Service, 1964).

[29] See National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General* (Atlanta, GA: Centers for Disease Control and Prevention, 2014); National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, "Current Cigarette Smoking among Adults in the United States," *Centers for*

Given that these environmental causes of lung cancer are preventable, the market size for cancer therapeutics and funding for screening begets the question, is the same level of concern and support given towards cancer prevention? From a financial perspective, many of the studies that highlighted the cost-effectiveness of lung cancer screening also show that the addition of smoking cessation programs results in reduced cost-utility ratios. Villanti and colleagues show a decreased price per QALY from $28,240 with screening alone to $16,198–$23,185 after adding smoking cessation programs.[30] Smoking cessation would also save the U.S. more than $300 billion per year in smoking-related illness expenses and lost productivity. Tobacco companies continue to profit, however, spending $8.2 billion in marketing in the U.S. in 2019 resulting in sales of nearly 250 billion cigarettes and a market size of over $900 billion.[31]

Low-income households are at especially high risk for developing adverse health effects due to increased exposure to second-hand smoke and other toxins. Many of these effects would be preventable with adequate maintenance and funding of public housing. While certain actions have been taken, especially with the 2018 U.S. Department of Housing and Urban Development rule that required smoke-free housing policies be implemented by all public housing authorities, there is still room to improve.

Case Analysis: New York City Housing Authority Public Housing

The New York City Housing Authority (NYCHA) is the oldest and largest public housing authority in the United States, with the goal of providing decent, affordable housing for low- and moderate-

Disease Control and Prevention, December 10, 2020, www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm.

[30] See Villanti, Jiang, Abrams, and Pyenson, "A Cost-Utility Analysis of Lung Cancer Screening and the Additional Benefits of Incorporating Smoking Cessation Interventions."

[31] See National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, "Economic Trends in Tobacco," Centers for Disease Control and Prevention, March 25, 2021, www.cdc.gov/tobacco/data_statistics/fact_sheets/economics/econ_facts/index.htm.

income residents throughout New York City. NYCHA's 335 public housing developments house over 500,000 people across the five boroughs of New York City.[32] Unfortunately, deteriorating living conditions including, but not limited to, mold, asbestos, lead, pest infestation, and second- or third-hand cigarette smoke, marijuana, and/or vaping have resulted in unsafe living conditions for tenants for years.

Over the course of 2018, Community Voices Heard (CVH), a grassroots organization founded by NYCHA resident leaders, and Regional Plan Association (RPA) engaged in a door-to-door survey documenting health and living conditions in NYCHA housing in Far Rockaway, New York. Major takeaways from this survey were that 81 percent of residents needed immediate repairs to their apartment and that the poor living conditions negatively impacted physical health in 25 percent of respondents and mental health in 33 percent of respondents. When asked about the presence of various toxins in their apartments, 15 percent of respondents reported lead, 13 percent reported asbestos, 32 percent reported visible mold, and 31 percent reported leaks, with potentially more unaware. Little or incomplete efforts were provided by NYCHA management to address these issues, with residents having nowhere else to turn.[33]

New York State Department of Health's assessment of NYCHA housing had similar findings, with 83 percent of apartments and 75 percent of common areas inspected having at least one severe condition that could pose a health hazard to tenants. A majority of areas had more than one environmental quality issue including water intrusion damage, chipping and peeling paint, damaged plaster, mold, insect and/or

[32] See New York City Housing Authority, "NYCHA 2021 Fact Sheet," New York City Housing Authority, March 2021, www1.nyc.gov/assets/nycha/downloads/pdf/NYCHA-Fact-Sheet_2021.pdf.

[33] See Moses Gates, "The Impacts of Living in NYCHA: Needs for Resident Health in the Rockaways and Beyond," *Regional Plan Association,* July 2020, rpa.org/work/reports/nycha-resident-needs-assessment.

rodent infestations, inoperable appliances, and malfunctioning or missing smoke and carbon monoxide detectors.[34]

According to NYCHA estimates in 2020, of the 175,000 apartments, 62,000 are receiving full repairs, while $18 billion is required to stabilize the remaining 110,000 apartments. Only $3.3 billion had been secured by NYCHA at that time.[35] Despite public awareness efforts and reports to government organizations, NYCHA residents have been left to tend to the repairs by themselves. While the residents lead initiatives to improve their own housing quality, governmental organizations and NYCHA have largely only followed.

Conclusion

Breaking down expenditure on lung cancer identifies three areas of focus: treatment, screening, and prevention. While these three facets are all important in promoting patient health and safety, from a utility perspective, screening and prevention have been shown to have much lower cost per QALY added compared with cancer therapeutics. The distribution of funding, however, does not accurately reflect the differences in impact on survival and quality of life. Over the last decade, lung cancer screening has gained significant prevalence since the NLST and I-ELCAP trials indicated earlier detection of lung cancer and better long-term survival for at-risk patients who undergo annual LDCT scans. Studies have also shown that integrating preventive measures with screening trials is not only cost-effective but also beneficial for patient health.

While smoking rates have declined over the last fifty years, the tobacco industry still generates exorbitant amounts of money, spending over $8 billion annually on marketing. Meanwhile, environmental factors that further increase risk of lung cancer and other health outcomes continue

[34] See New York State Department of Health, "Assessment of New York City Housing Authority (NYCHA) Properties," March 2018, www.governor.ny.gov/sites/default/files/atoms/files/FINAL_Assessment_of_NYCHA_Report.pdf.

[35] See New York City Housing Authority, "A Blueprint for Change," *New York City Housing Authority,* 2020, www1.nyc.gov/site/nycha/residents/blueprint-for-change.page.

to plague our most at-risk populations. In NYCHA public housing, for example, blueprints have been created that indicate $18 billion would be needed to install repairs that would directly decrease rates of lung cancer as well as asthma, diabetes, obesity, heart disease, and infections, yet only $3.3 billion had been secured. In contrast, $8.67 billion is spent on the lung cancer drug industry worldwide (as part of the $150 billion spent on all cancer therapeutics), with patients unaware that some of these lauded drugs may not improve overall survival. This current misappropriation of funding towards initiatives that are driven by business, political, and scientific agendas, ignores the underlying causes of poor health outcomes and undermines our goals in addressing cancer.

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