The Harvard Center for Population and Development Studies

Working Paper Series

Political determinants of US states' screening-amenable cancer stage at diagnosis and premature cancer mortality

Nancy Krieger, PhD,[1] Soroush Moallef, MSc,[1,2] Tori L. Cowger, PhD, MPH,[2] Jarvis T. Chen, ScD,[1] Ruchita Balasubramanian, MPhil,[2,5] Alecia J. McGregor, PhD,[3] Loni Philip Tabb, PhD,[4] William P. Hanage, PhD,[5] Mary T. Bassett, MD, MPH,[1,2]

April 21, 2025

HCPDS Working Paper Volume 25, Number 1

Affiliations:
[1]Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health
[2]FXB Center for Health and Human Rights, Harvard University
[3]Department of Health Policy and Management, Harvard T.H. Chan School of Public Health
[4]Department of Epidemiology and Biostatistics, Dornsife School of Public Health, Drexel University
[5]Department of Epidemiology and Center for Communicable Disease Dynamics, Harvard T.H. Chan School of Public Health

Corresponding author: Nancy Krieger, PhD, Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health
Kresge 717, 677 Huntington Avenue
Boston, MA 02115 USA
email: nkrieger@hsph.harvard.edu; phone: 617-432-1571

Word count: Abstract: 243 (limit: 250)
Text: 2968 (limit: 3000)

Figures/Tables: 1 Table, 2 Figures, 1 Textbox (limit: 8)

References: 58 (no limit)

Supplementary materials: 4 Tables, 2 Figures, 1 Textbox (limit: 8)

Submitted to *JNCI Cancer Spectrum* on April 19, 2025
Submitted to Harvard Center for Population and Development Studies Working Paper series (preprint) on April 19, 2025

ABSTRACT

Background. Political determinants of cancer risk are largely unexplored, conceptually and empirically.

Methods. Observational analysis of associations present in 2017-2021 between 5 state-level political metrics and four age-standardized cancer outcomes, overall and adjusting for state-level poverty and medical uninsurance.

Results. Higher scores for political conservativism were associated with both regional and distant stage at cancer diagnosis for breast, cervical, and colorectal cancer among screening-age adults and with premature cancer mortality. Adjustment for state-level poverty and the state-level medical uninsurance variables (% working age adults (age 35-64) without medical insurance; number of years of state Medicaid expansion) rendered many but not all these associations null. In fully adjusted models, risk of diagnosis with regional and distant breast and colorectal cancer remained associated with conservative political ideology (measured by voting record) among elected officials in the US House of Representatives (respectively: -0.76, 95% confidence interval (CI) -1.26 to -0.25; -0.75; 95% CI -1.5 to 0), as did risk of premature cancer mortality with more conservative scores for: the state electoral college vote (-2.01, 95% CI -3.68 to -0.33), the state liberalism policy index (-2.51, 95% CI -4.48 to -0.54), and political ideology of elected officials in the US Senate (-1.93, 95% CI -3.71 to -0.14).

Conclusion(s). Our state-level analyses suggest that political metrics are associated with preventable cancer outcomes. Efforts to reduce population burdens of cancer and inequities in these burdens could benefit from analyses of sociopolitical drivers of cancer risk across the cancer continuum.

INTRODUCTION

Political determinants of cancer risk and cancer inequities – that is, unfair social group differences in cancer outcomes that are in principle preventable[1,2] – are largely unexplored, conceptually and empirically.[3-6] At issue is how cancer risk is shaped by such political determinants as the political ideology of elected officials and of voters, political party concentrations of power, and the legislation they enact.[3-13] Suggesting such research could prove valuable, evidence indicates that risk of later stage at diagnosis for screening-amenable cancer and of premature cancer mortality is associated with several societal phenomena whose population distributions are shaped by political priorities and processes[3-13]: being impoverished, residing in a lower-income and medically underserved community, lacking access to affordable health care, and belonging to a racialized group at risk of racial discrimination.[2,14]

To date, the two most common types of metrics employed in the small but growing body of empirical public health research on political determinants of health pertain to the political lean of voters and of enacted policies,[6,9-11] as per recent US research on associations of political polarization with COVID-19 policies, outcomes, and health practices.[11,15,16] Even stronger associations between political metrics and health outcomes have been observed in the handful of public health studies[12,13,17] using metrics more commonly employed by political scientists, such as the political ideology of elected officials, as measured by their voting records, and the political concentration of power, as measured by which parties are in control of the executive and legislative branches of government.[7-9,18] Taken together, the suggestive evidence indicates that political conservatism is associated with worse health metrics,[3-18] noting that "conservatism places greater emphasis on the values of economic freedom and cultural traditionalism," while "liberalism involves greater government regulation and welfare provision to promote equality and protect collective goods."[19(p. 901)]

Currently, only a handful of published conceptual analyses and one empirical study have addressed how political determinants may affect cancer outcomes, primarily in relation to national cancer control policies.[3-6] We accordingly designed our exploratory observational study, employing US state date for 2017-2021, to quantify associations between US state-level political metrics with: (a) state-level distributions of cancer stage at diagnosis, among screening-age adults, for three leading types of cancer recommended for screening for either interception (cervix and colorectal) or early detection (breast and colorectal),[20] and (b) state-level rates of premature cancer mortality, a leading contributor to premature years of life lost in the US.[21] To generate preliminary data regarding potential pathways by which political determinants could exert their effects, we included, as covariates, state-level data on poverty and medical uninsurance, including in relation to Medicaid expansion.[14,22,23]

METHODS

Study design and study population. The study population for our observational investigation comprised the population of all US states and the District of Columbia during 2017-2021, a period which overlaps with two US presidential election cycles (2016-2020; 2021-2024). We employed exposure and covariate data from two periods, for: (1) our primary cross-sectional analyses, using 2017-2021 data; and (2) lagged sensitivity analyses, using 2012-2016 data. **Table S1** delineates the data sources and the link to the analytic code.

Study outcomes. We obtained state-level data on: (1) distribution of cancer stage at diagnosis (local, regional, distant, and unstaged) among screening-age adults for breast (female), cervix, and colorectal cancer,[20,24-27] and (2) premature mortality (death before age 65) due to cancer (all types combined; ICD-10 C00-C97).[21,28] According to American Cancer Society guidelines, the age at which screening is first recommended for both breast cancer and colorectal cancer is age 45,[25,27] and for cervical cancer it is age 25.[26] For cancer stage at diagnosis, our primary outcome was percent of site-specific cancer cases diagnosed as "regional + distant," excluding unstaged cancer cases.[29] See **Textbox S1** for technical details on the cancer and mortality data employed.

Study exposure. We employed five state-level political metrics, for which we provide detailed conceptual justification in **Textbox 1** and detailed technical description in **Textbox S1**. These political metrics comprised: (1) electoral college vote score (range: -1 (all Republican) to 1 (all Democrat)); (2) state liberalism policy index,[19] an annual score derived from a dynamic latent model based on 148 economic, civil rights, safety net, and other social policies (range: -1 (most conservative) to 1 (most liberal)); (3) political party concentration of power in relation to state trifecta status[30] (executive and legislative branches both controlled by the same political party; values: R (Republican trifecta), M (mixed government), and D (Democratic trifecta)); and (4) political ideology of elected representatives, based on their voting records, using the DW-Nominate metric (range: -1 (most conservative) to 1 (most liberal)),[31] for both (a) US House of Representatives, and (b) US Senate.

Study covariates. We used two sets of covariates associated with the study's exposures and outcomes[12-14,22,23] which could potentially act as confounders or mediators of any observed association: (1) poverty level, and (2) access to medical insurance, measured in relation to percent of the adult population (age 35-64) lacking health insurance and whether the state opted for Medicaid expansion starting in 2014. Technical details for these covariates are included in **Textbox S1.**

Statistical Analysis. We first described the distribution of each exposure, outcome, and covariate metric, across states, for both the cross-sectional data (2017-2021; **Table 1; Figure 1**), and for the lagged analyses using 2012-2016 exposure and covariate data (**Table S1**). **Figure S1** displays the correlations across all variables. To address the small amount of suppressed state-level data (counts ≤ 5) for stage at diagnosis, we employed a multiple imputation strategy of sampling from a uniform random distribution between 1 and 5 for each suppressed category to create 5 imputed datasets. For each imputed dataset, we then calculated, for each state, the age-specific proportions and variances for stage of cancer at diagnosis, weighted by the corresponding U.S. 2000 standard million population weights obtained from the National Cancer Institute.[32] We then pooled results across the imputed dataset using Rubin's rules[33] to generate each state's age-standardized proportions, variances, and associated 95% confidence intervals. The imputation process had minimal impact on our findings, given scant suppressed values (< 2.5%). State-level data for the age-standardized premature cancer mortality (<age 65) had no suppressed values.

Our primary analyses focused on fitting four linear regression models of the associations between each cross-sectional political exposure and age-standardized cancer outcome data. Model 1, the unadjusted model, included only the exposure and outcome variable; Model 2 adjusted Model 1 for poverty; Model 3 adjusted Model 1 for the health insurance covariates (medical uninsurance among working age adults and state Medicaid expansion status), and Model 4 adjusted Model 1 for both the poverty and health insurance covariates (**Figure 2, Table S3**). Diagnostic tests indicated no violations of model assumptions. We computed standardized parameter estimates (unit change in the outcome per 1 standard deviation of the exposure metric) to enable meaningful comparisons of estimate effect sizes across the political metrics, given their different scales.[34] We did not weight for population size, since the focus is on the state-level political metrics as the exposure and states as the unit analysis[35,36]; supporting this approach, in a prior state-level investigation of state-level political metrics and other health outcomes, we found that effect estimates were virtually identical for models which did vs. did not weight for state population size.[13] In the current study, sensitivity analyses investigated lagged associations, whereby the temporal period of the outcome data remained the same (2017-2021), but using the political metric and covariate data from 2012-2016 (**Table S4, Figure S2**).

Human Subjects. The Harvard Longwood Campus IRB decision tool determined (on Jan 7, 2025) that this investigation was "not considered human subjects research and no HLC IRB application is required."

RESULTS

State-level distribution of outcomes, exposure, and covariates. During the period 2017-2021, US states displayed heterogeneity in the proportion of screening-amenable cancers diagnosed as regional or distant, with this proportion varying by type of cancer (**Table 1; Figure 1**). For breast cancer (female), among persons age 45 and over, the mean proportion (and standard deviation (SD)) for regional equaled 28.4 (SD 1.8), and ranged from 23.1 to 31.5, while the mean proportion for distant equaled 5.7 (SD 0.9), and ranged from 3.7 to 7.4. For cervical cancer, the mean proportion for regional was similar to breast cancer, but the proportion for distant was higher: 14.8 (SD 2.5), ranging from 10.4 to 21.9. For colorectal cancer, the mean proportion for both regional and distant were higher compared to breast cancer; the mean proportion for regional was 36.6 (SD 2.2), ranging from 29.9 to 40.6, while the mean proportion for distant was 21.8 (SD 1.1), ranging from 18.9 to 23.8. The age-standardized death rate for premature cancer mortality (< age 65) equaled 47.7 per 100,000 (SD 7.5), and ranged from 34.5 to 66.3 per 100,000 person-years.

Both the political exposures and economic and medical insurance covariates for 2017-2021 likewise displayed heterogeneity by state (**Table 1; Figure 1**). Across US states, the political ideology scores for elected officials in the US congress ranged from -1 (most conservative) to 1 (most liberal) for member of the US House (mean: -0.05, SD 0.51)) and US Senate (mean: -0.04, SD 0.76)), as did the electoral college score for the 2020 presidential election. The state liberalism policy index (< 0: conservative; >0: liberal) ranged from -2.9 to 3.6 (mean: 0.07, SD 1.7), and 23.2% of the states had Democratic trifectas, 44.8% had Republican trifectas, and 30% had "mixed" governments. On average, across US states, 12.4% (SD 2.7) of the population was below the US federal poverty line (range: 7.4 to 19.4), 10.0% (SD 3.8) of working age adults (ages 35-64) lacked medical insurance (range: 3.2 to 20.9), and the average number of years covered for state Medicaid expansion (range: 0-5) equaled 3.4 (SD 2.2). Similar patterns of heterogeneity occurred for the lagged exposure and covariate metrics for 2012-2016 (**Table S2**).

Across all political metrics, state conservatism was positively correlated with: (a) the proportion of regional and distant stage at diagnosis for both breast and colorectal cancer, and (b) poverty, medical uninsurance, and fewer years of state Medicaid expansion (**Figure S1**). Higher levels of poverty and medical uninsurance were also positively correlated with the proportion of regional and distant stage at diagnosis for both breast and cervical cancer (**Figure S1**).

<u>Standardized associations between the cancer outcomes and the political exposures</u>. Results for the cross-sectional analyses (2017-2021) of associations between the age-standardized state-level cancer outcomes and the state-level political exposures for Models 1 through 4 are displayed in **Figure 1**, with point estimates and p-values provided in **Table S3**. In Model 1 (unadjusted model), state-level risk of regional and distant stage at cancer diagnosis and risk of premature cancer mortality was associated with higher values for state conservatism across nearly all political metrics, with the 95% confidence interval excluding 1 for all but cervical cancer (for all political metrics except electoral college score) and

colorectal cancer for state trifecta (Republican vs. Democrat). In most but not all cases, additional adjustment for state-level poverty (Model 2) and the state-level medical uninsurance variables (Model 3) rendered these associations null. However, in the fully adjusted models (Model 4), risk of diagnosis with regional and distant breast cancer remained associated with conservative political ideology among elected officials in the US House of Representatives (-0.76, 95% confidence interval (CI) -1.26 to -0.25), and were marginally associated with regional and distant colorectal stage at diagnosis (-0.75; 95% CI -1.5 to 0). In these models, risk of premature cancer mortality likewise remained associated with more conservative scores for: the state electoral college vote (-2.01, 95% CI -3.68 to -0.33), the state liberalism policy index (-2.51, 95% CI -4.48 to -0.54), and political ideology of elected officials in the US Senate (-1.93, 95% CI -3.71 to -0.14). Sensitivity analyses using lagged political exposure and covariate data (2012-2016, with 2017-2021 outcome data) yielded similar results (**Figure S2, Table S4**).

DISCUSSION

Our analyses provide novel evidence that state-level conservatism across a range of metrics – political ideology of officials elected to the US House of Representatives or US Senate, Electoral College vote share, presence of a Republican state trifecta, or a state liberalism policy index – is associated with worse cancer outcomes for regional or distant stage of diagnosis for screening-amenable cancers and premature cancer mortality. Controlling for poverty and medical uninsurance – the two set of covariates with well-documented association with both the study's adverse cancer outcomes and political conservatism[2-14,18,22,23] – reduced these associations (including across all political metrics for cervical cancer stage at diagnosis), consistent with the hypothesis that political conservatism may affect cancer outcomes in part by its impact on poverty and medical uninsurance rates (perhaps especially for cervical cancer, for which screening is the primary prevention measure in the absence of HPV vaccination[14,20,26]). Nevertheless, even after controlling for these latter variables, increased risk of premature cancer mortality remained associated with three political metrics (electoral college vote, state liberalism policy index, and US Senate political ideology score), and increased risk of regional or late stage of diagnosis persisted for both breast cancer and colorectal cancer for the US House political ideology score, suggesting additional pathways may matter.

We emphasize that our exploratory observational cross-sectional and lagged state-level analyses for cancer stage at diagnosis and premature cancer mortality do not provide causal estimates of risk and focus on only two components of the cancer continuum, which encompasses cancer etiology, prevention, detection, diagnosis, treatment, and survivorship.[2,37-40] However, despite these limitations, our study nonetheless contributes to the limited empirical data on political determinants of cancer outcomes[3-6] by providing important novel empirical evidence that can set the basis for further causal investigation for these outcomes of public health importance. In the US, breast and colorectal cancer are leading causes of cancer mortality.[20] A model-based simulation study for 1975 to 2000 estimated that 79% of US colorectal cancer deaths, 25% of US breast cancer deaths, and 100% of US cervical cancer deaths could be averted by screening. [20] These types of cancer are also among the leading causes of US premature years of life lost due cancer.[21] Premature cancer mortality also exhibits marked socioeconomic and racialized inequities in the US and other countries,[14,41-43] and globally, cancer ranks as the 1st or 2nd cause of premature death (age 30-69) in 134 of 183 countries.[41] Gaining new insight into who and what drives these risks matters for prevention.

An additional strength of our analyses is our use of US political metrics documented to be important determinants of both policies and societal conditions.[7-13,18,19] Another is the small amount of suppressed state-level data, rendering analytic results of the non-imputed and imputed data virtually identical. Also a strength is the temporal congruity of the exposure and outcome data: cancer stage at diagnosis – unlike cancer incidence (for which there typically is a long etiological period, that is, time between exposure to carcinogens and developing a detectable cancer) – is sensitive to concurrent ability to access cancer screening, as determined by ability to cover costs of medical care and geographic proximity of and costs of accessing this care (e.g., for transportation).[3,6,14,38] Risk of premature mortality due to cancer in turn reflects the impact of concurrent access to medical care, even as it also is shaped by preceding etiologic exposures.[14,38,41] These dual pathways are likely why adjusting for poverty had a greater impact on premature cancer mortality risk than adjusting for the medical uninsurance covariates, even as both sets of covariates mattered.

Our findings further suggest that future analyses of political determinants of cancer outcomes and their spatial heterogeneity should include such political metrics as the political ideology of elected officials, state concentrations of political power, and state policy bundles, not just metrics pertaining to voter political lean and individual policies.[7,8,12,13,18,19] Reliance on voter political lean is insufficient, since its impact is distorted by legislative determination of political district boundaries, with evidence indicating that gerrymandering (i.e., the redrawing of district boundaries to concentrate the vote of desired voters and dilute the vote of disfavored votes) can shape the lean of the districts' voters and amplify election of politicians with more extreme political ideologies.[13,44-46] It may be for this reason that political ideology of elected officials for the US House – whose districts are subject to gerrymandering[44-46] – was more strongly associated with regional and distant stage of diagnosis for breast cancer and colorectal cancer compared to the political ideology of elected officials in the US Senate, for whom elections are statewide and not dependent on within-state congressional district boundaries.

Pointing to the need to build the empirical evidence base on political determinants of cancer, to date the limited conceptual literature on this topic has focused primarily on analyses of the politics of national cancer control plans, funding of and access to clinical trials, and access to medical care.[3-6] Moreover, the one extant empirical study on the "sociodemographic, political, and policy contexts of cancer care" focused on five countries with high survival rates, all of which were high-income countries possessing a "strong welfare state with universal health coverage."[6] These limitations underscore the need for research on political determinants of cancer risk and cancer care in countries lacking as well as possessing a strong welfare state and universal health care. More generally, studies should employ a range of political metrics, cognizant of their potential strengths and limitations, and should account for the appropriate etiologic timeframes for outcomes across the cancer continuum as well as address issues of spatial heterogeneity, both substantively and statistically.[3,37-40]

In summary, our exploratory investigation suggest that efforts to reduce population burdens of cancer and inequities in these burdens could benefit from analyses of the sociopolitical drivers of cancer risk. Policies and societal conditions do not simply "exist"; they instead reflect the present and past ideologies, deliberate actions, and anticipated and unanticipated consequences of these actions on the conditions of life that affect population health, including cancer outcomes and cancer inequities.[7-13,18,19,47,48] Rigorous research on political determinants of cancer is both needed and warranted.

CONFLICTS OF INTEREST: None of the authors have any conflicts of interest to report.

ACKNOWLEDGMENTS: We thank Rita Hamad (written permission: 4/9/25) for her contributions to framing our analyses and we thank Meg Matthews (written permission: 4/8/25) for her assistance with proofing our manuscript before submission.

FUNDING: This work was supported in part by the American Cancer Society Clinical Research Professor Award to NK

DATA AVAILABLITY STATEMENT: *The data underlying this article are available in GitHub at* https://github.com/smoallef/political-cancer-analysis. *The datasets were derived from sources in the public domain; their sources and URLs provided in* ***Table S1***.

AUTHOR CONTRIBUTIONS AND ORCID ID

Author	CRediT categories	ORCID
Nancy Krieger	Conceptualization; Funding acquisition; Investigation; Methodology; Project administration; Resources; Supervision; Visualization; Writing – original draft	0000-0002-4815-5947
Soroush Moallef	Conceptualization; Data curation; Formal Analysis; Investigation; Methodology; Software; Visualization; Writing – review & editing	0000-0003-0339-7309
Tori L. Cowger	Conceptualization; Formal Analysis; Investigation; Methodology; Visualization; Writing – review & editing	0000-0001-5359-8155
Jarvis T. Chen	Conceptualization; Formal Analysis; Investigation; Methodology; Software; Writing – review & editing	0000-0002-7412-1783
Alecia J. McGregor	Conceptualization; Investigation; Methodology; Writing – review & editing	0000-0003-0993-4232
Loni Philip Tabb	Conceptualization; Investigation; Methodology; Writing – review & editing	0000-0002-7601-8368
Ruchita Balasubramanian	Conceptualization; Investigation; Methodology; Writing – review & editing	0000-0002-9151-9873
William P. Hanage	Conceptualization; Investigation; Methodology; Writing – review & editing	0000-0002-6319-7336
Mary T. Bassett	Conceptualization; Investigation; Methodology; Writing – review & editing	0000-0002-7810-4163

LIST OF TEXTBOXES, TABLES AND FIGURES

LIST OF SUPPLEMENTARY MATERIALS

Figure S2. Lagged standardized associations, at the state level, of current % regional + distant cancer stage at diagnosis (breast (female), cervix, colorectal) for adults at or above age at which screening is first recommended and premature cancer mortality rate (death before age 65) for the cancer outcomes (2017-2021) with the lagged political exposures and covariates, for 50 US states and the District of Columbia, age-standardized and additionally separately and together for: (a) percent below poverty (2012-2016), and (b) percent uninsured (adults 35-64)(2012-2016) and state Medicaid expansion (2014-2016).

REFERENCES

1. World Health Organization. Health Equity. https://www.who.int/health-topics/health-equity#tab=tab_1 ; accessed April 19, 2025.
2. Krieger N. Defining and investigating social disparities in cancer: critical issues. *Cancer Causes Control*. 2005 Feb; 16(1):5-14. doi: 10.1007/s10552-004-1251-5.
3. Loehrer AP, Green SR, Winkfield KM. Inequity in cancer and cancer care delivery in the United States. *Hematol Oncol Clin North Am*. 2024 Feb; 38(1):1-12. doi: 10.1016/j.hoc.2023.08.001. Epub 2023 Sep 4.
4. Dee EC, Eala MAB, Robredo JPG, et al. Leveraging national and global political determinants of health to promote equity in cancer care. *J Natl Cancer Inst*. 2023 Oct 9; 115(10):1157-1163. doi: 10.1093/jnci/djad123.
5. Dee EC, Magsanoc-Alikpala MJK, Moraes FY, Willmann J, Ting FIL, Feliciano EJG. Political determinants of cancer health. *Lancet Reg Health Am*. 2025 Feb 1; 43:101008. doi: 10.1016/j.lana.2025.101008.
6. Fuentes-García A, Flores-Figueroa C, Castillo-Delgado A. Sociodemographic, political, and policy contexts of cancer care: A comparative analysis of countries with the highest survival rates. *J Cancer Policy*. 2025 Mar; 43:100559. doi: 10.1016/j.jcpo.2025.100559. Epub 2025 Jan 31. Erratum in: *J Cancer Policy*. 2025 Mar 28:100577. doi: 10.1016/j.jcpo.2025.100577.
7. McGuire JW. *Democracy and Population Health*. Cambridge, UK: Cambridge University Press; 2020.

8. Beckfield J. *Political Sociology and the People's Health*. New York: Oxford University Press; 2018.
9. Oliver TR. The politics of public health policy. *Annu Rev Publ Health*. 2006; 27(1):195–233.
10. Navarro V, Muntaner C, Borrell C, et al. Politics and health outcomes. *Lancet*. 2006 Sep 16; 368(9540):1033-1037.
11. Dawes D, Gonzalez J. The politics of population health. *Milbank Q*. 2023; 101(S1):224–241.
12. Krieger N, Testa C, Chen JT, Hanage WP, McGregor AJ. Relationship of political ideology of US federal and state elected officials and key COVID pandemic outcomes following vaccine rollout to adults: April 2021-March 2022. *Lancet Reg Health Am*. 2022 Dec; 16:100384. doi: 10.1016/j.lana.2022.100384. Epub 2022 Oct 31.
13. Krieger N, Moallef S, Chen JT, et al. Politicians, power, and the people's health: US elections and state health outcomes, 2012-2024. *Health Aff Sch*. 2024 Nov 27; 2(12):qxae163. doi: 10.1093/haschl/qxae163.
14. Islami F, Baeker Bispo J, Lee H, et al. American Cancer Society's report on the status of cancer disparities in the United States, 2023. *CA Cancer J Clin*. 2024 Mar-Apr; 74(2):136-166. doi: 10.3322/caac.21812. Epub 2023 Nov 14.
15. Grossman G, Kim S, Rexer JM, Thirumurthy H. Political partisanship influences behavioral responses to governors’ recommendations for COVID-19 prevention in the United States. *Proc Natl Acad Sci USA*. 2020; 117(39):24144–24153.
16. Nayak SS, Fraser T, Aldrich DP, Panagopoulos C, Kim D. County-level political group density, partisan polarization, and individual-level mortality among adults in the United States: a lagged multilevel study. *SSM Popul Health*. 2024; 26:101662. doi: 10.1016/j.ssmph.2024.101662
17. Pomeranz JL, Siddiqi A, Bolanos GJ, Shor JA, Hamad R. Consolidated state political party control and the enactment of obesity-related policies in the United States. *Prev Med*. 2017; 105:397–403.

18. Lynch J. The political economy of health: bringing political science in. *Annu Rev Polit Sci*. 2023; 26(1):398–410.

19. Caughey D, Warshaw C. The dynamics of state policy liberalism index, 1936-2014. *Am J Polit Sci*. 2016; 60(4):889–913.

20. Goddard KAB, Feuer EJ, Mandelblatt JS, et al. Estimation of cancer deaths averted from prevention, screening, and treatment efforts, 1975-2020. *JAMA Oncol*. 2025 Feb 1; 11(2):162-167. doi: 10.1001/jamaoncol.2024.5381.

21. Song M, Hildesheim A, Shiels MS. Premature years of life lost due to cancer in the United States in 2017. *Cancer Epidemiol Biomarkers Prev*. 2020 Dec; 29(12):2591-2598. doi: 10.1158/1055-9965.EPI-20-0782. Epub 2020 Nov 13.

22. Kim U, Koroukian S, Statler A, Rose J. The effect of Medicaid expansion among adults from low-income communities on stage at diagnosis in those with screening-amenable cancers. *Cancer*. 2020 Sep 15; 126(18):4209-4219. doi: 10.1002/cncr.32895. Epub 2020 Jul 6.

23. Barnes JM, Johnson KJ, Osazuwa-Peters N, Yabroff KR, Chino F. Changes in cancer mortality after Medicaid expansion and the role of stage at diagnosis. *J Natl Cancer Inst*. 2023 Aug 8; 115(8):962- 970. doi: 10.1093/jnci/djad094.

24. US National Cancer Institute. Screening tests. Last reviewed: September 27, 2024. https://www.cancer.gov/about-cancer/screening/screening-tests; accessed April 19, 2025.

25. American Cancer Society Recommendations for the Early Detection of Breast Cancer. Last revised: December 19, 2023. https://www.cancer.org/cancer/types/breast-cancer/screening-tests-and-early-detection/american-cancer-society-recommendations-for-the-early-detection-of-breast-cancer.html ; accessed April 19, 2025.

26. National Cancer Institute. ACS's Updated Cervical Cancer Screening Guidelines Explained. Last revised: September 18, 2020. https://www.cancer.gov/news-events/cancer-currents-blog/2020/cervical-cancer-screening-hpv-test-guideline ; accessed April 19, 2025.

27. American Cancer Society Guideline for Colorectal Cancer Screening. Last revised: January 29, 2024. https://www.cancer.org/cancer/types/colon-rectal-cancer/detection-diagnosis-staging/acs-recommendations.html ; accessed April 19, 2025.

28. National Cancer Institute. SEER training modules. ICD-10-CM Chapter 2: Neoplasms (C00-D49). C Codes. Last updated: December 3, 2018. https://training.seer.cancer.gov/icd10cm/neoplasm/c-codes.html ; accessed April 19, 2025.

29. CDC. United States Cancer Statistics. June 13, 2024. https://www.cdc.gov/united-states-cancer-statistics/technical-notes/stage-at-diagnosis.html ; accessed April 19, 2025.

30. Ballotpedia . State government trifectas. https://ballotpedia.org/State_government_trifectas ; accessed April 19, 2025.

31. Voteview.com. About the project. https://voteview.com/about ; accessed April 19, 2025.

32. National Cancer Institute. Standard populations (millions) for age-adjustment. https://seer.cancer.gov/stdpopulations/ ; accessed April 19, 2025.

33. Rubin DB. Multiple imputation after 18+ years. *J Am Stat Assoc.* 1996; 91:473-489.

34. Gelman A. When to standardize regression inputs and when to leave them alone. July 11, 2009. https://statmodeling.stat.columbia.edu/2009/07/11/when_to_standar/ ; accessed April 19, 2025.

35. Miratrix LW, Sekhon JS, Theodoridis AG, Campos LF. Worth weighting? How to think about and use weights in survey experiments. *Polit Anal*. 2018; 26(3):275–291.

36. Solon G, Haider SJ, Woolridge JM. What are we weighting for? *J Human Resources*. 2015; 50(2):301–316.

37. National Cancer Institute. Cancer control continuum. https://cancercontrol.cancer.gov/about-dccps/about-cc/cancer-control-continuum ; accessed April 19, 2025.

38. Krieger N. Analyzing structural racism and its health impacts: it's about time. *Am J Epidemiol*. 2024 Oct 4:kwae392. doi: 10.1093/aje/kwae392. Epub ahead of print.

39. Gomez SL, Shariff-Marco S, DeRouen M, et al. The impact of neighborhood social and built environment factors across the cancer continuum: Current research, methodological

considerations, and future directions. *Cancer*. 2015 Jul 15; 121(14):2314-30. doi: 10.1002/cncr.29345. Epub 2015 Apr 6.

40. Sorice KA, Fang CY, Wiese D, et al. Systematic review of neighborhood socioeconomic indices studied across the cancer control continuum. *Cancer Med*. 2022 May; 11(10):2125-2144. doi: 10.1002/cam4.4601. Epub 2022 Feb 14.

41. Cao B, Soerjomataram I. The burden and prevention of premature deaths from noncommunicable diseases, including cancer: a global perspective. In: Wild CP, Weiderpass E, Stewart BW, editors. *World Cancer Report: Cancer research for cancer prevention*. Lyon (FR): International Agency for Research on Cancer; 2020. 1.1. https://www.ncbi.nlm.nih.gov/books/NBK606514/?report=reader ; accessed April 19, 2025.

42. Ma J, Yabroff KR, Siegel RL, Cance WG, Koh HK, Jemal A. Progress in reducing disparities in premature mortality in the USA: a descriptive study. *J Gen Intern Med*. 2022 Sep; 37(12):2923-2930. doi: 10.1007/s11606-021-07268-5. Epub 2022 Jun 22.

43. Thomas AL, Kulchar RJ, Stephens ES, et al. County socioeconomic status and premature mortality from cancer in the United States. *Cancer Epidemiol*. 2025 Apr; 95:102747. doi: 10.1016/j.canep.2025.102747. Epub 2025 Jan 18.

44. Keena A, Latner M, McGann AJM, Smith CA. *Gerrymandering the States: Partisanship, Race, and the Transformation of American Federalism*. Cambridge, UK: Cambridge University Press, 2021.

45. Syed Q, Schmidt S, Powell RE, et al. Gerrymandering and political determinants of health. *Popul Health Manag*. 2022; 25(4):568–570.

46. Rushovich T, White A, Nethery RC, Krieger N. Gerrymandering and the packing and cracking of medical uninsurance in the United States. *J Public Health Manage Policy*. 2024; 30(6):832–834. doi: 10.1097/PHH.0000000000001916

47. Krieger N. *Ecosocial Theory, Embodied Truths, and the People's Health*. New York: Oxford University Press, 2021.

48. Heller JC, Givens ML, Johnson SP, Kindig DA. Keeping it political and powerful: defining the structural determinants of health. *Milbank Q*. 2024; 102(2):351–366.

49. Montez JK, Grumbach JM. US state policy contexts and population health. *Milbank Q*. 2023; 101(S1):196–223.

50. Matthay EC, Gottlieb LM, Rehkopf D, Tan ML, Vlahov D, Glymour MM. What to do when everything happens at once: analytic approaches to estimate the health effects of co-occurring social policies. *Epidemiol Rev*. 2022; 43(1):33–47.

51. United States National Archives. What is the electoral college? Page last reviewed: November 2, 2024. https://www.archives.gov/electoral-college/about ; accessed April 19, 2025.

52. McDonald M. Election Lab, State and National Turnout Rates for Selected Elections. https://election.lab.ufl.edu/voter-turnout/ ; accessed April 19, 2025.

53. Hartig H, Daniller A, Keeter S, Van Green T. Voter Turnout, 2018-2022. Pew Research Center; July 12, 2023. https://www.pewresearch.org/politics/2023/07/12/voter-turnout-2018-2022/ ; accessed April 19, 2025.

54. Barber M, Holbein JB. 400 Million voting records show profound racial and geographic disparities in voter turnout in the United States. *PLoS One*. 2022;17(6):e0268134. 10.1371/journal.pone.0268134

55. US Department of Health and Human Services . *Healthy People 2020*. Last reviewed December 14, 2020. https://www.cdc.gov/nchs/healthy_people/hp2020.htm ; accessed April 19, 2025.

56. US Department of Health and Human Services . *Healthy People 2030*. Last reviewed: August 18, 2020. https://www.cdc.gov/nchs/healthy_people/hp2030/hp2030.htm ; accessed April 19, 2025.

57. US Department of Health and Human Services. Programs that use the poverty guidelines as part of eligibility determination. Content last reviewed November 5, 2019. https://www.hhs.gov/answers/hhs-administrative/what-programs-use-the-poverty-guidelines/index.html ; accessed April 19, 2025.

58. Tolbert J, Bell C, Rudowitz R. Medicaid expansion is a Red and Blue state issue. KFF, November 27, 2024, https://www.kff.org/medicaid/issue-brief/medicaid-expansion-is-a-red-and-blue-state-issue/ ; accessed April 19, 2025.

TEXTBOXES

Textbox 1. Theoretical justification for the US state-level variables: political metrics, health outcomes, and socioeconomic covariates*		
State-level variable	**Theoretical justification**	**Additional considerations**
Political metrics	**1) Political ideology of elected representatives.** Elected officials campaign to win positions of power and legislate based on their political ideology. Political ideologies, while complex, in the US typically are categorized as ranging from conservative to liberal, in relation to both social and economic positions. Political ideologies can affect population health and health inequities via their material impacts on people's living and working conditions and on their economic, social, political, civil, and cultural rights.	Politicians' legislative voting records (i.e., roll call votes) provide public data on their political positions and can reflect their willingness to use state power to implement their political ideology. In the US, members of Congress (US House and Senate) legislate to shape federal policy, including its impact on states and resources for constituents in their states. A political ideology score based on roll call votes of US members of Congress is available (DW-Nominate)[31] is employed in numerous social science studies, but rarely in population health studies.[8,13,18]
	2) Political party concentration of power. Political parties provide the resources and organizational means for politicians with a similar political ideology to enact their legislative agenda. Achieving political party concentration of power, in order to have a sufficient number of votes to pass legislation and override any vetoes, is a core objective. The likelihood of particular policies to impact population health depends in part on the power of political parties to enact the legislation they advocate.	In the US political system, political party concentration of power can be measured in relation to whether a single party controls the executive and legislative branches of government. At the US state level, this involves control of three seats of power (also referred to as a "trifecta"): Governor (executive) and each component of their bicameral legislatures (e.g., House and Senate), with the one exception of Nebraska (which has a unicameral legislature).[30] Trifecta data are employed in numerous social science studies, but rarely in population health studies.[8,13,17,18]
	3) State policy index. State policies are the political enactment of elected officials' political ideologies and the government agencies they control and whose budgets they set. These policies, enacted over time, singly and together, shape the conditions of life for people and ecosystems within their state (and sometimes neighboring states, as per the case of environmental pollution), thereby affecting people's health.	Beyond the direct health impacts of specific policies (e.g., Medicaid expansion), both public health and social science studies increasingly are investigating impacts of policy "bundles," which reflect a shared underlying political ideology and base of support,[8,18,19,49,50] Some state policy indices focus on multiple policies in a specific policy domain (e.g., health care), others consider policies across multiple domains (e.g., social and economic policies); most are cross-sectional and cover a limited set of years, but some include decades of policy data to create dynamic measures of state policy indices.[19,49]
	4) Electoral college votes. In the US, states' electoral college votes reflect the states' voter political lean. This is because "[m]ost States have a "winner-take-all" system that awards all electors to the Presidential candidate who wins the State's popular vote," with the exceptions being Maine and Nebraska, which each have a variation of "proportional representation."[51] Each state has the same number of electors as its Congressional delegation (House plus Senate), with DC having 3 electors; the electors are picked by each presidential candidate's political party, they cast their vote "on the first Tuesday after the second Wednesday in December after the general election," and these votes are tallied on the following January 6 in a joint session of Congress.[51]	Electoral college votes reflects voter political lean, with the latter being a metric that has been increasingly employed in public health research since 2020, prompted by research on the COVID-19 pandemic and political polarization.[12,13,15,16] Key caveats are that voter political lean is based solely on who votes, noting that only 58.6%, 60.1%, and 66.4% of US eligible voters respectively voted in the 2012, 2016, and 2020 presidential election.[52] Research indicates that persons least likely to vote are concentrated among politically, socially, and economically marginalized sectors of society who also are at higher risk of poor health.[53,54] Moreover, by definition voter political lean does not reflect views of persons legally not permitted to vote (e.g., ex-felons, non-citizens, young people < age 18).[53,54] Thus, while voter political lean shapes who is elected to hold and wield political power, it is not by itself a comprehensive gauge of the total population's political lean.[13]
Health outcomes: screening-amenable cancer stage of diagnosis and premature cancer mortality	Screening-amenable cancer stage at diagnosis among adults in the recommended age group for screening is a metric that is: (1) quickly responsive to policy changes affecting access to health care (in contrast to the longer etiologic period required for exposures to causes of cancer leading to screen-detectable cancer),[3,6,14,38] (2) exhibits health inequities,[2,14,22,23] and (3) is included as a "leading health indicator" or "objective" in the US Department of Health and Human Services agenda-setting national initiatives *Healthy People 2020* and *Healthy People 2030*.[55,56] Prevention of premature mortality due to noncommunicable diseases, including cancer, is a United Nations Sustainable Development Goal.[41]	The selected cancer outcomes were based on state-level data for the entire population. Delayed stage of diagnosis is defined as "regional + distant," versus "local," and is computed, following CDC recommendations, without including the percent unstaged.[24] Premature mortality due to cancer in the US exhibits economic and racialized inequities.[2,14,38,41,42] According to the 2020 World Cancer Report issued by the International Agency for Research on Cancer (IARC), "Cancer is the first or second leading cause of premature death (i.e. at ages 30–69 years) in 134 of 183 countries, and it ranks third or fourth in an additional 45 countries"[41]; in the US, breast, colorectal and lung cancer are the main contributors to premature years of life lost due to cancer.[21]

Socio-economic covariate: poverty	We opted to adjust for state poverty rates as a potential confounder, since: (1) poverty is associated with the selected exposures and health outcomes and poverty rates vary by state, and (2) poverty rates (unlike other socioeconomic metrics, such as education level or wealth) are rapidly responsive to changes in fiscal policies.[8,12,13]	We focused on poverty rates for the total population, noting that numerous US safety net programs use the federal poverty level to determine eligibility.[13,57] We recognize that adjusting for poverty may be over-control, since it may be on the causal pathway between the political metrics and the cancer outcomes.
Medical uninsurance covariates: percent uninsured and Medicaid expansion	Guiding selection of the 2 medical uninsurance covariates are that they: (1) are quickly responsive to policy changes, at both the state and federal level, and (2) are important indicators of access (or lack thereof) to affordable health care.[14,22,23] Access to health care, including health insurance among adults under age 65, is a “leading health indicator” or “objectives” in one or both of the US Department of Health and Human Services agenda-setting national initiatives *Healthy People 2020* and *Healthy People 2030*.[55,56]	The state-level data on percent lacking health insurance among working-age adults (ages 35-64) reflects a combination of state and federal policies affecting access to health care; this age group is also outside of the age range for government programs for health care intended to cover children and adults age 65 and older (e.g., Medicare).[9,57,58] State policy decisions regarding the Affordable Care Act’s (ACA) Medicaid expansion, commencing in 2014, require legislation that must be passed by a state’s legislature and signed into law by its Governor; as of 2025, all but 10 states have adopted the expansion.[58] As per the poverty rate, adjusting for the medical care covariates may be over-control, since they may be on the causal pathway between the political metrics and the cancer outcomes.

* Note: the original version of this textbox was originally published in reference 13: Krieger N et al, Politicians, power, and the people's health: US elections and state health outcomes, 2012-2024. Health Aff Sch. 2024 Nov 27;2(12):qxae163. (whose open access license permits reproduction if source is cited), and has been modified to include information on: (1) the political metric electoral college votes; (2) the cancer outcomes, and (3) health insurance covariates (percent uninsured and Medicaid expansion). Social epidemiologic, political science, and political sociology theories inform the justifications for the variables selected; for supporting scholarship, see citations 1-19.

TABLES

Table 1. Cross-sectional distribution of US state-level variables: cancer stage at diagnosis (breast (female), cervix, colorectal) for adults at or above age at which screening is first recommended[a] and premature cancer mortality rate (death before age 65), political exposures, and covariates, for 50 US states and the District of Columbia, 2017-2021.				
Variable	Year(s)	Mean (SD)	Median	Min, Max, IQR
Health outcomes[c]				
Breast cancer stage at diagnosis (age ≥ 45)	2017-2021			
% local		65.86 (2.47)	65.74	61.29, 72.93, 3.08
% regional		28.43 (1.78)	28.58	23.06, 31.54, 2.38
% distant		5.71 (0.95)	5.71	3.66, 7.40, 1.33
Cervix cancer stage at diagnosis (age ≥ 25)	2017-2021			
% local		41.82 (4.68)	41.86	28.74, 50.51, 4.42
% regional		31.06 (4.55)	32.13	20.62, 39.73, 6.14
% distant		14.82 (2.52)	14.28	10.42, 21.94, 2.72
Colorectal cancer stage at diagnosis (age ≥ 40)	2017-2021			
% local		31.31 (2.76)	31.07	24.98, 38.01, 3.13
% regional		36.61 (2.23)	36.97	29.92, 40.57, 3.54
% distant		21.80 (1.12)	21.93	18.93, 23.79, 1.57
Premature cancer mortality rate (age-standardized cancer death rate for persons < age 65 per 100,000 person-years)	2017-2021	47.66 (7.53)	46.06	34.48, 66.30, 9.48
Political exposures[b]				
DW-nominate ICE score: US House of Representatives	2017-2021	-0.051 (0.51)	-0.11	-1, 1, 0.81
DW-nominate ICE score: US Senate	2017-2021	-0.044 (0.76)	0	-1, 1, 1.5
Electoral college vote score[c]	2020	-0.04 (0.96)	0.5	-1, 1, 2
State liberalism policy index	2017-2020	0.068 (1.72)	-0.18	-2.95, 3.61, 3.08
State trifecta	2017-2021			
% Democratic trifecta		23.20 (8.56)	28	12.0, 30.0, 14.0
% Republican trifecta		44.80 (4.15)	44.0	40.0, 50.0, 6.0
% "mixed"		30.0 (5.29)	28.0	24.0, 38.0, 4.0
Covariates				
% below poverty	2017-2021	12.45 (2.67)	12.10	7.40, 19.40, 3.35
% adults without health insurance (ages 35-64)	2017-2021	10.03 (3.81)	9.55	3.22, 20.94, 5.86
State Medicaid expansion[d]: N of years covered (range: 2017-2021: 0 to 5)	2017-2021	3.37 (2.23)	5.0	0, 5, 4.62

Missing data: no variables had missing data; the political metrics for DW-Nominate and state trifecta, however, exclude DC because they are not applicable to its governance structure

Abbreviations: IQR = interquartile range; Min = minimum value; Max = maximum value; NA = not available

[a] Age at which screening is first recommended (per American Cancer Society guidelines[25-27]: female breast = age ≥ 45; cervix: ≥ age 25; colorectal: ≥ age 45.

[b] For the political exposures on a continuous scale, lower values are more conservative, and higher values are more liberal. The values for the DW-Nominate metric[31] for 2017-2021 used Congress 115, 116, 117 scores.

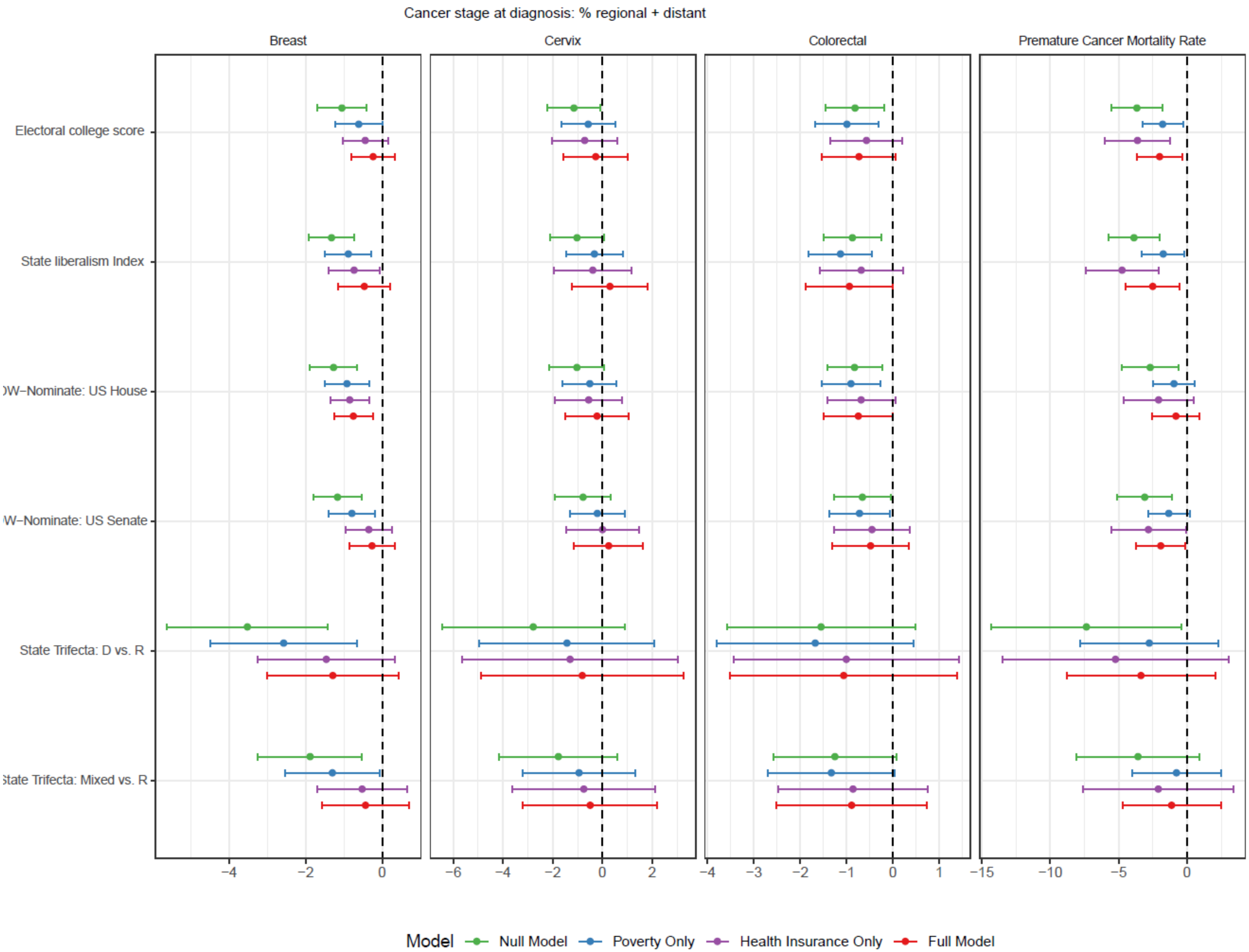
[c] The electoral college vote score for each state in the 2020 U.S. presidential elections was determined by assessing changes based on voting patterns from the preceding election (comparing 2016 for 2020 scores). A score of 1 was assigned for states voting Democratic in consecutive elections, while a change from Republican to Democratic resulted in a score of 0.5. Conversely, a switch from Democratic to Republican resulted in a score of -0.5, and a consistent Republican vote yielded a score of -1. Special considerations were applied to Maine, which received a score of 0.75 in both years, and Nebraska, which received a score of -0.80 in 2020, to account for their unique electoral vote distributions

[d] The State Medicaid score ranges from 0 to 5 points. Each full year of Medicaid implementation earns a state one point, with partial points awarded for periods of less than a year (based on the N of months in a year that the program was implemented, e.g., 0.5 for 6 months)

FIGURES

Figure 1. Maps of state-level data for study cancer outcomes, political metrics, and covariates: (1) <u>outcomes</u>: age-standardized cancer stage at diagnosis (breast (female), cervix, colorectal) for adults at or above age at which screening is first recommended (% regional + distant) and cancer premature mortality rate (death before age 65) (panels a-d), (2) political metrics (panels e-h), and (3) covariates (panels i-k), for 50 US states and the District of Columbia (2017-2021).

Figure 2. Cross-sectional standardized associations, at the state level, of current % regional + distant cancer stage at diagnosis (breast (female), cervix, colorectal) for adults at or above age at which screening is first recommended and premature cancer mortality rate (death before age 65) with the concurrent political exposures, for 50 US states and the District of Columbia, age-standardized and additionally separately and together for: (a) percent below poverty, and (b) percent uninsured (adults 35-64) and state Medicaid expansion, 2017-2021.



SUPPLEMENTARY MATERIALS

▪ LIST OF SUPPLEMENTARY MATERIALS

Textbox S1. Detailed information on generation, coding, and analysis of the study data.

Note: data sources for each type of data are listed in Table S1.

State level political metrics

▪ Political ideology: DW-Nominate (2012-2021). The DW-Nominate metric provides a political ideology score based on the roll-call votes of every member of the US Congress, especially regarding votes on the economy and government regulation.[S1] The score is produced by a "scaling procedure" that evaluates the closeness of the legislators' voting records.[S1] We employed data on the first dimension of this scale, which we coded as ranging from -1 (most conservative) to 1 (most liberal), using data spanning from the 112th through 117th Congress (see **Table S1**).

Of note, US states currently range from having 1 to 52 members in the House of Representatives, with a median value of 6 and average value of 8.7, and every US state has 2 senators.[S2] To guide our analysis of the DW-Nominate data, we determined that between 2012 and 2021, the DW-Nominate score nationally ranged, within the US House (435 voting representatives annually) from -0.936 to 0.784 (mean: -0.0785; SD: 0.454); among Republicans the range was -0.936 to -0.139 (mean: -0.487; SD: 0.146), and among Democrats the range was 0.069 to 0.784 (mean: 0.384; SD: 0.113) (p-value for difference comparing Republican to Democratic score in a two-sample t-test: 0.000), while for the one independent present who had a score (solely for Congress 116), the score equaled -0.359. During this same time period, in the US Senate (100 voting representatives annually) the DW-Nominate score ranged from -0.936 to 0.751 (mean: -0.118; SD: 0.435); among Republicans, the range was -0.936 to -0.091 (mean: -0.484; SD: 0.161) and among Democrats the range was 0.030 to 0.751 (mean: 0.333; SD: 0.133) (p-value for difference comparing Republican to Democratic scores in a two-sample t-test: 0.000), and for the one independent in Senate 112, and the two independents each present in Senates 113-117, the range was 0.163 to 0.543 (mean: 0.370; SD: 0.189).

To create an informative annual state level metric that considered the range of scores among the elected officials from each US state, we employed a novel approach,[S8] using the Index of Concentration at the Extremes (ICE). The ICE was initially developed by Douglas Massey to measure economic polarization within geographic areas[S3]; it can, however, be used with any social groups in a defined population.[S4-S7] Our innovative use of the ICE enabled us to assess political polarization among state delegations to Congress.

The ICE ranges from -1 to 1, where -1 represents the most conservative extreme (C), 1 represents the most liberal extreme (L), and 0 is the middle value (M). The ICE formula[S3-S5] is:

$$ICE_i = (A_i - P_i)/T_i$$

where A_i equals the number of representatives in one of the specified extremes within the designated state *i* (here, the top tercile for the DW-nominate score), P_i equals the number of representatives in the other specified extreme in state *i* (here, the bottom tercile for the DW-nominate score) and T_i equals the total number of representatives in state *i* (here, the total number of elected officials with a DW-nominate score). For example, considering the case of 2 US senators per state: if both are C, the score is -1; if one is C and one is M, the score is -0.5; if one is C and one is L, the score is 0; if both are M, the score is 0; if one is L and one is M, the score is 0.5; and if both are L, the score is 1. The 0 score thus equally captures the impact of the two different scenarios of: (a) only "middle" votes, and (b) "extremes" cancelling each other out.

▪ Political party concentrations of power (2012-2021). As defined by Ballotpedia, "trifecta" is "a term to describe single-party government, when one political party holds the governorship and majorities in both chambers of the state legislature in relation to control of the state legislator and Governor."[S9] For each time period under consideration (2012-2016, 2017-2021; see **Table S1**), we assessed each state's annual trifecta status[S8,S9] and categorized states in relation to whether they were: (1) consistently a Republican trifecta; (2) consistently a Democratic trifecta; or (3) "mixed" (neither consistently a Republican or Democratic trifecta). This metric is not applicable to Washington, DC.

▪ State liberalism policy index (2012-2020). This metric, developed by Caughey and Warshaw, assigns scores derived from "a dynamic latent-variable model" based initially on "data on 148 policies collected over eight decades (1936–2014)" and extended to 2020 (see **Table S1**).[S10,S11] Domains of policies included in the model pertain to: abortion, criminal justice, drugs and alcohol, education, the environment, civil rights, gun control, labor, social welfare, and taxation.[S10(pp. 902-903)] The premise is that "in a context of American politics … [r]elative to conservatism, liberalism involves greater government regulation and welfare provision to promote equality and protect collective goods, and less government effort to uphold traditional morality and social order at the expense of personal autonomy," while "conservatism places greater emphasis on the values of economic freedom and cultural traditionalism."[S10(p.901)] We coded this metric as ranging from -1 (most conservative) to 1 (most liberal).

▪ Electoral college vote score (2012-2020): We generated the electoral college[S12] vote score for each state in the 2016 and 2020 U.S. presidential elections by assessing changes based on voting patterns from the preceding election (change from 2012 to 2016 for the 2016 scores, and change from 2016 to 2020 for the 2020 scores; see **Table S1**). A score of 1 was assigned for states voting Democratic in consecutive elections, while a change from Republican to Democratic resulted in a score of 0.5. Conversely, a switch from Democratic to Republican resulted in a score of -0.5, and a consistent Republican vote yielded a score of -1. Special considerations were applied to Maine, which received a score of 0.75 in both years, and Nebraska, which received a score of -0.80 in 2020, to account for their unique electoral vote distributions, whereby these are the sole two US states whose electoral college votes are based on each state's version of "proportional representation."[S12]

State level cancer outcomes

▪ Cancer stage at diagnosis (2012-2021). Cancer stage at diagnosis is a critical predictor of cancer survival and mortality and is dependent on access to care as well as the speed at which the tumor grows. The three types of cancer for which screening has been recommended since at least 2012 and for which screening has been shown to be effective, with acceptably low false positive rates, are: breast cancer (female), cervix cancer, and colorectal cancer.[S13,S14] Age at which screening is first recommended, per American Cancer Society guidelines, is as follows[S15-S17]: female breast = age ≥ 45; cervix: ≥ age 25; colorectal: ≥ age 45. We used state-level cancer stage at diagnosis data, stratified by age, compiled by the North American Association of Cancer Registries (see **Table S1**).

▪ Premature cancer mortality rates (2012-2021). Premature mortality, including for cancer, is a long-recognized indicator of inequities in both health status and access to health care.[S18-S20] We set age 65 as the cut-point for three reasons: (1) it determines eligibility to Medicare and Social Security[S21;] (2) growing concerns about rising mortality in US working age adults[S22,S23]; and (3) the large contribution of cancer to premature mortality, in the US and globally.[S18,S20] We obtained the annual age-specific mortality data from CDC WONDER (see **Table S1**) for January 1, 2012-May 31, 2024, and age-adjusted the rates (deaths per 100,000 person-years) using the Year 2000 Standard Million.[S24] We analyzed total population data for 2012-2021, with ICD-10 codes for all cancer mortality defined as C00-C97.[S25]

State level covariates

▪ Percent below poverty (2012-2016; 2017-2021). We included data on percent of state population below poverty for three reasons: (1) impoverishment contributes to excess cancer risk across the cancer continuum[S26]; (2) poverty rates (unlike education and wealth distributions) are temporally responsive to fiscal policy changes[S8,S27]; and (3) numerous US safety net programs use the federal poverty level to determine eligibility.[S28] We obtained the poverty data from the US American Community Survey (see Table S1).

▪ Health insurance (2012-2021). We accessed annual 1-year state-level estimates for the percent of adults ages 35 to 64 lacking health insurance, using US Census American Community Survey data for January 1, 2012 through December 31, 2022 (see **Table S1**); for 2020, however, we employed the average of the 2019 and 2021 data because, due to COVID-19, no data were released for 2020. We focused on ages 35 to 64 because: (a) this age group is not eligible for US government insurance programs targeted to children and to seniors,[S8,S28] and (b) this was the sole age bracket for working age adults consistently available for 2012-2022.

▪ State Medicaid coverage expansion (2014-2021). We included data on US state's status vis a vis the Affordable Care Act's Medicaid expansion provision, enacted in 2014.[S9] This policy initiative "expanded Medicaid coverage to nearly all adults with incomes up to 138% of the Federal Poverty Level ($20,783 for an individual in 2024) and provided states with an enhanced federal matching rate (FMAP) for their expansion populations."[S29] We obtained data for each state from the database maintained by the Kaiser Family Foundation (see **Table S1**) and counted the N of years each state was enrolled in Medicaid Expansion from 2017-2021 (range: 0 to 5) and also during 2014-2016 (range: 0 to 3).

Table S1. Resources for study replication: (a) data sources (all public access), and (b) analytic code		
(a) Data Sources		
State-level variable (annual)	**Years of data (used in study)**	**Website**
Political metrics		
-- Electoral college vote score	2012-2020	https://www.270towin.com/2012-election/#google_vignette https://ballotpedia.org/Presidential_election,_2016 https://ballotpedia.org/Presidential_candidates,_2020
-- State liberalism policy index	2012-2020	https://www.dropbox.com/t/MRDUHsLpFAzNBDhu
-- DW-nominate	2012-2021	https://voteview.com/about
-- State trifecta	2012-2021	https://ballotpedia.org/State_government_trifectas
Health outcomes		
-- Cancer stage at diagnosis	2017-2021	https://www.naaccr.org/cina-public-use-data-set/
-- Cancer premature mortality rates	2017-2021	https://wonder.cdc.gov/
Covariates		
-- % below poverty	2012-2016, 2017-2021	https://data.census.gov/table/ACSST5Y2012.S1701?q=Poverty+rates+by+state&g=010XX00US https://data.census.gov/table/ACSST5Y2021.S1701?q=Poverty+rates+by+state&g=010XX00US
-- % of adults without health insurance (ages 35-65)	2012-2021	https://data2.nhgis.org/main
-- N of years of state Medicaid expansion	2014-2016 2017-2021	https://www.kff.org/status-of-state-medicaid-expansion-decisions/
(b) Analytic Code		
Analytic code to produce study results in Tables and Figures		https://github.com/smoallef/political-cancer-analysis

Table S2. Distribution of US state-level exposure and covariate variables for the lagged analyses[a]: political exposures (2012-2016), medical uninsurance (2012-2016), state Medicaid expansion (2014-2016) and percent below poverty (2012-2016), for 50 US states and the District of Columbia.				
Variable	Year(s)	Mean (SD)	Median	Min, Max, IQR
Political exposures[b]				
DW-nominate ICE score: US House of Representatives	2012-2016	-0.066 (0.49)	-0.09	-1, 1, 0.62
DW-nominate ICE score: US Senate	2012-2016	0.021 (0.70)	0	-1, 1, 1
Electoral college vote score[c]	2016	-0.15 (0.93)	-0.5	-1, 1, 2
State liberalism policy index	2012-2016	0.011 (1.46)	-0.10	-2.73, 3.08, 2.60
State trifecta	2012-2016			
% Democratic trifecta		20.40 (6.07)	22.0	14.0, 26.0, 12.0
% Republican trifecta		46.0 (1.41)	46.0	44.0, 48.0, 0
% “mixed”		31.60 (7.13)	30.0	24.0, 40.0, 12.0
Covariates				
% below poverty	2012-2016	14.53 (3.12)	14.90	8.50, 22.30, 4.90
% adults without health insurance (ages 35-64)	2012-2016	12.82 (4.28)	12.53	3.64, 22.15, 6.81
State Medicaid expansion[d]: N of years covered (range: 2014-2016: 0 to 3)	2014-2016	1.70 (1.42)	2.75	0, 3.0, 3

Missing data: no variables had missing data; the political metrics for DW-Nominate and state trifecta, however, exclude DC because they are not applicable to its governance structure

Abbreviations: IQR = interquartile range; Min = minimum value; Max = maximum value; NA = not available

[a] Time period: all variables for 2012-2016, except for Medicaid expansion data (policy started in 2014, so data only for 2014-2016)

[b] For the political exposures on a continuous scale, lower values are more conservative, and higher values are more liberal. The values for the DW-Nominate metric for 2012-2016 = Congress 112, 113, 114 scores.

[c] The electoral college vote score for each state in the 2016 U.S. presidential elections was determined by assessing changes based on voting patterns from the preceding election (comparing 2012 for 2016 scores). A score of 1 was assigned for states voting Democratic in consecutive elections, while a change from Republican to Democratic resulted in a score of 0.5. Conversely, a switch from Democratic to Republican resulted in a score of -0.5, and a consistent Republican vote yielded a score of -1. Special considerations were applied to Maine, which received a score of 0.75 in both years, and Nebraska, which received a score of -0.80 in 2020, to account for their unique electoral vote distributions

[d] The State Medicaid score ranges from 0 to 5 points. Each full year of Medicaid implementation earns a state one point, with partial points awarded for periods of less than a year (based on the N of months in a year that the program was implemented, e.g., 0.5 for 6 months).

Table S3. Cross-sectional standardized associations, at the state level, of current cancer stage at diagnosis (breast (female), cervix, colorectal) for adults at or above age at which screening is first recommended and premature cancer mortality rate (death before age 65) with the concurrent political exposures, for 50 US states and the District of Columbia, age-standardized and additionally adjusted for concurrent covariates (percent below poverty; percent uninsured (adults 35-64); state Medicaid), 2017-2021.

Variable	**Political exposure: standardized effect estimate (95% confidence interval) and p-value (for different from 0)**											
Health outcomes	Electoral college vote score[c]	P-value	State liberalism index	P-value	State trifecta				DW-nominate: US House	P-value	DW-nominate: US Senate	P-value
					D vs R	P-value	Mixed vs R	P-value				
Cancer stage at diagnosis[a,b]												
% local												
Breast (female; age ≥ 45): age-standardized	1.06 (0.42 to 1.7)	0.002	1.33 (0.73 to 1.92)	0.000	3.52 (1.43 to 5.62)	0.001	1.89 (0.53 to 3.25)	0.008	1.27 (0.66 to 1.89)	0.000	1.17 (0.53 to 1.81)	0.001
+ adjusted for poverty	0.62 (0 to 1.23)	0.050	0.89 (0.28 to 1.5)	0.005	2.58 (0.67 to 4.48)	0.009	1.31 (0.07 to 2.54)	0.039	0.92 (0.34 to 1.5)	0.002	0.80 (0.2 to 1.39)	0.010
+ adjusted for percent uninsured and state Medicaid	0.45 (-0.15 to 1.04)	0.138	0.74 (0.06 to 1.41)	0.033	1.46 (-0.32 to 3.25)	0.106	0.53 (-0.66 to 1.71)	0.374	0.85 (0.34 to 1.36)	0.002	0.35 (-0.26 to 0.97)	0.252
+ adjusted for all covariates	0.24 (-0.34 to 0.82)	0.406	0.47 (-0.21 to 1.15)	0.169	1.29 (-0.42 to 3.01)	0.136	0.44 (-0.7 to 1.58)	0.440	0.76 (0.25 to 1.26)	0.004	0.27 (-0.32 to 0.86)	0.365
Cervix (age ≥ 25): age-standardized	1.46 (0.18 to 2.74)	0.026	0.84 (-0.48 to 2.16)	0.209	2.73 (-1.42 to 6.89)	0.192	3.20 (0.5 to 5.9)	0.021	0.45 (-0.87 to 1.78)	0.496	1.23 (-0.05 to 2.51)	0.060
+ adjusted for poverty	1.37 (-0.03 to 2.77)	0.054	0.63 (-0.86 to 2.11)	0.399	2.58 (-1.77 to 6.93)	0.238	3.11 (0.29 to 5.93)	0.031	0.29 (-1.11 to 1.7)	0.676	1.16 (-0.21 to 2.54)	0.095
+ adjusted for percent uninsured and state Medicaid	1.17 (-0.41 to 2.75)	0.143	-0.02 (-1.9 to 1.86)	0.984	1.17 (-3.71 to 6.06)	0.631	2.16 (-1.08 to 5.4)	0.186	-0.43 (-1.97 to 1.11)	0.574	0.47 (-1.21 to 2.15)	0.578
+ adjusted for all covariates	1.17 (-0.48 to 2.83)	0.161	-0.15 (-2.15 to 1.86)	0.885	1.26 (-3.7 to 6.21)	0.611	2.20 (-1.07 to 5.48)	0.182	-0.40 (-1.99 to 1.19)	0.613	0.51 (-1.2 to 2.22)	0.552
Colorectal (age ≥ 40): age-standardized	0.68 (-0.09 to 1.45)	0.081	0.98 (0.24 to 1.72)	0.011	2.57 (0.09 to 5.06)	0.043	1.93 (0.32 to 3.55)	0.020	0.75 (-0.03 to 1.53)	0.058	0.79 (0.02 to 1.57)	0.044
+ adjusted for poverty	0.62 (-0.22 to 1.46)	0.143	1.00 (0.17 to 1.84)	0.020	2.46 (-0.14 to 5.06)	0.063	1.87 (0.18 to 3.55)	0.031	0.68 (-0.14 to 1.51)	0.104	0.73 (-0.1 to 1.56)	0.081
+ adjusted for percent uninsured and state Medicaid	-0.06 (-0.88 to 0.77)	0.890	0.15 (-0.81 to 1.11)	0.757	0.74 (-1.93 to 3.41)	0.579	0.71 (-1.06 to 2.48)	0.421	0.16 (-0.68 to 0.99)	0.707	-0.11 (-1.02 to 0.8)	0.803
+ adjusted for all covariates	0.04 (-0.82 to 0.89)	0.933	0.31 (-0.7 to 1.32)	0.541	0.87 (-1.8 to 3.55)	0.515	0.78 (-0.99 to 2.55)	0.378	0.25 (-0.6 to 1.09)	0.556	-0.05 (-0.97 to 0.86)	0.906
% regional + distant												
Breast (female; age ≥ 45): age-standardized	-1.06 (-1.7 to -0.42)	0.002	-1.33 (-1.92 to -0.73)	0.000	-3.52 (-5.62 to -1.43)	0.001	-1.89 (-3.25 to -0.53)	0.008	-1.27 (-1.89 to -0.66)	0.000	-1.17 (-1.81 to -0.53)	0.001

			)									
+ adjusted for poverty	-0.62 (-1.23 to 0)	0.050	-0.89 (-1.5 to -0.28)	0.005	-2.58 (-4.48 to -0.67)	0.009	-1.31 (-2.54 to -0.07)	0.039	-0.92 (-1.5 to -0.34)	0.002	-0.80 (-1.39 to -0.2)	0.010
+ adjusted for percent uninsured and state Medicaid	-0.45 (-1.04 to 0.15)	0.138	-0.74 (-1.41 to -0.06)	0.033	-1.46 (-3.25 to 0.32)	0.106	-0.53 (-1.71 to 0.66)	0.374	-0.85 (-1.36 to -0.34)	0.002	-0.35 (-0.97 to 0.26)	0.252
+ adjusted for all covariates	-0.24 (-0.82 to 0.34)	0.406	-0.47 (-1.15 to 0.21)	0.169	-1.29 (-3.01 to 0.42)	0.136	-0.44 (-1.58 to 0.7)	0.440	-0.76 (-1.26 to -0.25)	0.004	-0.27 (-0.86 to 0.32)	0.365
Cervix (age ≥ 25): age-standardized	-1.15 (-2.22 to -0.07)	0.037	-1.02 (-2.11 to 0.06)	0.064	-2.78 (-6.46 to 0.89)	0.134	-1.77 (-4.16 to 0.61)	0.142	-1.03 (-2.13 to 0.08)	0.068	-0.78 (-1.9 to 0.35)	0.170
+ adjusted for poverty	-0.57 (-1.66 to 0.52)	0.297	-0.32 (-1.46 to 0.81)	0.569	-1.43 (-4.95 to 2.09)	0.419	-0.94 (-3.22 to 1.34)	0.411	-0.51 (-1.59 to 0.58)	0.352	-0.21 (-1.3 to 0.89)	0.709
+ adjusted for percent uninsured and state Medicaid	-0.71 (-2.03 to 0.61)	0.284	-0.39 (-1.94 to 1.16)	0.617	-1.30 (-5.66 to 3.05)	0.550	-0.75 (-3.63 to 2.14)	0.604	-0.55 (-1.9 to 0.79)	0.413	0.00 (-1.48 to 1.48)	0.996
+ adjusted for all covariates	-0.27 (-1.56 to 1.02)	0.676	0.30 (-1.23 to 1.84)	0.694	-0.81 (-4.9 to 3.28)	0.692	-0.49 (-3.19 to 2.21)	0.716	-0.22 (-1.5 to 1.07)	0.735	0.25 (-1.13 to 1.64)	0.714
Colorectal (age ≥ 40): age-standardized	-0.82 (-1.45 to -0.19)	0.012	-0.88 (-1.5 to -0.25)	0.007	-1.55 (-3.59 to 0.48)	0.131	-1.25 (-2.57 to 0.07)	0.062	-0.83 (-1.43 to -0.24)	0.035	-0.66 (-1.27 to -0.05)	0.007
+ adjusted for poverty	-0.99 (-1.67 to -0.32)	0.005	-1.13 (-1.82 to -0.45)	0.002	-1.68 (-3.8 to 0.44)	0.118	-1.33 (-2.71 to 0.04)	0.057	-0.91 (-1.54 to -0.28)	0.006	-0.72 (-1.38 to -0.07)	0.031
+ adjusted for percent uninsured and state Medicaid	-0.57 (-1.35 to 0.2)	0.144	-0.69 (-1.59 to 0.22)	0.133	-1.01 (-3.43 to 1.42)	0.407	-0.86 (-2.47 to 0.74)	0.285	-0.69 (-1.42 to 0.04)	0.065	-0.45 (-1.27 to 0.37)	0.271
+ adjusted for all covariates	-0.74 (-1.53 to 0.06)	0.069	-0.94 (-1.88 to -0.01)	0.049	-1.06 (-3.52 to 1.39)	0.387	-0.89 (-2.52 to 0.73)	0.274	-0.75 (-1.5 to 0)	0.051	-0.48 (-1.32 to 0.35)	0.247
Premature cancer mortality (death before age 65): deaths per 100,000 persons years												
age-standardized	-3.67 (-5.56 to -1.78)	0.000	-3.88 (-5.74 to -2.03)	0.000	-7.36 (-14.29 to -0.43)	0.038	-3.59 (-8.10 to 0.92)	0.116	-2.70 (-4.76 to -0.63)	0.011	-3.10 (-5.11 to -1.08)	0.003
+ adjusted for poverty	-1.79 (-3.28 to -0.29)	0.020	-1.74 (-3.3 to -0.19)	0.028	-2.77 (-7.8 to 2.27)	0.274	-0.78 (-4.03 to 2.48)	0.634	-0.96 (-2.5 to 0.58)	0.216	-1.34 (-2.87 to 0.19)	0.084
+ adjusted for percent uninsured and state Medicaid	-3.63 (-5.99 to -1.27)	0.003	-4.75 (-7.42 to -2.09)	0.001	-5.23 (-13.52 to 3.05)	0.210	-2.10 (-7.59 to 3.38)	0.444	-2.08 (-4.62 to 0.45)	0.105	-2.83 (-5.55 to -0.1)	0.042

+ adjusted for all covariates	-2.01 (-3.68 to -0.33)	0.020	-2.51 (-4.48 to -0.54)	0.014	-3.37 (-8.8 to 2.06)	0.217	-1.13 (-4.73 to 2.46)	0.528	-0.82 (-2.54 to 0.9)	0.343	-1.93 (-3.71 to -0.14)	0.035

[a] All exposure, outcome, and covariate data are for 2017-2021, except for State liberalism index (2017-2020); age-standardization used the Year 2000 standard million[S24] with the age groups: <45, 45-54, 55-64, 65-74, 75+ years.[S30]

[b] Percent of cases by stage at diagnosis: based on percentage for local, regional, and distant, not including “unstaged.”[S31] Age at which screening is first recommended (per American Cancer Society guidelines[S15-S17]: female breast = age ≥ 45; cervix: ≥ age 25; colorectal: ≥ age 45.

[c] The electoral college vote score for each state in the 2016 and 2020 U.S. presidential elections was determined by assessing changes based on voting patterns from the preceding election (2012 for 2016 scores, and 2016 for 2020 scores). A score of 1 was assigned for states voting Democratic in consecutive elections, while a change from Republican to Democratic resulted in a score of 0.5. Conversely, a switch from Democratic to Republican resulted in a score of -0.5, and a consistent Republican vote yielded a score of -1. Special considerations were applied to Maine, which received a score of 0.75 in both years, and Nebraska, which received a score of -0.80 in 2020, to account for their unique electoral vote distributions

[d] The State Medicaid score ranges from 0 to 5 points. Each full year of Medicaid implementation earns a state one point, with partial points awarded for periods of less than a year (based on the N of months in a year that the program was implemented, e.g., 0.5 for 6 months)

Table S4: Lagged standardized associations, at the state level, of current cancer stage at diagnosis (breast (female), cervix, colorectal) for adults at or above age at which screening is first recommended and premature cancer mortality rate (death before age 65) with the prior political exposures (2012-2016) for 50 US states and the District of Columbia (2017-2021), age-standardized and additionally adjusted for the prior covariates (percent below poverty: 2012-2016; percent uninsured (adults 35-64): 2012-2016; state Medicaid expansion: 2012-2014).

Variable	**Political exposure: standardized effect estimate (95% confidence interval) and p-value (for different from 0)**											
Health outcomes	Electoral college vote score[c]	P-value	State liberalism policy index	P-value	State trifecta				DW-nominate: US House	P-value	DW-nominate: US Senate	P-value
					D vs R	P-value	Mixed vs R	P-value				
Cancer stage at diagnosis[a,b]												
% local												
Breast (female; age ≥ 45): age-standardized	1.02 (0.38 to 1.67)	0.002	1.40 (0.81 to 1.98)	0.000	3.16 (0.82 to 5.5)	0.009	1.61 (0.21 to 3.02)	0.025	1.54 (0.98 to 2.11)	0.000	1.23 (0.61 to 1.86)	0.000
+ adjusted for poverty	0.60 (-0.01 to 1.21)	0.052	0.96 (0.36 to 1.56)	0.002	1.83 (-0.34 to 4)	0.097	1.04 (-0.23 to 2.31)	0.107	1.24 (0.72 to 1.75)	0.000	0.85 (0.26 to 1.44)	0.006
+ adjusted for percent uninsured and state Medicaid	0.4 (-0.2 to 1.01)	0.187	0.79 (0.1 to 1.47)	0.025	1.25 (-0.68 to 3.18)	0.199	0.7 (-0.55 to 1.94)	0.266	1.03 (0.5 to 1.55)	0.000	0.33 (-0.33 to 0.99)	0.321
+ adjusted for all covariates	0.43 (-0.15 to 1.01)	0.143	0.94 (0.31 to 1.58)	0.005	0.91 (-0.91 to 2.74)	0.318	0.77 (-0.31 to 1.85)	0.159	1.05 (0.56 to 1.55)	0.000	0.37 (-0.29 to 1.04)	0.263
Cervix (age ≥ 25): age-standardized	1.15 (-0.15 to 2.46)	0.081	0.89 (-0.43 to 2.21)	0.184	-0.59 (-5.05 to 3.86)	0.790	2.91 (0.24 to 5.59)	0.034	0.27 (-1.06 to 1.6)	0.683	1.45 (0.18 to 2.71)	0.026
+ adjusted for poverty	1.24 (-0.17 to 2.64)	0.084	1.00 (-0.5 to 2.5)	0.187	-0.45 (-5.21 to 4.3)	0.849	2.97 (0.19 to 5.76)	0.037	0.29 (-1.12 to 1.69)	0.683	1.63 (0.28 to 2.98)	0.019
+ adjusted for percent uninsured and state Medicaid	0.72 (-0.91 to 2.34)	0.380	0.01 (-1.89 to 1.92)	0.988	-2.8 (-7.87 to 2.27)	0.272	1.65 (-1.63 to 4.92)	0.317	-1.08 (-2.69 to 0.53)	0.184	0.8 (-1 to 2.6)	0.377
+ adjusted for all covariates	1.44 (-0.23 to 3.1)	0.089	1.12 (-0.88 to 3.12)	0.265	-2.27 (-7.38 to 2.84)	0.375	2.15 (-0.87 to 5.17)	0.159	-0.97 (-2.65 to 0.72)	0.254	1.22 (-0.7 to 3.14)	0.207
Colorectal (age ≥ 40): age-standardized	0.74 (-0.02 to 1.51)	0.055	1.07 (0.34 to 1.8)	0.005	4.38 (1.83 to 6.94)	0.001	1.32 (-0.22 to 2.85)	0.091	1.05 (0.3 to 1.8)	0.007	0.84 (0.07 to 1.61)	0.033
+ adjusted for poverty	0.59 (-0.23 to 1.4)	0.155	0.97 (0.14 to 1.8)	0.022	4.04 (1.33 to 6.75)	0.004	1.17 (-0.42 to 2.76)	0.146	0.93 (0.15 to 1.71)	0.021	0.68 (-0.14 to 1.5)	0.100
+ adjusted for percent uninsured and state Medicaid	0.03 (-0.81 to 0.87)	0.945	0.24 (-0.73 to 1.22)	0.617	2.92 (0.19 to 5.66)	0.037	0.57 (-1.2 to 2.33)	0.519	0.38 (-0.5 to 1.26)	0.385	-0.21 (-1.19 to 0.77)	0.664
+ adjusted for all covariates	0.29 (-0.62 to 1.2)	0.521	0.77 (-0.28 to 1.82)	0.145	3.57 (0.91 to 6.24)	0.010	1.17 (-0.41 to 2.75)	0.142	0.55 (-0.34 to 1.44)	0.220	0.02 (-1.01 to 1.06)	0.966
% regional + distant												

Breast (female; age ≥ 45): age-standardized	-1.02 (-1.67 to -0.38)	0.002	-1.40 (-1.98 to -0.81)	0.000	-3.16 (-5.5 to -0.82)	0.009	-1.61 (-3.02 to -0.21)	0.025	-1.54 (-2.11 to -0.98)	0.000	-1.23 (-1.86 to -0.61)	0.000
+ adjusted for poverty	-0.60 (-1.21 to 0.01)	0.052	-0.96 (-1.56 to -0.36)	0.002	-1.83 (-4 to 0.34)	0.097	-1.04 (-2.31 to 0.23)	0.107	-1.24 (-1.75 to -0.72)	0.000	-0.85 (-1.44 to -0.26)	0.006
+ adjusted for percent uninsured and state Medicaid	-0.4 (-1.01 to 0.2)	0.187	-0.79 (-1.47 to -0.1)	0.025	-1.25 (-3.18 to 0.68)	0.199	-0.7 (-1.94 to 0.55)	0.266	-1.03 (-1.55 to -0.5)	0.000	-0.33 (-0.99 to 0.33)	0.321
+ adjusted for all covariates	-0.43 (-1.01 to 0.15)	0.143	-0.94 (-1.58 to -0.31)	0.005	-0.91 (-2.74 to 0.91)	0.318	-0.77 (-1.85 to 0.31)	0.159	-1.05 (-1.55 to -0.56)	0.000	-0.37 (-1.04 to 0.29)	0.263
Cervix (age ≥ 25): age-standardized	-1.07 (-2.15 to 0.02)	0.053	-0.96 (-2.05 to 0.13)	0.082	-2.12 (-6.13 to 1.89)	0.293	-1.20 (-3.61 to 1.2)	0.320	-0.67 (-1.8 to 0.46)	0.237	-0.71 (-1.84 to 0.41)	0.209
+ adjusted for poverty	-0.56 (-1.66 to 0.53)	0.306	-0.29 (-1.45 to 0.87)	0.620	-0.33 (-4.28 to 3.61)	0.866	-0.43 (-2.74 to 1.89)	0.712	-0.21 (-1.31 to 0.89)	0.708	-0.16 (-1.28 to 0.96)	0.771
+ adjusted for percent uninsured and state Medicaid	-0.58 (-1.93 to 0.77)	0.390	-0.24 (-1.82 to 1.34)	0.760	-0.07 (-4.76 to 4.62)	0.975	0.22 (-2.81 to 3.25)	0.886	0.13 (-1.31 to 1.57)	0.856	0.28 (-1.32 to 1.87)	0.728
+ adjusted for all covariates	-0.32 (-1.74 to 1.11)	0.657	0.31 (-1.37 to 1.99)	0.710	0.50 (-4.01 to 5.01)	0.825	0.10 (-2.57 to 2.76)	0.942	0.12 (-1.29 to 1.54)	0.861	0.35 (-1.27 to 1.97)	0.663
Colorectal (age ≥ 40): age-standardized	-0.93 (-1.55 to -0.31)	0.004	-0.89 (-1.51 to -0.27)	0.006	-3.32 (-5.38 to -1.27)	0.002	-1.08 (-2.31 to 0.16)	0.085	-0.87 (-1.46 to -0.28)	0.005	-0.44 (-1.07 to 0.19)	0.163
+ adjusted for poverty	-0.99 (-1.66 to -0.33)	0.004	-1.02 (-1.72 to -0.32)	0.005	-3.34 (-5.53 to -1.15)	0.004	-1.08 (-2.37 to 0.2)	0.096	-0.85 (-1.47 to -0.23)	0.009	-0.38 (-1.06 to 0.29)	0.262
+ adjusted for percent uninsured and state Medicaid	-0.74 (-1.52 to 0.04)	0.062	-0.72 (-1.64 to 0.19)	0.120	-3.03 (-5.5 to -0.56)	0.017	-0.82 (-2.41 to 0.78)	0.308	-0.8 (-1.57 to -0.02)	0.044	-0.01 (-0.91 to 0.88)	0.974
+ adjusted for all covariates	-0.66 (-1.48 to 0.17)	0.115	-0.57 (-1.55 to 0.41)	0.247	-2.97 (-5.48 to -0.46)	0.022	-0.88 (-2.36 to 0.61)	0.240	-0.74 (-1.55 to 0.07)	0.072	0.16 (-0.79 to 1.12)	0.732
Premature cancer mortality (death before age 65): deaths per 100,000 persons years												
age-standardized	-3.43 (-5.36 to -1.51)	0.001	-3.69 (-5.58 to -1.81)	0.000	-6.00 (-13.62 to 1.62)	0.120	-2.50 (-7.07 to 2.08)	0.278	-2.18 (-4.3 to -0.07)	0.043	-2.63 (-4.7 to -0.56)	0.014
+ adjusted for poverty	-1.91 (-3.58 to -0.23)	0.026	-1.80 (-3.58 to -0.03)	0.047	-0.43 (-6.72 to 5.86)	0.891	-0.08 (-3.76 to 3.61)	0.967	-0.78 (-2.51 to 0.96)	0.373	-1.02 (-2.78 to 0.74)	0.249
+ adjusted for percent uninsured and state Medicaid	-3.32 (-5.76 to -0.87)	0.009	-4.48 (-7.25 to -1.72)	0.002	-2.58 (-11.57 to 6.42)	0.567	-0.01 (-5.81 to 5.8)	0.998	-1.24 (-4 to 1.51)	0.368	-2.07 (-5.09 to 0.94)	0.172

+ adjusted for all covariates	-2.10 (-4.13 to -0.07)	0.043	-2.47 (-4.86 to -0.08)	0.043	0.70 (-5.98 to 7.38)	0.834	1.07 (-2.88 to 5.03)	0.587	-1.04 (-3.13 to 1.04)	0.319	-1.68 (-4.04 to 0.67)	0.157

[a] All exposure, outcome, and covariate data are for 2017-2021, except for State liberalism policy index (2017-2020); age-standardization used the Year 2000 standard million[S24] with the age groups: <45, 45-54, 55-64, 65-74, 75+ years.[S30]

[b] Percent of cases by stage at diagnosis: based on percentage for local, regional, and distant, not including “unstaged.”[S31] Age at which screening is first recommended (per American Cancer Society guidelines[S15-S17]: female breast = age ≥ 45; cervix: ≥ age 25; colorectal: ≥ age 45.

[c] The electoral college vote score for each state in the 2016 and 2020 U.S. presidential elections was determined by assessing changes based on voting patterns from the preceding election (2012 for 2016 scores, and 2016 for 2020 scores). A score of 1 was assigned for states voting Democratic in consecutive elections, while a change from Republican to Democratic resulted in a score of 0.5. Conversely, a switch from Democratic to Republican resulted in a score of -0.5, and a consistent Republican vote yielded a score of -1. Special considerations were applied to Maine, which received a score of 0.75 in both years, and Nebraska, which received a score of -0.80 in 2020, to account for their unique electoral vote distributions

[d] The State Medicaid score ranges from 0 to 5 points. Each full year of Medicaid implementation earns a state one point, with partial points awarded for periods of less than a year (based on the N of months in a year that the program was implemented, e.g., 0.5 for 6 months)

Figure S1. Correlations among the cancer outcomes (age-standardized cancer stage at diagnosis (% local; % regional + distant) for adults at or above age at which screening is first recommended, age-standardized cancer premature mortality rate (death before age 65 per 100,000 person-years), political metrics, and covariates, 50 US States and the District of Columbia, 2017-2021.

Figure S2. Lagged standardized associations, at the state level, of current % regional + distant cancer stage at diagnosis (breast (female), cervix, colorectal) for adults at or above age at which screening is first recommended and premature cancer mortality rate (death before age 65) for the cancer outcomes (2017-2021) with the lagged political exposures and covariates, for 50 US states and the District of Columbia, age-standardized and additionally separately and together for: (a) percent below poverty (2012-2016), and (b) percent uninsured (adults 35-64)(2012-2016) and state Medicaid expansion (2014-2016).

REFERENCES FOR SUPPLMENTARY MATERIALS

S1. Voteview.com. About the project. https://voteview.com/about ; accessed April 19, 2025.

S2. Ballotpedia . List of current members of the U.S. Congress. https://ballotpedia.org/List_of_current_members_of_the_U.S._Congress#Congressional_delegations_by_state ; accessed April 19, 2025.

S3. Massey DS. The prodigal paradigm returns: ecology comes back to sociology. In: Booth A, Crouter A, eds. *Does It Take a Village? Community Effects on Children, Adolescents, and Families.* Mahwah, NJ: Lawrence Erlbaum Associates; 2001, pp. 41–48.

S4. Krieger N, Waterman PD, Gryparis A, Coull BA. Black carbon exposure, socioeconomic and racial/ethnic spatial polarization, and the Index of Concentration at the Extremes (ICE). *Health Place*. 2015; 34:215–228.

S5. Krieger N, Waterman PD, Spasojevic J, Li W, Maduro G, Van Wye G. Public health monitoring of privilege and deprivation with the Index of Concentration at the Extremes. *Am J Public Health*. 2016; 106(2):256–263.

S6. Larrabee Sonderlund A, Charifson M, Schoenthaler A, Carson T, Williams NJ. Racialized economic segregation and health outcomes: a systematic review of studies that use the Index of Concentration at the Extremes for race, income, and their interaction. *PLoS One*. 2022; 17(1):e0262962. doi: 10.1371/journal.pone.0262962

S7. Tabb LP, Bayliss R, Xu Y. Spatial and spatio-temporal statistical implications for measuring structural racism: a review of three widely used residential segregation measures. *Spatial Spatio-temporal Epidemiol*. 2024; 50:100678. doi: 10.1016/j.sste.2024.100678

S8. Krieger N, Moallef S, Chen JT, et al. Politicians, power, and the people's health: US elections and state health outcomes, 2012-2024. *Health Aff Sch*. 2024 Nov 27; 2(12):qxae163. doi: 10.1093/haschl/qxae163.

S9. Ballotpedia . State government trifectas. https://ballotpedia.org/State_government_trifectas ; accessed April 19, 2025.

S10. Caughey D, Warshaw C. The dynamics of state policy liberalism index, 1936-2014. *Am J Polit Sci*. 2016; 60(4):889–913.

S11. Caughey D. Updated estimates of state policy and mass ideology, 1936-2020. Accessed July 24, 2024. https://www.dropbox.com/t/MRDUHsLpFAzNBDhu ; accessed April 19, 2025.

S12. United States National Archives. What is the electoral college? Page last reviewed: November 2, 2024. https://www.archives.gov/electoral-college/about ; accessed April 19, 2025.

S13. US National Cancer Institute. Screening tests. Last reviewed: September 27, 2024. https://www.cancer.gov/about-cancer/screening/screening-tests; accessed April 19, 2025.

S14. Goddard KAB, Feuer EJ, Mandelblatt JS, et al. Estimation of cancer deaths averted from prevention, screening, and treatment efforts, 1975-2020. *JAMA Oncol*. 2025 Feb 1; 11(2):162-167. doi: 10.1001/jamaoncol.2024.5381.

S15. American Cancer Society Recommendations for the Early Detection of Breast Cancer. Last revised: December 19, 2023. https://www.cancer.org/cancer/types/breast-cancer/screening-tests-and-early-detection/american-cancer-society-recommendations-for-the-early-detection-of-breast-cancer.html ; accessed April 19, 2025.

S16. National Cancer Institute. ACS's Updated Cervical Cancer Screening Guidelines Explained. Last revised: September 18, 2020. https://www.cancer.gov/news-events/cancer-currents-blog/2020/cervical-cancer-screening-hpv-test-guideline ; accessed April 19, 2025.

S17. American Cancer Society Guideline for Colorectal Cancer Screening. Last revised: January 29, 2024. https://www.cancer.org/cancer/types/colon-rectal-cancer/detection-diagnosis-staging/acs-recommendations.html ; accessed April 19, 2025.

S18. Cao B, Soerjomataram I. The burden and prevention of premature deaths from noncommunicable diseases, including cancer: a global perspective. In: Wild CP, Weiderpass E, Stewart BW, editors. *World Cancer Report: Cancer research for cancer prevention*. Lyon (FR): International Agency for Research on Cancer; 2020. 1.1. https://www.ncbi.nlm.nih.gov/books/NBK606514/?report=reader ; accessed April 19, 2025.

S19. Ma J, Yabroff KR, Siegel RL, Cance WG, Koh HK, Jemal A. Progress in reducing disparities in premature mortality in the USA: a descriptive study. *J Gen Intern Med*. 2022 Sep; 37(12):2923-2930. doi: 10.1007/s11606-021-07268-5. Epub 2022 Jun 22.

S20. Thomas AL, Kulchar RJ, Stephens ES, et al. County socioeconomic status and premature mortality from cancer in the United States. *Cancer Epidemiol*. 2025 Apr; 95:102747. doi: 10.1016/j.canep.2025.102747. Epub 2025 Jan 18.

S21. US Federal Government. Approaching retirement. https://www.usa.gov/approaching-retirement ; accessed April 19, 2025.

S22. National Academies of Sciences, Engineering, and Medicine; Division of Behavioral and Social Sciences and Education; Committee on National Statistics; Committee on Population; Committee on Rising Midlife Mortality Rates and Socioeconomic Disparities. Becker T, Majmundar MK, Harris KM, eds. *High and Rising Mortality Rates Among Working-Age Adults*. Washington, DC: National Academies Press, 2021.

S23. Dowd JB, Doniec K, Zhang L, Tilstra A. US exceptionalism? International trends in midlife mortality. *Int J Epidemiol*. 2024; 53(2):dyae024. doi: 10.1093/ije/dyae024

S24. National Cancer Institute. Standard populations (millions) for age-adjustment. https://seer.cancer.gov/stdpopulations/ ; accessed April 19, 2025.

S25. National Cancer Institute. SEER training modules. ICD-10-CM Chapter 2: Neoplasms (C00-D49). C Codes. Last updated: December 3, 2018. https://training.seer.cancer.gov/icd10cm/neoplasm/c-codes.html ; accessed April 19, 2025.

S26. Islami F, Baeker Bispo J, Lee H, et al. American Cancer Society's report on the status of cancer disparities in the United States, 2023. *CA Cancer J Clin*. 2024 Mar-Apr; 74(2):136-166. doi: 10.3322/caac.21812. Epub 2023 Nov 14.

S27. Beckfield J. *Political Sociology and The People's Health*. New York: Oxford University Press, 2018.

S28. US Department of Health and Human Services. Programs that use the poverty guidelines as part of eligibility determination. Content last reviewed November 5, 2019. https://www.hhs.gov/answers/hhs-administrative/what-programs-use-the-poverty-guidelines/index.html ; accessed April 19, 2025.

S29. Tolbert J, Bell C, Rudowitz R. Medicaid expansion is a Red and Blue state issue. KFF, November 27, 2024, https://www.kff.org/medicaid/issue-brief/medicaid-expansion-is-a-red-and-blue-state-issue/ ; accessed April 19, 2025.

S30. US Centers for Disease Control and Prevention. United States Cancer Statistics: Data Visualizations. Stage at Diagnosis. https://gis.cdc.gov/Cancer/USCS/#/StageatDiagnosis/ ; accessed April 19, 2025.

S31. CDC. United States Cancer Statistics. June 13, 2024. https://www.cdc.gov/united-states-cancer-statistics/technical-notes/stage-at-diagnosis.html ; accessed April 19, 2025.