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Original Research

Longitudinal Associations From US State/Local Police and Social Service Expenditures to Suicides and Police-Perpetrated Killings Between Black and White Residents

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Policy Points:

- Despite documented inequities in suicide trends and police-perpetrated killing for Black compared with White Americans, government expenditures have not been examined as upstream drivers of these inequities.
- This longitudinal study found police expenditures predicted increases in suicide and police-perpetrated killings for Black, but not White, residents. Housing and community development expenditures were associated with decreases in suicide for Black residents only, and kindergarten through 12th grade (K-12) education expenditures were associated with decreases in suicide for White residents only.
- Findings suggest reducing police, and increasing housing, expenditures may reduce Black–White inequities in suicide and police-perpetrated killing.

Context: Despite documented inequities in suicide trends and police-perpetrated killing for Black US Americans, there is little research investigating how structural factors like government expenditures may drive these outcomes. This study examined associations from police

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and social services expenditures to later suicides and police-perpetrated killings for Black and White residents.

Methods: This longitudinal study analyzed 2010–2020 US Census of Governments–tracked state and local government expenditures and Centers for Disease Control and Prevention (CDC)-tracked years of potential life lost (YPLL) to suicide and police-perpetrated killing. Dynamic structural equation models estimated 1- and 5-year lagged associations. Models adjusted for reverse associations (i.e., violent death to later expenditures) and state-level variables including Medicaid expansion, Black–White population, racial residential segregation, political representation, overall expenditures, state firearm policies, and firearm violence rates.

Findings: For suicide, every $100 increase in per capita police expenditures was associated with 35 more YPLL 1 year later ($\gamma = 0.35$, 95% credible interval [CI] 0.02-0.90) and 28 more YPLL 5 years later ($\gamma = 0.28$, 95% CI 0.001-0.55) per 100,000 Black residents. For police-perpetrated killings, every $100 increase in per capita police expenditures was associated with 7 more YPLL 1 year later ($\gamma = 0.07$, 95% CI 0.02-0.12) per 100,000 Black residents. As such, a $100 per capita increase in annual police expendiutres translated to 14,385 more YPLL to suicide, and 2,877 more YPLL to police-pepetrated killing, 1 year later for the United States' 41.1 million Black residents. There were no associations between police expenditures and outcomes for White residents. Conversely, every $100 increase in per capita housing and community development expenditures was associated with 29 fewer YPLL to suicide 5 years later per 100,000 Black residents ($\gamma = -0.29$, 95% CI −0.53 to −0.05). Every $100 increase in per capita kindergarten through 12th grade (K-12) education expenditures was associated with 4 fewer YPLL to suicide 1 year later per 100,000 White residents ($\gamma = -0.04$, 95% CI −0.07 to −0.01).

Conclusions: Consistent with CDC recommendations to promote housing stability as suicide prevention, reducing police expenditures and increasing housing expenditures may decrease Black–White inequities in YPLL to suicide and police-perpetrated killing.

Keywords: violent death, racial disparities, social determinants of health, mental health, government spending.

Throughout US history, Black communities have inequitably faced violence.[1–3] For example, police kill Black US Americans at twice the rate of White US Americans.[4,5] Additionally, although early suicidality research suggested White US American communities may be at higher risk than other racial and ethnic communities,[6] more recent studies indicate youth suicide rates are higher and are increasing at greater rates among Black children compared with their peers of other races.[7] Despite the profound societal impact of these premature deaths, and growing recognition that racial health inequities result from policy decisions,[8] most research examining predictors of violent death among Black and White communities focuses on individual-level (e.g., depression, substance use) and community-level (e.g., unemployment, neighborhood disadvantage) variables. However,

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policymakers' decisions on state and local government expenditures, which have been examined as predictors of other health outcomes (e.g., maternal morbidity),[9–11] may be critical structural drivers of Black–White violent death inequities.[12] In particular, there has been recent debate over whether police expenditures increase community safety and reduce violent death.[13] Yet, with the exception of a substantial body of research examining homicide,[14] there have been no studies, to our knowledge, that have tested associations between state and local police expenditures and other forms of violent death among Black and White residents. This is critical because police are the United States' front-line responders to mental health crises, including suicide response,[12] and estimates suggest about one in every four police-perpetrated killings are linked to mental health response.[15] Thus, the present study examined longitudinal associations between state and local expenditures, including police expenditures, and their associations with Centers for Disease Control and Prevention (CDC)-tracked nonhomicide violent deaths (suicides, police-perpetrated killings) from 2010 to 2020.

Population-level racial inequities are driven by racial oppression.[1,12,16,17] In the United States, racial oppression manifests as inequitable distribution of power, political representation, and financial opportunities away from, and discrimination toward, Black communities.[1] One of the foundational enforcers of anti-Black racial oppression has been the police, which have been fundamental in implementing slavery, racial segregation, mass incarceration, and other policies that have oppressed Black communities throughout US history.[2,3,17,18] This has created, sustained, and exacerbated Black–White inequities in health, wealth, education, and longevity.[1,16,17,19] The conceptual framework by Alvarez and colleagues suggests contemporaneous Black–White inequities in suicide and police-perpetrated killings may be driven by the United States' widespread reliance on police for emergency response, including acute mental health crises (e.g., imminent suicide risk).[12] Despite recent calls to redress these inequities through macro-level interventions such as the reallocation of police funding to housing, community development, and economic assistance,[12,13] there is little research examining whether police expenditures, and potential social services alternatives, are linked to population health, including suicide and police-perpetrated killing.

Studies that have examined the effects of state and local funding on health have found mixed results on the impact of law enforcement expenditures but have consistently supported the benefit of some social service expenditures. McCullough and Leider found that investments in community health programs, public hospitals, fire protections, kindergarten through 12th grade (K-12) education, libraries, and housing and community development were all associated with better overall US county-level health from 2007 to 2012.[10] Dunn and colleagues found police and corrections (for men only), K-12 education, higher education, public welfare, environment and housing, and general government spending were all negatively associated with

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all-cause mortality.[9] Conversely, Muchomba and colleagues found, within New Jersey municipalities, police expenditures were prospectively positively associated with severe maternal morbidity (SMM), whereas fire and ambulance, transportation, health, housing, and library expenditures were negatively associated with SMM.[11] Likewise, Lindenfeld and colleagues found that per capita county police spending was positively associated with US overdose deaths in 2017–2020.[20] Regarding associations between state expenditures and suicide specifically, Flavin and Radcliff found US state per capita spending on public assistance (e.g., medical benefits, family assistance) and state liberalism (e.g., policies on gun control, welfare) from 1990 to 2000 were associated with lower state suicide rates.[21] Additional domestic and international studies support these results, suggesting that state spending on social services may be associated with lower suicide rates.[22] Critically, no studies, to our knowledge, have elucidated whether racial groups are inequitably impacted by government expenditures.

Although it remains unclear how police expenditures may impact Black and White residents' health, mounting evidence indicates increased policing is linked to increased risk for suicide and police-perpetrated killing for Black communities. Specifically, arrests are positively associated with suicidal ideation and attempt among Black, but not White, residents.[23–25] Additionally, in the months following the police-perpetrated killing of a Black person, one study found increased rates of suicide among Black residents, but no change in the rates among White residents, in the census division where it occurred.[26] In addition to suicide risk, evidence shows Black communities are much more likely to experience police violence than White communities.[27,28] Estimates from 1960 to present indicate that Black men are 2.5 times, and Black women are 1.4 times, more likely than their White counterparts to be killed by police during their lifetimes.[4,5] Given this evidence showing the negative psychological impacts of policing and the higher likelihood of police violence in Black, but not White, communities, it is possible that increased government police expenditures are associated with higher rates of suicide and police-perpetrated killings for Black, but not White, residents.

The present study examined longitudinal associations between US state and local government expenditures and years of potential life lost (YPLL) to suicides and police-perpetrated killings among Black and White residents from 2010 to 2020. Specifically, we examined 1- and 5-year longitudinal associations from eight of the largest state and local expenditure categories tracked by the US Census of Governments[29] (police expenditures are sixth highest) to suicide and police-perpetrated killing deaths tracked by the CDC.[30] We chose these lags to examine the immediate and longer-term impact of expenditures. Given research showing the negative health impacts of policing for Black communities,[4,5,23,26,31] our primary hypothesis was that police expenditures would be associated with increases in suicide and police-perpetrated killing for Black, but not White, residents. Given research showing the broad benefits of social services like K-12 education, housing, community development, economic

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assistance, and other community investments,[9,11,21,32] we tested a secondary hypothesis that expenditures in these areas would be associated with decreases in suicide for both Black and White communities.

Methods

Data

CDC's Web-Based Injury Statistics Query and Reporting System (WISQARS) database[30] provided violent death data for 2010–2020, drawing mortality data from the US National Vital Statistics System (NVSS) of US resident death certificates. Cause of death is coded using the International Classification of Diseases, Tenth Revision (ICD-10). The NVSS has shown validity in classifying violent deaths,[33] though some estimates suggest it may undercount suicides and police-perpetrated killings.[34,35] The WISQARS provides death rates across states, ages, races, ethnicities, sexes, and causes/intents of death. To emphasize the long-run social, economic, and public health impact of suicides and police-perpetrated killings early in the life span, we assessed outcomes using the age-adjusted YPLL rate, which quantifies premature mortality by subtracting the age at death from a set life expectancy.[36] The US Census Bureau's Annual Survey of State and Local Government Finances for 2010–2020 compiled by the Urban Institute,[29] which collects detailed expenditure information for each state and constituent local governments, provided expenditure data.

Variables

State and Local Government Expenditures. We examined annual per capita expenditures from the Urban Institute's Database on State and Local Finance Data (https://state-local-finance-data.taxpolicycenter.org/pages.cfm). We drew state and local direct expenditures in nominal dollars for all 50 states and Washington, District of Columbia (DC), including the following: 1) police (series E087), 96% of these expenditures covers operational costs like salaries/benefits for police, sheriffs, state highway patrols, and public safety governmental departments; 2) K-12 education (series E027), 89% of these expenditures covers public school employee salaries/benefits for instruction, administration, and guidance counseling and support programs for textbooks, transportation and lunches, and 11% covers school construction and renovation (US K-12 education is primarily funded through state and local governments); 3) higher education (series E030), 90% of these expenditures covers salaries and operating costs for public community colleges, universities, and postgraduate institutions, and 10% covers capital outlays and construction; 4) public welfare (series E090), 97% of these expenditures covers operational costs for cash assistance programs like Temporary Assistance for Needy Families and Supplemental Security

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Income and payments toward service providers under Medicaid; 5) housing and community development (series E074), 86% of these expenditures covers operation of new housing, public housing support, rental assistance, and home ownership promotion, and 14% covers construction and redevelopment of public housing; 6) hospitals (series E058), 97% of these expenditures covers operation of university medical schools, state-owned hospitals, public children's hospitals, and payments to private hospitals for public services (~80% of US hospitals are private); 7) public health (series E055), 97% of these expenditures covers public health administration and community health services addressing mental health and substance abuse, inspections of health departments and providers, and water and air quality regulation; and 8) highways and roads (series E068), 43% of these expenditures covers operation and maintenance costs, and 57% covers construction of highways, roads, bridges, and sidewalks.[29]

Suicide and Police-Perpetrated Killing. We set WISQARS filters to download intent of death across all mechanisms, ages, sexes, and metropolitan/nonmetropolitan areas for individual years for suicide ("intentionally self-inflicted injury that results in death")[30] and legal intervention ("injuries inflicted by the police or other law-enforcing agents, including military on duty, in the course of arresting or attempting to arrest lawbreakers, suppressing disturbances, maintaining order, and other legal actions"),[30] which we refer to as police-perpetrated killing. We set the YPLL reference age to 75 years to correspond to the average life expectancy for Black Americans.[37] We downloaded separate data sets for White non-Hispanic and Black populations of all ethnicities given people with perceived darker skin have inequitably negative police experiences across ethnicity.[38]

Control Variables. To adjust for the effect of federal funding, we controlled for state Medicaid expansion,[39] the largest source of federal grants to states from 2010 to 2020. Because of robust evidence for their effects on firearm-related deaths,[40] a primary mechanism for suicide and police-perpetrated killing, we adjusted for 2010–2020 state firearm policies from the RAND State Firearm Law Database[40]: background checks (both handguns and long-guns), child-access prevention, concealed carry, and self-defense laws. We drew overall expenditures and Black–White population proportions from the Urban Institute databases to control for differences in overall state budget and sracial composition. To adjust for the effect of the presence and impact of firearms, we used the 2020 age-adjusted firearm death rate from the CDC's Wide-Ranging Online Data for Epidemiologic Research (WONDER) data.[41] To adjust for the effects of racial residential segregation and political representation on funding and policing, we used the 2012–2022 County Health Rankings Black/White Residential Segregation Measure,[42] which covers segregation during the 2010–2020 study period, and the 2010–2020 National Conference of State Legislatures state political control tracker.[43]

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Data Analytic Plan

We examined longitudinal associations between sets of multiple time series, which required models that account for serial correlation, reverse causality, and lagged effects. We used dynamic structural equation modeling (DSEM),[44] an analytic approach that combines time series analysis, multilevel modeling, and structural equation modeling. We followed best practices in two-level DSEM in M*plus* 8.4,[44] running analyses that specified within-state variance (i.e., year-to-year changes in states' outcomes) and between-state variance (i.e., differences between states' overall outcomes). The standard approach to M*plus* DSEM uses Bayesian estimation to aid convergence and flexibility. Bayesian statistics do not produce *p* values, but frequentist inference can be approximated by examining whether 0 is within the 95% credible interval (CI) model parameters. DSEM was appropriate here because we expected outcome stationarity (i.e., no developmental change in violent death across 10 years), and we had at least ten timepoints. However, like many DSEM analyses,[44] we observed an upward trend in some outcomes across time. To account for this and potential time-varying variables (e.g., inflation), we detrended the death and expenditures variables by regressing them on time.

We ran separate sets of models to examine shorter-term (1-year) and longer-term (5-year) associations between each expenditure category and later death categories separately for Black and White residents (8 expenditures × 2 outcomes × 2 racial groups × 2 lag lengths = 64 models). Associations were from expenditures in year *t-x* to violent deaths in year *t*, where *x* was 1 or 5, within a multilevel vector autoregressive DSEM, which allows for multiple outcome variables on the within-state level.[44] On the within-state level, we adjusted for the reciprocal association from violent deaths in year *t-x* to expenditures in year *t*, and year *t* Medicaid expansion, firearm policies, Black–White population proportion, racial residential segregation, political representation, and total expenditures. On the between-state level, we adjusted models for Medicaid expansion, firearm policies, Black–White population proportion, political representation, and gun violence rates. Figure 1 depicts a simplified DSEM model (see full DSEM notation in Appendices 1, 3, 4). The 5-year models were equivalent to the 1-year models, only with the addition of a 5-year expenditure predicting death lag, and 1-5-year expenditure autoregressions.

We tested for influential cases using Cook's D estimates for expenditure and death regressions. As a robustness check, we reran the police spending models, eliminating states with relatively extreme values for expenditure and death variables (e.g., high/low on police expenditures and high/low on suicide).

Results

Table 1 includes study variable descriptives (see Appendices 2 and 3 for state-level means and control variables). Figures 2A and 2B depict descriptive information for

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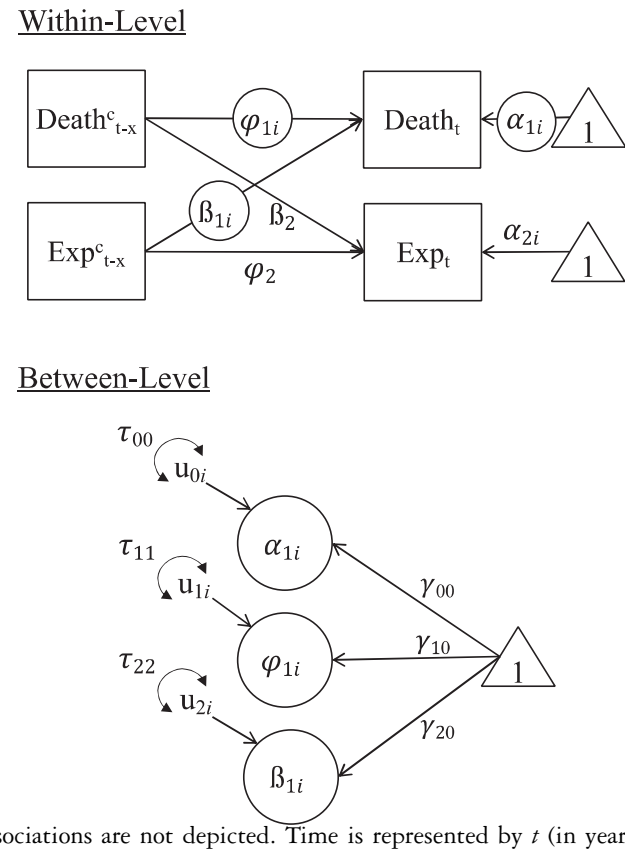
Figure 1. Simplified Dynamic Structural Equation Model Representation



Control associations are not depicted. Time is represented by t (in years, $t = 1, \ldots, 11$), i is states ($i = 1, \ldots 51$), $\propto_{1i}$ is a state-specific intercept for violent death, φ_i is the autoregressive effect measuring the carryover of variables from the previous year to the current year, and c is latent-centered violent death such that $\text{Death}_{ic} = \text{Death} - \propto_{1i}$. In the between-state level, γ is fixed effects that capture the average effect of the parameter across all states, and u is random effects that are normally distributed and include state-specific deviations from the fixed effects. Death, violent death outcome; Exp, expenditure predictor.

the primary hypothesis: darker blue states indicate higher quartiles of average annual increases in police expenditures, whereas numbers within states indicate the average annual change in YPLL per 100,000 Black residents.

For the DSEM models, Tables 2 and 3 include posterior distribution summaries and 95% CIs. In the 1-year lag suicide models, every $100 increase in previous-

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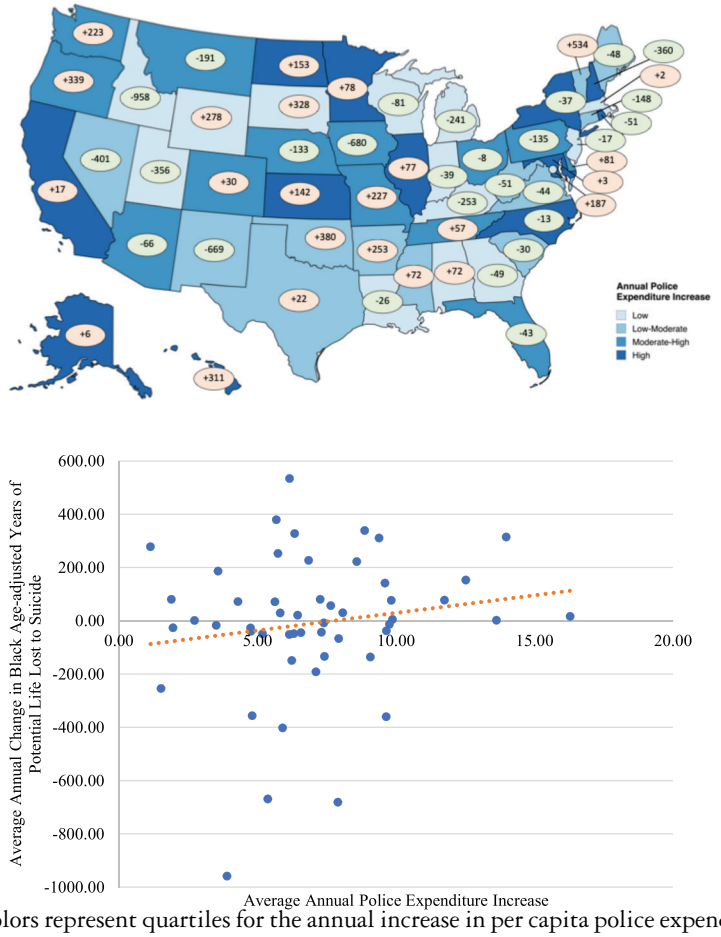
Figure 2. Map and Scatterplot Depicting Average Annual Police Expenditure Increase and Average Annual Change in the Age-Adjusted Years of Potential Life Lost to Suicide Rate Among Black Residents From 2010 to 2020



State colors represent quartiles for the annual increase in per capita police expenditures. The map numbers and graph y-axis are the annual change in years of potential life lost to suicide per 100,000 people after adjusting for the state's overall budget, Black–White population proportion, Medicaid expansion, state firearm policies, and same-year police funding. The dotted line depicts the best-fitting regression line.

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Table 1. Primary Study Variable Descriptives Across All States From 2010 to 2020

Variables	Grand Mean	SD	Min	Max
Expenditures, dollars per capita				
Police	319.71	115.36	159.00	987.00
K-12 education	1975.20	561.06	1,136.00	4,584.00
Higher education	901.92	256.37	183.00	1,596.00
Public welfare	1,919.44	769.26	749.00	6,367.00
Housing and community development	173.79	169.88	26.00	1,720.00
Hospital	509.32	379.09	9.00	2,279.00
Health	285.00	157.22	77.00	1,078.00
Roads	658.05	334.00	268.00	2,429.00
Age-adjusted YPLL per 100,000 people				
Black suicide	306.07	215.51	0.00	2,210.69
Black police-perpetrated killing	13.62	19.78	0.00	160.37
White suicide	578.93	157.05	1,099.30	1,108.08
White police-perpetrated killing	6.75	6.33	0.00	39.45

K-12, kindergarten through 12th grade; Max, maximum; Min, minimum; SD, standard deviation; YPLL, years of potential life lost.
Expenditures are based on state and local per capita expenditures. Violent death is age-adjusted YPLL rate per 100,000 people with the reference age set to 75 years.

year per capita police expenditures was associated with 35 more YPLL to suicide per 100,000 Black residents ($\gamma = 0.35$, 95% CI 0.02, 0.90). There was no association among White residents ($\gamma = -0.03$, 95% CI −0.25,0.19). Conversely, previous-year K-12 education expenditures were not associated with suicide for Black residents ($\gamma_{10} = 0.07$, 95% CI −0.10, .13), but every $100 increase in previous-year per capita K-12 education expenditures was associated with 4 fewer YPLL to suicide per 100,000 White residents ($\gamma = -0.04$, 95% CI −0.07,−0.01). For the 1-year lag police-perpetrated killing models, every $100 increase in per capita previous-year police expenditures was associated with 7 more YPLL to police-perpetrated killing per 100,000 Black residents ($\gamma = 0.07$, 95% CI 0.02, 0.12). There was no association for White residents ($\gamma = -0.001$, 95% CI −0.03, 0.03). We did not find evidence for any additional 1-year associations.

For the 5-year lag suicide models, every $100 increase in per capita police expenditures 5 years earlier was associated with 28 more YPLL to suicide per 100,000 Black

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Table 2. Dynamic Structural Equation Results for State and Local Expenditures and YPLL to Suicide Rate and Police-Perpetrated Killing Rate for Black Residents

Expenditure	Parameter	Black Suicide, Estimate (95% CI)		Black Police Killing, Estimate (95% CI)	
		1-Year Lag	5-Year Lag	1-Year Lag	5-Year Lag
Police	Fixed effects	**0.35[a] (0.02, 0.90)**	**0.28[a] (0.001, 0.55)**	**0.07[a] (0.02, 0.12)**	0.02 (−0.02, 0.05)
	Variance	0.01[a] (0.001, 0.02)	0.12[a] (0.05, 0.24)	0.001[a] (0.001, 0.002)	0.001[a] (0.001, 0.002)
K-12 Ed	Fixed effects	−0.002 (−0.08, 0.08)	0.07 (−0.10, 0.13)	−0.003 (−0.03, 0.02)	0.004 (−0.01, 0.01)
	Variance	0.001[a] (0.001, 0.002)	0.01[a] (0.001, 0.01)	0.000 (0.000, 0.001)	0.001 (0.000, 0.001)
Higher Ed	Fixed effects	0.002 (−0.07, 0.10)	−0.08 (−0.25, 0.13)	−0.01 (−0.03, 0.01)	0.01 (−0.01, 0.03)
	Variance	0.002[a] (0.001, 0.005)	0.05[a] (0.01, 0.12)	0.000 (0.000, 0.001)	0.001 (0.000, 0.001)
Pub Wel	Fixed effects	−0.03 (−0.08, 0.03)	−0.03 (−0.10, 0.04)	0.003 (−0.01, 0.02)	0.001 (−0.01, 0.01)
	Variance	0.001[a] (0.001, 0.002)	0.01[a] (0.002, 0.02)	0.000 (0.000, 0.001)	0.000 (0.000, 0.001)
H&C Dev	Fixed effects	0.01 (−0.32, 0.42)	**−0.29[a] (−0.53, −0.05)**	−0.01 (−0.06, 0.03)	0.01 (−0.02, 0.04)
	Variance	0.06[a] (0.01, 0.18)	0.31[a] (0.15, 0.57)	0.001[a] (0.001, 0.003)	0.002[a] (0.001, 0.004)
Hospitals	Fixed effects	−0.07 (−0.14, 0.01)	−0.02 (−0.13, 0.09)	0.01 (−0.004, 0.03)	0.004 (−0.01, 0.02)
	Variance	0.002[a] (0.001, 0.01)	0.04[a] (0.02-0, 0.08)	0.001 (0.000, 0.001)	0.001 (0.000, 0.001)
Health	Fixed effects	0.17 (−0.03, 0.43)	−0.17 (−0.42, 0.12)	−0.02 (−0.05, 0.000)	0.02 (−0.01, 0.04)
	Variance	0.10[a] (0.001, 0.05)	0.20[a] (0.06, 0.39)	0.001 (0.000, 0.002)	0.001[a] (0.001, 0.003)
Roads	Fixed effects	0.10 (−0.02, 0.18)	−0.08 (−0.17, 0.01)	0.01 (−0.01, 0.03)	0.01 (−0.003, 0.02)
	Variance	0.002[a] (0.001, 0.01)	0.03[a] (0.01, 0.05)	0.001 (0.000, 0.001)	0.001 (0.000, 0.001)

CI, credible interval; Ed, education; H&C Dev, housing and community development; K-12, kindergarten through 12th grade; Pub Wel, public welfare; YPLL, years of potential life lost.

The estimates are medians of posterior distribution, and the CIs use the highest posterior density method. The age-adjusted YPLL rate is per 100,000 people in these models. These models adjust for the effects of previous-year violent death and expendiures, violent death on expenditures, total expenditures, Black–White population proportion, gun violence rates, Medicaid expenditures, and gun control policies. Bolded values indicate significant focal associations (i.e., expenditures predicting death).

[a] Value of 0 is not in the 95% CI of the parameter and is analogous to being statistically significant in frequentist inference.

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Table 3. Dynamic Structural Equation Results for State and Local Expenditures and YPLL to Suicide Rate and Police-Perpetrated Killing Rate for White Residents

Expenditure	Parameter	White Suicide, Estimate (95% CI)		White Police Killing, Estimate (95% CI)	
		1-Year Lag	5-Year Lag	1-Year Lag	5-Year Lag
Police	Fixed effects	−0.03 (−0.25, 0.19)	−0.08 (−0.17, 0.02)	−0.001 (−0.03, 0.03)	0.01 (−0.001, 0.02)
	Variance	0.03[a] (0.004, 0.08)	0.01[a] (0.001, 0.003)	0.000 (0.000, 0.001)	0.001 (0.000, 0.001)
K-12 Ed	Fixed effects	**−0.04[a] (−0.07, −0.01)**	−0.01 (−0.03, 0.01)	−0.01 (−0.03, 0.03)	0.000 (−0.01, 0.004)
	Variance	0.001[a] (0.001, 0.002)	0.001 (0.001, 0.002)	0.000 (0.000, 0.001)	0.000 (0.000, 0.001)
Higher Ed	Fixed effects	0.05 (−0.002, 0.11)	0.03 (−0.01, 0.07)	−0.001 (−0.01, 0.01)	0.01 (−0.002, 0.01)
	Variance	0.003[a] (0.001, 0.009)	0.003 (0.001, 0.008)	0.000 (0.000, 0.000)	0.000 (0.000, 0.001)
Pub Wel	Fixed effects	−0.02 (−0.05, 0.01)	−0.01 (−0.03, 0.01)	0.001 (−0.004, 0.01)	0.000 (−0.003, 0.003)
	Variance	0.001[a] (0.001, 0.002)	0.01[a] (0.001, 0.002)	0.000 (0.000, 0.001)	0.000 (0.000, 0.000)
H&C Dev	Fixed effects	−0.07 (−0.26, 0.12)	−0.02 (−0.12, 0.08)	0.01 (−0.13, 0.02)	0.01 (−0.01, 0.02)
	Variance	0.02[a] (0.01, 0.08)	0.02[a] (0.001, 0.05)	0.001 (0.000, 0.001)	0.001 (0.000, 0.001)
Hospitals	Fixed effects	0.05 (−0.02, 0.11)	0.00 (−0.04, 0.04)	0.001 (−0.01, 0.01)	0.000 (−0.01, 0.01)
	Variance	0.004[a] (0.001, 0.01)	0.002[a] (0.001, 0.005)	0.000 (0.000, 0.001)	0.000 (0.000, 0.000)
Health	Fixed effects	−0.10 (−0.12, 0.09)	−0.04 (−0.13, 0.04)	0.003 (−0.01, 0.02)	−0.001 (−0.01, 0.01)
	Variance	0.01[a] (0.001, 0.05)	0.01[a] (0.001, 0.03)	0.000 (0.000, 0.001)	0.001 (0.000, 0.001)
Roads	Fixed effects	−0.03 (−0.09, 0.05)	0.02 (−0.01, 0.06)	0.002 (−0.01, 0.01)	0.000 (−0.01, 0.01)
	Variance	0.004[a] (0.001, 0.01)	0.03[a] (0.001, 0.01)	0.000 (0.000, 0.000)	0.000 (0.000, 0.000)

CI, credible interval; Ed, education; H&C Dev, housing and community development; K-12, kindergarten through 12th grade; Pub Wel, public welfare; YPLL, years of potential life lost.

The estimates are medians of the posterior distribution, and CIs use the highest posterior density method. The age-adjusted YPLL rate is per 100,000 people in these models. These models adjust for the effects of previous-year violent death and expendiures, violent death on expenditures, total expenditures, Black–White population proportion, gun violence rates, Medicaid expenditures, and gun control policies. Bolded values indicate significant focal associations (i.e., expenditures predicting death).

[a]Value of 0 is not in the 95% CI of the parameter and is analogous to being statistically significant in frequentist inference.

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residents ($\gamma = 0.28$, 95% CI 0.001,0.55). There was no association among White residents ($\gamma = -0.08$, 95% CI −0.17,0.02). Conversely, every $100 increase in per capita housing and community development expenditures 5 years earlier was associated with 29 fewer YPLL to suicide per 100,000 Black residents ($\gamma = -0.29$, 95% CI −0.53,−0.05). There was no association among White residents ($\gamma_{10} = -0.02$, 95% CI −0.12, 0.08). We did not find evidence for any additional 5-year associations.

Regarding outlier analyses, we did not find any Cook's D values greater than 0.004 for any regressions, suggesting no highly influential cases. Regarding robustness check analyses, we identified Hawaii and Idaho as extreme cases for the suicide models because Hawaii and Idaho were among the highest and lowest, respectively, in both police expenditures and suicide (Figures 2 and 3). We identified Minnesota and Utah as extreme cases for the police-pepetrated killing models because Minnesota and Utah were among the highest and lowest, respectively, in police expenditures and police-perpetrated killing. The altnerative models suggested our original results were robust because alternative models were comparable with our original results, including 1-year Black suicide models without Hawaii ($\gamma = 0.56$, 95% CI 0.09, 0.87) and Idaho ($\gamma = 0.33$, 95% CI 0.07, 0.70) and White suicide models without Hawaii ($\gamma = 0.05$, 95% CI −0.17, 0.31) and Idaho ($\gamma = 0.07$, 95% CI −0.19, 0.25), 5-year Black suicide models without Hawaii ($\gamma = 0.30$, 95% CI 0.04, 0.54) and Idaho ($\gamma = 0.27$, 95% CI 0.03, 0.54) and White suicide models without Hawaii ($\gamma = -0.07$, 95% CI −0.17, 0.03) and Idaho ($\gamma = -0.08$, 95% CI −0.19, 0.02), and 1-year Black police killing models without Minnesota ($\gamma = 0.03$, 95% CI −0.008, 0.07) and Utah ($\gamma = 0.05$, 95% CI 0.001, 0.10) and White police killing models without Minnesota ($\gamma = 0.001$, 95% CI −0.02, 0.04) and Utah ($\gamma = 0.00$, 95% CI −0.02, 0.03).

Discussion

Our primary findings show, after adjusting for relevant covariates, every $100 per capita increase (30% increase) in annual police expenditures was associated with next-year increases of 35 YPLL to suicide for every 100,000 Black residents. These estimates suggest that police expenditures accounted for an over 11% change in the overall 306 YPLL to suicide among Black US residents. In the context of other leading causes of death, 35 YPLL is a rate within the top 20 leading causes of death and comparable with the YPLL rate for HIV (35 YPLL in 2020)[30] and hypertension (51 YPLL in 2020)[30] across all US residents. For police-perpetrated killing, our results showed every $100 per capita increase in police expenditures also was associated with 7 YPLL to police-perpetrated killings for every 100,000 Black residents. Therefore, on a national level, a $100 increase in annual police expendiutres translated to 14,385 more YPLL to suicide and 2,877 more YPLL to police-pepetrated

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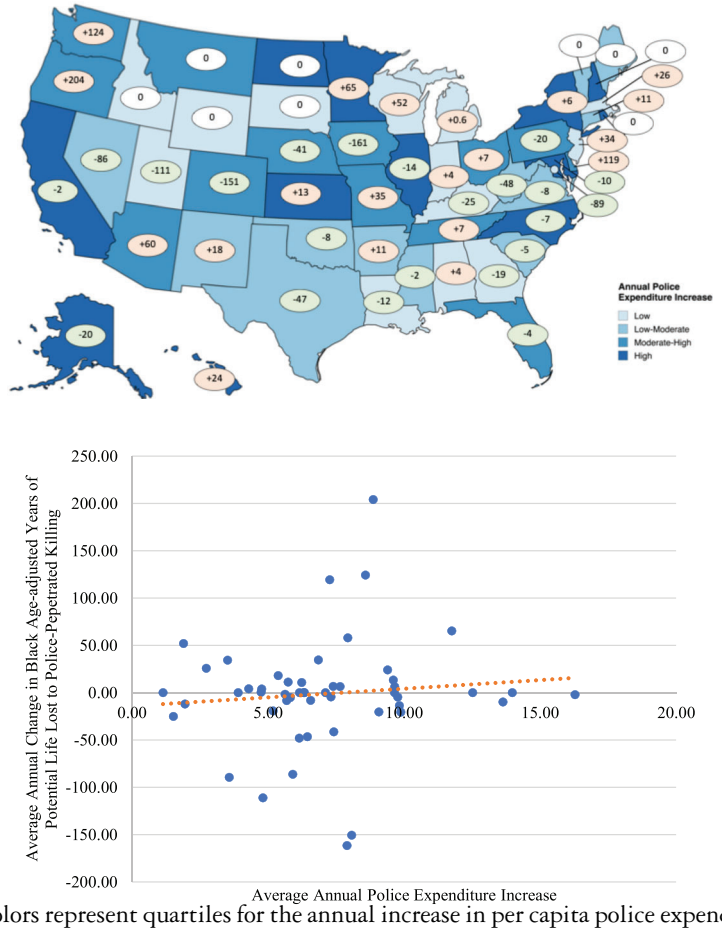
Figure 3. Map and Scatterplot Depicting Average Annual Police Funding Increase and Average Annual Change in the Age-Adjusted Years of Potential Life Lost to Police-Perpetrated Killing Rate Among Black Residents From 2010 to 2020



State colors represent quartiles for the annual increase in per capita police expenditures. The map numbers and graph y-axis are the annual change in years of potential life lost to suicide per 100,000 people after adjusting for the state's overall budget, Black–White population proportion, Medicaid expansion, state firearm policies, and same-year police funding. "0" indicates there was no change from 2010 to 2020. The dotted line depicts the best-fitting regression line.

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killing the next year for the 41.1 million Black US residents.[45] We also found every $100 per capita increase in annual police expenditures was associated with increases of 28 YPLL to suicide for every 100,000 Black residents 5 years later. Conversely, every $100 per capita increase in housing and community development expenditures (56% increase) was associated with decreases of 29 YPLL to suicide for every 100,000 Black residents 5 years later. Every $100 per capita increase (5% increase) in K-12 education expenditures was associated with next-year decreases of 5 YPLL to suicide for every 100,000 White residents. Thus, across all states, a $100 per capita increase in housing and community development translated to 11,890 fewer YPLL to suicide 5 years later for the 41.1 million Black US residents and the same annual increase in K-12 education expenditures translated to 8,172 fewer YPLL to suicide the next year for the 204.3 million White US residents.[45] Overall, our results suggest that reducing police expenditures and increasing expenditures for housing and community development may reduce Black–White inequities in suicide and police-perpetrated killing.

The fact that police expenditures (i.e., operational costs like salaries/benefits for officers and public safety departments) were associated with Black suicide and police-perpetrated killing, but not with White suicide and police-perpetrated killing, is consistent with past research documenting that structural racism and policing have negative health impacts for Black communities but null or positive impacts for White communities.[4,5,23,26,31] These results also suggest studies that found population health benefits of law enforcement expenditures[9,10] may have shown differential effects if samples were disaggregated by race. Additionally, in measuring outcomes using the YPLL metric, our results speak to the societal impact of the death of young Black residents.[7]

Alternatively, consistent with past research showing the benefits of state social service spending on population suicide rates,[21] our results suggest housing and community development expenditures may reduce suicide. That housing and community development expenditures (i.e., operation of new housing, public housing support, rental assistance, home ownership promotion) were associated with reductions in suicide for Black, but not White, residents suggests these investments may help to reduce recent racially inequitable suicide trends.[7] This may reflect the fact that Black residents are more likely than White residents to be unstably housed as a result of intergenerational and systemic housing discrimination[1,16,19,46] and suggests that housing may be one of the key reasons why Black suicide rates are highest in urban areas with high rates of socioeconomic inequalities.[47] These findings support the "housing is health care" literature that shows safe and affordable housing is essential to physical and mental health[48,49] and they support CDC recommendations to promote housing stability as a suicide prevention measure.[50]

K-12 education expenditures (i.e., public school employee salaries and benefits, textbooks and support services like transportation and lunch programs) were asso-

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ciated with moderate reductions in YPLL to suicide for White residents but not Black residents. This result likely reflects the fact that state and local spending on education[51] is inequitably allotted to White residents and, as such, is more likely to support White students than their Black peers. As such, White students may benefit to a greater degree from the health benefits of education expenditures.[9,10]

Public Health Implications

That police expenditures were associated with increases in suicide and police-perpetrated killing for Black residents is alarming given the national norm for suicide and mental health crisis intervention is a police-led response.[12] Consistent with recommendations from Alvarez and colleagues,[12] our results suggest this approach may need to be reassessed, including examining whether localities that have reduced police involvement in mental health response (e.g., San Francisco street crisis response teams) are experiencing drops in suicide and police-perpetrated killing. For those elected officials and staffers who shape state and local budgets and want to reduce suicide inequities, our results suggest housing and community development may be a good investment. For future research implications, our results suggest studies on the economic determinants of health[52] may benefit from incorporating government expenditures in their models and testing if there are relatively more effective ways to spend these funds(e.g., better training, more accountability) regardless of overall funding levels.

This study's strengths include testing an 11-year longitudinal multilevel model that adjusted for the reciprocal associations from violent death to expenditures as well as Medicaid expansion, state firearm laws and activity, Black–White population proportion, overall spending, and other potential spurious causal pathways. However, there are limitations of note. First, although theory and causal observation strongly suggest police expenditures cause increases in Black suicide and police-perpetrated killing, policy experiments would bolster causal inference (e.g., examining associations between suicide and police-perpetrated killing rates and police spending changes, exogenous to population violent deaths). Although we find a connection between police spending overall and violent death inequities by race, we were not able to disaggregate the composition of police spending (i.e., how the money was spent). Future research should examine the composition of police spending, which may be as, or more, important as the overall level. Additionally, although our expenditures variable accounted for local spending, we used US Census Bureau data aggregated to the state level, and we were not able to examine the effects of county- and municipal-level expenditures, which may provide insight into local-level expenditures effects. Also, the proportion of public health spending that is actually for mental health—versus public health as defined by organizations such as the CDC—varies by state, which is a source of measurement error in the present analyses. Studies also show the WISQARS

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database undercounts Black suicides[34] and police-perpetrated killing rates relative to nongovernmental trackers.[35] Therefore, our results may underestimate the strength of the associations with these outcomes. Our analysis also used DSEM in a unique way: modeling 11-year annual repeated measures rather than shorter-term intensive longitudinal data. Future research may seek to replicate our findings and gain further insight into the utility of DSEM for multiyear longitudinal studies. It is also possible that the associations between funding and YPLL for White communities presented here may have slightly underestimated the effect given that life expectancy for White communities is higher than Black communities and our YPLL reference of 75 years old (2020 White life expectancy was 78 years). Finally, this study focused on White non-Hispanic residents and Black residents of all ethnicities and did not consider differences across gender identity. Given past research on the inequitable effects of policing across race, ethnicity and gender identity,[53–56] future research should examine the effects of expenditures on violent deaths across these social position variables.

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Appendix 1

DSEM Notation and Estimation Information

As an example of the DSEM model specification, the models examining the association between police funding (POL) and 1-year suicide (SUI) can be written statistically as:

Within-State

$$\begin{aligned}
\mathrm{SUI}_{\mathrm{ti}} &= \alpha_{1_i} + \varphi_{1_i}\mathrm{SUI}^{c}{}_{(t-1)i} + ß_{1_i}\mathrm{POL}_{(t-1)_i} + ß_{2i}\mathrm{MED}_{\mathrm{ti}} + ß_{3i}\mathrm{BW}_{\mathrm{ti}} + ß_{4i}\mathrm{EXP}_{\mathrm{ti}} \\
&\quad + ß_{5i}\mathrm{SD}_{\mathrm{ti}} + ß_{6i}\mathrm{BKH}_{\mathrm{ti}} + ß_{7i}\mathrm{BKL}_{\mathrm{ti}} + ß_{8i}\mathrm{CON}_{\mathrm{ti}} + ß_{9i}\mathrm{CHI}_{\mathrm{ti}} + ß_{10i}\mathrm{REP}_{\mathrm{ti}} \\
&\quad + ß_{11i}\mathrm{SEG}_{\mathrm{ti}} + ß_{12i}\mathrm{Time}_{\mathrm{ti}} + \mathrm{e}_{1\mathrm{ti}} \\
\mathrm{POL}_{\mathrm{t}i} &= \alpha_{2i} + \varphi_{1i}POL^{c}{}_{(t-1)i} + ß_{12i}\mathrm{SUI}_{(t-1)i} + ß_{13i}\mathrm{MED}_{\mathrm{t}i} + ß_{14i}\mathrm{REP}_{\mathrm{ti}} \\
&\quad + ß_{15i}\mathrm{Time}_{\mathrm{ti}} + \mathrm{e}_{2\mathrm{ti}} \\
\mathrm{BW}_{\mathrm{ti}} &= \alpha_{3i} + ß_{16i}\mathrm{SEG}_{\mathrm{ti}}
\end{aligned}$$

Between-State

$$\begin{aligned}
\alpha_{1i} &= \gamma_{00} + \gamma_{40}\mathrm{MED}^{c}{}_{i} + \gamma_{50}\mathrm{BW}^{c}{}_{i} + \gamma_{60}\mathrm{SD}^{c}{}_{i} + \gamma_{70}\mathrm{BKH}^{c}{}_{i} + \gamma_{80}\mathrm{BKL}^{c}{}_{i} \\
&\quad + \gamma_{90}\mathrm{CON}^{c}{}_{i} + \gamma_{100}\mathrm{CHI}^{c}{}_{i} + \gamma_{110}\mathrm{GV}^{c}{}_{i} + \mathrm{u}_{0i} \\
ß_{1i} &= \gamma_{10} + \mathrm{u}_{1i} \\
\varphi_{i} &= \gamma_{20} + \mathrm{u}_{2i} \\
\mathrm{GV} &= \gamma_{30+}\mathrm{u}_{3i.} + \gamma_{120}\mathrm{SD}^{c}{}_{i} + \gamma_{130}\mathrm{BCH}^{c}{}_{i} + \gamma_{140}\mathrm{BCL}^{c}{}_{i} + \gamma_{150}\mathrm{CON}^{c}{}_{i} + \gamma_{160}\mathrm{CHI}^{c}{}_{i}
\end{aligned}$$

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$$BW_{ti} = \gamma_{40+}u_{4i.} + \gamma_{170}SEG^{c}{}_{i}$$

The distributional assumptions were:

$$e_i \sim N(0, \text{diag}[\sigma_1{}^2, \sigma_2{}^2])$$

$$u_i \sim N\left(0, \begin{bmatrix} \tau_{00} & & \\ \tau_{21} & \tau_{11} & \\ 0 & 0 & \tau_{22} \end{bmatrix}\right)$$

SUI is the YPLL suicide outcome, t is time (in years, $t = 1, \ldots, 11$), i is states ($i = 1, \ldots 51$), $\propto_{1i}$ is a state-specific intercept for suicide, φ_i is the autoregressive effect measuring the carryover of variables from the previous year to the current year, ^{c} is latent-centered suicide such that $SUI_i^{c} = SUI_i - \propto_{1i}$ which helps to address biases in time-series models. Abbreviations are: MED(Medicaid expansion), BW(Black-White population proportion), EXP(total state and local expenditures), SD(self-defense gun laws), BKH(handgun background checks), BKL(long-gun background checks), CON(conceal carry laws), CHI(child protection laws), REP (political control), SEG (racial segregation), and GV(gun violence rate). On the within-level, the ß's that correspond to these variables were the time-varying covariate effects and e_{1ti} and e_{2ti} are normally distributed within-state error with variance $\sigma_1{}^2$ and $\sigma_2{}^2$, respectively.

In the between-state level, γ represents fixed effects that capture the average effect of the parameter across all states, and u represents random effects that are normally distributed and include state-specific deviations from the fixed effects. The variances of the random effects are represented by the diagonal elements of the tau-matrix. The GV = statement accounts for the association between firearm violence and the firearm policies. The association between Black-White population proportion and racial segregation is accounted for on both within and between levels with the BW = statements. The 5-year models were equivalent to the 1-years models, only with the addition of a 5-year expenditure→death lag, and 1–5 year lagged autoregressive effects for expenditures (e.g., $EXP_{t-1} \rightarrow Exp_t$, $EXP_{t-2} \rightarrow Exp_t$, … $EXP_{t-5} \rightarrow Exp_t$).

Consistent with best practices for DSEM with small sample sizes,[26] we used range restricted priors of *Uniform* [0,1] for the random effect variances τ_{11} and τ_{22} to stabilize the sampling in the Markov Chain Monte Carlo (MCMC) optimization. For other parameters minimally influenced by sample size, we used M*plus* defaults.[25] We estimated parameters using a Gibbs sampler using two chains with a minimum of 20,000 iterations. We computed credible intervals with the highest posterior density method.

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Appendix 2

2010–2020 Annual State Average Years of Potential Life Lost to Violent Death

State	Black Suicide	White Suicide	Police Killing (Black)	Police Killing (White)
AL	215	640	8	5
AK	634	745	–	14
AZ	373	693	10	10
AR	254	732	16	8
CA	246	462	17	8
CO	425	732	24	9
CT	178	379	–	2
DE	222	521	23	6
DC	219	186	31	–
FL	199	616	11	5
GA	234	578	13	7
HI	364	586	–	–
ID	333	753	–	12
IL	213	429	16	2
IN	297	549	30	6
IA	286	535	–	2
KS	425	629	23	6
KY	324	575	10	9
LA	222	612	8	5
ME	376	549	–	10
MD	193	409	22	5
MA	171	332	14	3
MI	294	499	7	3
MN	276	465	25	5
MS	192	638	9	8
MO	320	626	12	6
MT	746	786	–	17
NE	300	483	–	3
NV	377	829	34	16
NH	289	572	–	10
NJ	165	331	9	2
NM	490	914	–	19
NY	153	332	8	1
NC	206	531	9	5
ND	372	613	–	–

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State	Black Suicide	White Suicide	Police Killing (Black)	Police Killing (White)
OH	306	498	20	5
OK	379	732	–	20
OR	334	646	–	12
PA	253	495	16	3
RI	219	389	–	–
SC	229	637	7	5
SD	347	585	–	9
TN	241	594	8	6
TX	248	621	14	7
UT	464	779	–	11
VT	406	571	–	6
VA	242	526	12	5
WA	339	547	31	12
WV	369	622	–	14
WI	253	518	19	6
WY	404	905	–	–
USA	*306*	*579*	*14*	7

Note. Age-adjusted years of potential life lost (YPLL) per 100,000 people is based on a 75-year life expectancy.
– values suppressed from table based on less than 1 deaths in accordance with National Center for Health Statistics (NCHS) data restrictions.

Appendix 3

2010–2020 Average Dollars Per Capita of State and Local Expenditures

State	Police	K-12 Ed	Higher Ed	Pub Wel	H&C Dev	Hospital	Health	Roads
AL	252	1573	1030	1490	105	1170	180	492
AK	508	3279	1154	3046	440	564	352	2050
AZ	342	1230	822	1723	80	161	219	372
AR	220	1740	886	2061	73	389	100	562
CA	452	1972	1032	2436	230	680	524	462
CO	336	1748	999	1372	168	479	201	533
CT	324	2541	825	1366	227	390	252	583
DE	363	2066	1365	2360	174	86	501	681
DC	922	3908	236	5254	1177	389	799	805
FL	399	1359	521	1292	129	450	273	496
GA	253	1848	596	1133	120	496	209	369
HI	312	1458	884	1820	183	428	407	498

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State	Police	K-12 Ed	Higher Ed	Pub Wel	H&C Dev	Hospital	Health	Roads
ID	255	1257	666	1485	94	437	180	587
IL	395	2047	709	1659	165	236	177	627
IN	199	1548	924	1790	137	696	137	424
IA	242	2043	1165	1793	81	1118	143	831
KS	285	1984	1097	1353	90	972	203	618
KY	173	1600	897	2190	100	494	192	555
LA	330	1721	715	1993	222	785	156	529
ME	210	1857	594	2420	221	145	231	705
MD	419	2168	1018	1953	247	85	306	542
MA	337	2262	733	2877	415	234	210	479
MI	255	1751	1133	1571	117	459	433	406
MN	346	2122	888	2580	183	378	222	802
MS	242	1518	955	1940	102	1249	148	569
MO	294	1678	639	1470	112	622	349	439
MT	301	1732	852	1698	95	140	345	877
NE	251	2206	1143	1361	109	504	174	768
NV	421	1502	504	1112	102	350	140	598
NH	302	2146	658	1529	163	43	99	566
NJ	386	2894	723	1793	159	279	294	504
NM	329	1758	1194	2577	83	623	282	507
NY	492	3222	706	3167	313	806	352	577
NC	296	1439	980	1411	148	952	383	462
ND	262	2156	1368	1744	115	72	241	1864
OH	303	2007	807	2153	182	406	307	482
OK	252	1536	955	1665	130	319	263	647
OR	317	1762	1133	2192	177	599	410	528
PA	285	2155	794	2297	160	303	398	757
RI	392	2220	626	2557	232	54	229	453
SC	246	1752	822	1489	104	1243	260	375
SD	226	1665	849	1276	119	124	223	1136
TN	285	1430	562	1678	132	527	170	366
TX	277	1906	1014	1300	84	620	197	543
UT	245	1584	1355	1196	123	594	209	617
VT	313	2695	1259	2694	240	30	516	982
VA	277	1968	945	1404	122	560	256	566
WA	275	2007	928	1500	202	775	474	604
WV	210	1724	910	2244	80	225	166	722
WI	315	1925	1056	1990	59	337	286	751
WY	386	3066	1373	1438	41	1899	758	1291
USA	*320*	*1975*	*902*	*285*	*509*	*658*	*174*	*1919*

Note. Ed = Education, Wel = Welfare, H&C Dev = Housing and Community Development.

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Appendix 4

Control Variable Descriptives Across All States From 2010 to 2020

Variables	Grand Mean	SD	Min	Max
Control Variables				
Overall Per-Capita Expenditures	11016.36	3261.43	7356.00	34053.00
Black/White Population Proportion	0.21	0.23	0.01	1.49
Gun Violence Estimate	151.34	61.10	34.00	286.00
Racial Segregation	62.12	8.67	41.00	84.00
	No (n)	**No (%)**	**Yes (n)**	**Yes (%)**
Medicaid Expansion	339	60.40	222	39.60
Firearm Policies				
Self Defense	207.00	36.90	354.00	63.10
Background Check Law (Hand gun)	339.00	60.40	222.00	39.60
Background Check Law (Long gun)	430.00	76.60	131.00	23.40
Conceal Carry Law	458.00	81.60	103.00	18.40
Child Access Law	249.00	44.40	312.00	55.60
	Rep (n)	Rep (%)	Dem (n)	Dem (%)
Political Control	235	41.89	121	22.10

Note. Expenditures are based on state and local per-capita expenditures.
The gun violence estimate is the 2020 WONDER death rate estimate per 1,000,000 people.
Self-defense laws were coded using the RAND four category scale: Stand Your Ground Law (0), Expanded 2 (1), Expanded 1 (2), Castle Doctrine (3)
Child Access laws were coded using the RAND three category scale: No Law (0), Reckless Provision Law (1), Negligent Storage Law (2)
Rep = Republican, Dem = Democrat. States that were not Rep or Dem in a given year were coded as "Divided."

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