SSM - Population Health 26 (2024) 101662

Contents lists available at ScienceDirect

SSM - Population Health

journal homepage: www.elsevier.com/locate/ssmph

County-level political group density, partisan polarization, and individual-level mortality among adults in the United States: A lagged multilevel study

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ARTICLE INFO

Keywords:
Polarization
Partisanship
Elections
Mortality
Social determinants of health
Political determinants of health

ABSTRACT

Objective: To investigate the associations between county-level political group density, partisan polarization, and individual-level mortality from all causes and from coronary heart disease (CHD) in the United States.
Methods: Using data from five survey waves (1998–2006) of the General Social Survey-National Death Index dataset and the County Presidential Election Return 2000 dataset, we fit weighted Cox proportional hazards models to estimate the associations between (1) political group density and (2) partisan polarization measured at the county level in 2000 (n = 313 counties) categorized into quartiles with individual-level mortality (n = 14,983 participants) from all causes and CHD, controlling for individual- and county-level factors. Maximum follow-up was from one year after the survey up until 2014. We conducted these analyses using two separate measures based on county-level vote share differences and party affiliation ideological extremes.
Results: In the overall sample, we found no evidence of associations between county-level political group density and individual-level mortality from all causes. There was evidence of a 13% higher risk of dying from heart disease in the highest quartile of county-level polarization (hazards ratio, HR = 1.13; 95% CI = 0.74–1.71). We observed heterogeneity of effects based on individual-level political affiliation. Among those identifying as Democrats, residing in counties with high (vs. low) levels of polarization appeared to be protective against mortality, with an associated 18% lower risk of dying from all causes (HR = 0.82, 95% CI = 0.71–0.94). This association was strongest in areas with the highest concentrations of Democrats.
Conclusions: Among all study participants, political group density and polarization at the county level in 2000 were not linked to individual-level mortality. At the same time, we found that Democratic party affiliation may be protective against the adverse effects of high polarization, particularly in counties with high concentrations of Democrats. Future research should further explore these associations to potentially identify new structural interventions to address political determinants of population health.

1. Introduction

Partisan polarization, both at the individual and area levels, has been growing in the United States (U.S.) since the 1970s (Abramowitz & Saunders, 2005, 2008; Hetherington, 2001; Iyengar et al., 2012; Iyengar & Westwood, 2015; Layman et al., 2006). Polarization is a multifaceted concept and includes both ideological and affective polarization. Unlike ideological polarization, affective polarization is characterized by feelings of negativity, hostility, and even loathing for those with different party affiliations (Iyengar et al., 2019; Iyengar & Westwood, 2015).

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https://doi.org/10.1016/j.ssmph.2024.101662
Received 7 December 2023; Received in revised form 28 February 2024; Accepted 18 March 2024
Available online 19 March 2024

Party affiliations are often relatively stable and can strongly influence political and social values (Goren, 2005). These affiliations with the two primary U.S. political parties, the Republican Party and the Democratic Party, often function as a social identity rather than an indicator of divergent policy attitudes (Greene, 1999; Iyengar et al., 2012; Iyengar & Westwood, 2015). In fact, an experimental study after the 2004 U.S. Presidential election found evidence of negative changes to brain affectivity and emotion regulation when participants were exposed to images of candidates from opposing parties (Kaplan et al., 2007).

Research on the health effects of elections and associated partisanship has burgeoned in the last decade, first emerging after the 2008 U.S. Presidential election (Classen, 2009; Stanton et al., 2010; Waismel-Manor et al., 2011). Since then, studies have documented a range of negative biobehavioral health consequences of elections including increases in poor health (Fraser et al., 2022; Nelson, 2022), rising cortisol levels (Stanton et al., 2010; Waismel-Manor et al., 2011), increases in the incidence of mental health conditions such as stress, depression, anxiety, sleep problems, and suicide (Anýž et al., 2019; Classen, 2009; Hagan et al., 2020; Hoyt et al., 2018; Nayak et al., 2021), elevated blood pressure (Hwang et al., 2022), increases in the onset of cardiac arrhythmias and acute cardiovascular disease (Mefford et al., 2022; Rosman et al., 2021), and increases in all-cause mortality (Maas & Lu, 2020). Given that issues such as immigration, foreign policy, welfare, taxes, racism, and marriage equality have historically been important during elections (Dao, 2004; Newport, 2008; O'Connor, 2001; Yau, 2004), the impacts might be particularly salient for marginalized communities which tend to be deeply impacted by the policy effects of partisan changes. Recent studies from the 2016 and 2020 election have clearly documented such detrimental effects (Fleming et al., 2019; Frost & Fingerhut, 2016; Gemmill et al., 2019; Grzenda et al., 2021; Krieger et al., 2018; Morey et al., 2021). Existing studies have primarily examined health outcomes in the time leading up to elections, in the immediate aftermath of elections, and in the periods between election years. Fewer studies have examined the long-term health effects of political partisanship in general and virtually none have investigated effects prior to 2008, even though partisanship has been on the rise since before then (Abramowitz & Saunders, 2005; Hetherington, 2001; Layman et al., 2006). Moreover, existing research has been primarily limited to the individual level.

Evidence from other domains of social epidemiology has established the importance of contextual and ecological factors on a variety of health outcomes, over and above the effects of individual-level factors (Bessett et al., 2015; Callaghan, 2011; Chitewere et al., 2017; Dev & Kim, 2020; Diez Roux, 2001; Jia et al., 2009; Oakes et al., 2015; Orchard & Price, 2017; Weidner & Schultz, 2019). One domain of interest is the sociodemographic composition of the environment. For example, the literature on 'ethnic group density effects' demonstrates that living in areas with high ethnic group density can impact the health of ethnic minorities in different ways (Alba et al., 2014; Bécares et al., 2009; Bécares, Shaw, Nazroo, Stafford, et al., 2012; Pickett & Wilkinson, 2008). Some evidence from the study of racial health disparities suggests that being part of the 'out-group' in a fairly homogeneous neighborhood environment can detrimentally impact health (Alegría et al., 2014; DeAngelis, 2022). Given the salience of partisanship and party identity, it is plausible that the political composition of the social environment may also generate health effects. Living in areas with high political group density (i.e., a more homogeneous area-level political distribution reflected by a greater difference in the vote share) could result in greater feelings of social isolation and stress for those identifying with the minority political party.

Chronic exposure to stressful and isolating events can increase the risk of premature mortality through biological mechanisms such as elevated cortisol (Stanton et al., 2010; Waismel-Manor et al., 2011), and behavioral mechanisms, such as increases in disordered tobacco, alcohol, and drug use (Musse & Schneider, 2022). Long-term exposure to psychosocial stressors including feelings of anger and hostility, experiencing anxiety, social conflict, and feelings of non-specific stress are associated with increased cardiovascular disease burden (Everson-Rose & Lewis, 2005). Likewise, social isolation is a well-established risk factor for mortality and cardiovascular diseases (Pantell et al., 2013; Valtorta et al., 2016). The sociopolitical environment generated by high area-level political group density and widespread polarization could adversely influence health at the individual level. Over time, the adverse individual-level effects of experiencing high area-level political group density and polarization, such as higher stress, isolation, ill health and maladaptive health behaviors, could contribute to subsequent mortality, including mortality from coronary heart disease (CHD) (Nelson, 2022).

In this study, we investigated the associations between county-level (1) political group density and (2) polarization around the time of the 2000 U.S. presidential election and individual mortality, controlling for individual and county-level factors. We examined whether these measures at the county level were associated with individual-level mortality from all causes and from CHD up to 14 years after the 2000 election. To the best of our knowledge, no previous studies have investigated the health associations of area-level political group density and area-level partisanship using a longitudinal dataset and going as far back as the 2000 election. Moving beyond individual-level approaches to incorporate multilevel influences is necessary to capture the complex social patterning of illnesses (Diez Roux, 2022). Area-level polarization may also plausibly drive individual-level polarization, and studying such contextual effects can potentially inform public health interventions at the population level that can have larger impacts than interventions at the individual level (Merlo, 2011).

2. Methods

Participants. We used individual-level data from the General Social Survey-National Death Index (GSS-NDI) dataset (Muennig et al., 2011). The General Social Survey is a repeated cross-sectional nationally representative survey of the U.S. population conducted every 2 years that attends to a range of social and political topics. The sample uses multistage probability sampling. Data are collected through in-person interviews, and the survey has high response rates (between 60% and 85% depending on the wave) (GSS, 2018). The National Death Index (NDI) is a national U.S. database of mortality data collected by the Centers for Disease Control (CDC, 2021). The GSS-NDI is a prospectively matched dataset that includes mortality data for participants from the General Social Survey who could be linked to the NDI or who were still alive in 2014. For our analytic sample, we pooled data from participants from five survey waves of the GSS (1998, 2000, 2002, 2004, and 2006) linked to mortality in the GSS-NDI dataset.

Exposure. We operationalized county-level political group density using data from the County Presidential Election Return dataset at the Massachusetts Institute of Technology Election Data and Science Lab Dataverse (MIT Election Data and Science Lab, 2018). This measure was constructed using a continuous measure of the absolute difference in the proportion of votes between Democrats and Republicans in the 2000 Presidential election in each county (Panagopoulos et al., 2021). Existing evidence suggests that voting patterns and party identification are strongly correlated (Bartels, 2000; Bonneau & Cann, 2015). This operationalization is based on the conceptualization that in an area with a larger gap between the shares of Democrats and Republicans, members of the minority party might feel more socially isolated, experience more exclusion, and heightened stress. Area-level political group density was categorized into quartiles for counties represented in the analytic sample ($n = 313$ counties). The cutoff values for political group density were 7.67 (25th percentile), 16.4 (50th percentile), and 27.4 (75th percentile).

Our second exposure variable measured partisan polarization and was derived from data gathered from the overall GSS dataset in the 1998, 2000, 2002, 2004, and 2006 waves ($n = 15{,}736$). Partisan polarization has been defined in different ways by different political

scientists and the extent of the issue is hotly debated (Abramowitz & Saunders, 2008; Fiorina & Abrams, 2008). For the purpose of this study, we conceptualized polarization as a bimodal distribution based on ideological extremes (Fiorina & Abrams, 2008; Winkler, 2019). To measure this, we calculated the weighted county-level mean of GSS participants who identified as either "Strong Republican" or "Strong Democrat" by aggregating individual-level survey responses to a survey question about political affiliation in which respondents rated themselves on an eight-point scale ranging from Strong Republican to Strong Democrat. We theorized that those counties with a greater proportion of individuals at either extreme would reflect higher levels of polarization (Fiorina & Abrams, 2008; Winkler, 2019). In other words, counties with a greater proportion of those with strong partisan identities would be more polarized compared to counties with more moderate partisan identities. We categorized this area-level measure of polarization into quartiles at the county level. The cutoff values for political polarization were 18.8 (25th percentile), 25.0 (50th percentile), and 31.2 (75th percentile).

Outcome. Mortality data were extracted from the GSS-NDI dataset, and based on linkages of GSS participants to the NDI. The primary outcomes were time to mortality from all causes or from CHD (based on International Classification of Diseases, Tenth Revision codes I20–I25), with follow-up from one year after the GSS survey year up until 2014. Participants who died less than a year after they completed the survey were excluded. Participants who did not develop the outcome by 2014 were censored. The time to event (incident all-cause mortality or mortality from CHD) was calculated in years, as the exact date and month of death was not provided in the GSS-NDI dataset. Our final analytic sample consisted of 14,983 participants.

Covariates. Covariates at the individual level drawn from the GSS included age, gender, race/ethnicity, household income, level of education, political party affiliation, marital status, and census division of residence. At the county level, data came from the Decennial 2000 Census; variables included the percentage of the county that was Black, Hispanic, over the age of 65 years, living in poverty, and with a high school degree, and median household income (U.S. Census Bureau, 2020). Since our research questions are centered around the bimodal distribution of the electorate and the salience of party affiliation, we included a binary indicator of whether Republicans or Democrats won more votes in the county and whether individuals' political affiliations matched with the winning party. This binary distinction of the vote share is in keeping with other studies of elections and health (Toshkov & Mazepus, 2023), with physiological and psychological effects previously linked to binary winning and losing effects (Buser, 2016; Longman et al., 2018). We further controlled for Census region of residence. All county-level continuous covariates were rescaled for ease of interpretation, with percentage variables rescaled so that one unit represented a 5-percentage point change. Median household income was rescaled so that one unit represented a $10,000 change.

Statistical Analysis. Variables were merged across datasets using the GSS participant identification number, survey year, and Federal Information Processing System (FIPS) county codes. Survey-weighted descriptive statistics were used to examine the distribution of the data. We used weighted Cox proportional hazards regression to model the associations between county-level political group density and partisan polarization with (1) all-cause mortality and (2) CHD mortality, controlling for covariates at the individual and county levels. We used the Variance Inflation Factor (VIF) to test for multicollinearity. All predictors had VIFs less than 10, suggesting no collinearity issues. All covariates were selected *a priori* and included to reduce the likelihood of model misspecification (Arceneaux & Huber, 2007).

We conducted all analyses for the two measures in separate sets of models. All models adjusted for clustering and stratification and applied sample weights to account for the complex survey design of the GSS. We used the missing indicator method to handle missing data for annual income (12.8% of the weighted sample). Missing data on all other variables (less than 1%) were handled using complete case analysis. All analyses were conducted in SAS 14.3, and we applied a significance level of 5% (two-sided tests).

Heterogeneity of Effects. Given findings from recent research on the differential health effects of political events in subpopulations (Brown et al., 2021; Fattore et al., 2022; Gemmill et al., 2019; Grzenda et al., 2021; Rostosky et al., 2009), we explored the presence of heterogeneous effects of county-level political group density and polarization according to participant gender, race and ethnicity, level of education, and political party affiliation. We performed these analyses by testing the significance of added interaction terms between both exposure variables and each characteristic, with the exposures modeled as a binary variable using the median value as a cutpoint.

3. Results

Descriptive statistics. Full descriptive characteristics of the weighted sample are provided in Table 1. The mean age of the sample was 44.81 years, with 54.32% being female. The majority of the sample (57.44%) had at least a high school diploma and/or some college, 26.40% had a college degree or more, and 15.89% did not have a high school degree. The sample was primarily non-Hispanic White (78.45%), followed by non-Hispanic Black (13.02%). Participants who were Hispanic made up 2.62% and participants who were Asian or Pacific Islander were 2.65% of the sample. Eight percent of the sample had an annual family income of less $10,000 and 19.55% had an income of $75,000 or more. There was a higher proportion of Democrats in the sample (42.9%) as compared to Republicans (35.4%). The sample characteristics are generally in alignment with estimates of the national population from the 2000 Census (Bauman & Graf, 2003; Grieco & Cassidy, 2001; Welniak & Posey, 2005). The smaller proportion of Hispanic respondents than the national percentage (12.5%) (Grieco & Cassidy, 2001) is likely because the GSS did not include a Spanish version until 2006. On average (mean), participants lived in counties with a median household income of $43,230 and where 12.2% of residents were over the age of 65 years. In total, there were 2,333 deaths from all causes over 159,307 person-years of follow-up (crude mortality rate = 1464.5 deaths per 100,000 person-years). The weighted percentage of participants in the sample who died from all causes by the end of follow-up (2014) was 13.89%. There were 344 deaths from CHD over 159,307 person-years of follow-up (mortality rate = 215.9 per 100,000 person-years). Two percent of the sample died from CHD. Of the 155 counties classified as 'high polarization' based on the percentage of ideological extremes (strong Democrats, strong Republicans, or both), 35.5% were primarily 'Strong Democrat' counties, 32.9% were primarily 'Strong Republican' counties, and 31.6% were a mix of 'Strong Democrats' and 'Strong Republicans' counties.

Associations between political group density, polarization, and all-cause mortality. Table 2 displays results from the adjusted Cox proportional hazards model of political group density based on 2000 election results and time to all-cause mortality. Compared to counties in the lowest quartile, participants in counties with low or high levels (second or third quartiles) of county-level political group density did not have a higher individual-level risk of dying from all causes: HR = 0.94 (95% CI = 0.83–1.07) and HR = 0.95 (95% CI = 0.83–1.10) respectively. Living in a county in the highest (vs. lowest) quartile of political group density in the 2000 presidential election was associated with a non-significantly higher risk of dying (HR = 1.02, 95% CI = 0.90–1.16), and there was no significant linear trend (*P* for trend = 0.67).

Table 3 shows results from the adjusted Cox proportional hazards model of party affiliation-based polarization and all-cause mortality. Compared to living in counties in the lowest quartile of polarization, participants in counties in the second-lowest or the highest quartiles of polarization (second or fourth quartile) had higher non-significant individual-level risks of dying: HR = 1.12 (95% CI = 0.98–1.29) and HR = 1.07 (95% CI = 0.91–1.26), respectively. We observed no significant

Table 1
Weighted descriptive characteristics of the GSS-NDI analytic sample (unweighted n = 14,983).

Sample Characteristic	Weighted percentage (95% CI)
All-Cause Mortality	13.89 (13.26, 14.52)
CHD Mortality	1.99 (1.76, 2.22)
Age, years (Mean)	44.81 (44.43, 45.19)
Gender	
Man	45.68 (44.74, 46.61)
Woman	54.32 (53.39, 55.26)
Race/Ethnicity	
Non-Hispanic White	78.45 (77.11, 79.80)
Non-Hispanic Black	13.02 (11.84, 14.19)
Hispanic of any race	2.62 (2.06, 3.18)
Asian	2.65 (2.18, 3.11)
Other	3.26 (2.81, 3.71)
Level of Education	
College graduate or more	26.40 (25.32, 27.48)
At least high school graduate	57.44 (56.44, 58.45)
Below high school	15.89 (15.05, 16.74)
Missing	0.27 (0.17, 0.36)
Inflation-Adjusted Annual Household Income	
$75,000 or more	19.55 (18.55, 20.55)
$50,000-$74,999	16.84 (16.09, 17.60)
$25,000-$49,999	26.36 (25.42, 27.30)
$10,000-$24,999	16.50 (15.70, 17.29)
Less than $10,000	7.99 (7.37, 8.60)
Missing	12.76 (11.92, 13.60)
Marital Status	
Married	56.39 (55.32, 57.47)
Not married	23.33 (22.39, 24.26)
Other (divorced, widowed, separated)	20.27 (19.51, 21.02)
Missing	0.01 (0.00, 0.02)
Party Affiliation	
Democrat	42.93 (41.75, 44.12)
Republican	35.41 (34.24, 36.58)
Independent/Other	21.07 (20.12, 22.01)
Missing	0.59 (0.43, 0.75)

County-Level Variables	**Weighted Mean (95% CI)**
Percent Black	12.38 (11.66, 13.10)
Percent Hispanic	11.34 (10.30, 12.39)
Percent with high school degree	80.40 (79.95, 80.85)
Percent in poverty	12.27 (11.92, 12.63)
Percent over age 65 years	12.25 (12.06, 12.43)
Median household income	$43,230.00 ($42,694.03, $43,765.55)

linear trend (*P* for trend = 0.99).

Associations between political group density, polarization and mortality from CHD. Table 4 displays the adjusted Cox proportional hazards model estimates for mortality from CHD associated with political group density. Compared to counties in the lowest quartiles of political group density, living in counties in the highest quartile of political group density was not linked to CHD mortality (HR = 1.00, 95% CI = 0.72–1.40), and there was no significant linear trend (*P* for trend = 0.71).

Table 5 shows the adjusted Cox proportional hazards model estimates for polarization and mortality from CHD. In this model, we observed positive though non-significant associations consistent with detrimental effects of increasing polarization on mortality from CHD.

Table 2
Adjusted Cox proportional hazards ratios of all-cause mortality according to level of political group density based on 2000 U.S. presidential election results aggregated at the U.S. county level.[1]

	Deaths from all causes (n = 2,303)	P value
	HR (95% CI)	
County-Level Variables		
Political Group Density		
Very Low (Q1)	Ref	
Low (Q2)	0.94 (0.83, 1.07)	0.36
High (Q3)	0.95 (0.83, 1.10)	0.51
Very High (Q4)	1.02 (0.90, 1.16)	0.73
P for trend		0.67
Party that won more votes in the county		
Democrats	Ref	
Republicans	1.09 (0.97, 1.24)	0.16
Percent Black[2]	0.98 (0.96, 1.01)	0.14
Percent Hispanic[2]	1.01 (0.99, 1.04)	0.31
Percent with high school degree[2]	1.00 (0.94, 1.06)	0.95
Percent in poverty[2]	1.04 (0.94, 1.14)	0.48
Percent over age 65 years[2]	1.02 (0.92, 1.12)	0.74
Median household income[3]	1.04 (0.95, 1.14)	0.37
Individual-Level Variables		
Age***	1.06 (1.06, 1.07)	<0.001
Gender		
Man	Ref	
Woman***	0.72 (0.65, 0.79)	<0.001
Race/Ethnicity		
Non-Hispanic White	Ref	
Non-Hispanic Black***	1.40 (1.21, 1.62)	<0.001
Hispanic of any race	0.93 (0.59, 1.47)	0.75
Asian	0.69 (0.39, 1.23)	0.21
Other	1.01 (0.70, 1.45)	0.97
Level of Education		
College graduate or more	Ref	
At least high school graduate***	1.25 (1.10, 1.41)	<0.001
Below high school***	1.45 (1.24, 1.70)	<0.001
Annual income		
$75,000 or more	Ref	
$50,000-$74,999	1.09 (0.89, 1.33)	0.41
$25,000-$49,999*	1.22 (1.02, 1.47)	0.03
$10,000-$24,999***	1.39 (1.15, 1.69)	<0.001
Less than $10,000 ***	1.49 (1.21, 1.83)	<0.001
Marital status		
Married	Ref	
Not married**	1.26 (1.06, 1.50)	0.008
Other (divorced, widow, separated)*	1.16 (1.04, 1.30)	0.01
Party affiliation		
Democrat	Ref	
Republican	0.95 (0.85, 1.06)	0.35
Independents/Other	0.95 (0.83, 1.09)	0.45
Alignment with party that won more votes in the county		
Aligned	Ref	
Misaligned	1.09 (0.98, 1.21)	0.10

[1]All models are also adjusted for Census division of residence. *p < 0.05, **p < 0.01, ***p < 0.001. [2]Corresponding to a unit increase of 5%. [3] Corresponding to a unit increase of $10,000.

Table 3
Adjusted Cox proportional hazards ratios of all-cause mortality according to levels of partisan polarization based on political party affiliation aggregated at the U.S. county level.[1]

	Deaths from all causes (n = 2,303)	P value
	HR (95% CI)	
County-Level Variables		
Partisan Polarization		
Very Low (Q1)	Ref	
Low (Q2)	1.12 (0.98, 1.29)	0.09
High (Q3)	0.97 (0.85, 1.11)	0.65
Very High (Q4)	1.07 (0.91, 1.26)	0.40
P for trend		0.99
Party that won more votes in the county		
Democrats	Ref	
Republicans	1.10 (0.98, 1.25)	0.12
Percent Black[2]	0.98 (0.96, 1.01)	0.25
Percent Hispanic[2]	1.01 (0.99, 1.04)	0.27
Percent with high school degree[2]	0.99 (0.94, 1.05)	0.82
Percent in poverty[2]	1.03 (0.93, 1.14)	0.57
Percent over age 65 years[2]	1.02 (0.92, 1.12)	0.75
Median household income[3]	1.05 (0.96, 1.15)	0.29
Individual-Level Variables		
Age***	1.06 (1.06, 1.07)	<0.001
Gender		
Man	Ref	
Woman***	0.72 (0.65, 0.79)	<0.001
Race/Ethnicity		
Non-Hispanic White	Ref	
Non-Hispanic Black***	1.40 (1.21, 1.62)	<0.001
Hispanic of any race	0.93 (0.59, 1.48)	0.76
Asian	0.71 (0.40, 1.26)	0.24
Other	1.00 (0.70, 1.44)	1.00
Level of Education		
College graduate or more	Ref	
At least high school graduate***	1.24 (1.09, 1.41)	<0.001
Below high school***	1.45 (1.23, 1.70)	<0.001
Annual income		
$75,000 or more	Ref	
$50,000-$74,999	1.09 (0.89, 1.34)	0.40
$25,000-$49,999*	1.23 (1.03, 1.48)	0.02
$10,000-$24,999***	1.40 (1.15, 1.70)	<0.001
Less than $10,000***	1.50 (1.21, 1.84)	<0.001
Marital status		
Married	Ref	
Not married**	1.26 (1.06, 1.50)	0.008
Other (divorced, widow, separated)*	1.16 (1.03, 1.30)	0.01
Political party affiliation		
Democrat	Ref	
Republican	0.95 (0.85, 1.06)	0.34
Independents/Other	0.95 (0.83, 1.10)	0.51
Alignment with party that won more votes in the county		
Aligned	Ref	
Misaligned	1.09 (0.98, 1.21)	0.12

[1]All models also adjusted for Census division of residence. *p < 0.05, **p < 0.01, ***p < 0.001. [2]Corresponding to a unit increase of 5%. [3] Corresponding to a unit increase of $10,000.

Table 4
Adjusted Cox proportional hazards ratios of CHD mortality according to level of political group density based on U.S. presidential election results in 2000 aggregated at the U.S. county level.[1]

Variable	CHD deaths (n = 338)	P value
	HR (95% CI)	
County-Level Political Group Density		
Very Low (Q1)	Ref	
Low (Q2)	0.81 (0.57, 1.16)	0.25
High (Q3)	1.01 (0.69, 1.48)	0.96
Very High (Q4)	1.00 (0.72, 1.40)	0.98
P for trend		0.71

[1]All models are also adjusted for individual age, gender, race/ethnicity, education, household income, marital status, political party affiliation, alignment with winning party in the county in 2000, county-level winning party in 2000, percentage Black, Hispanic, with a high school degree, in poverty, over the age of 65, median household income, and Census division of residence. *p < 0.05, **p < 0.01, ***p < 0.001.

Table 5
Adjusted Cox proportional hazards ratios of CHD mortality according to level of partisan polarization based on political party affiliation aggregated at the U.S. county level.[1]

Variable	CHD deaths (n = 338)	P value
	HR (95% CI)	
County-Level Partisan Polarization		
Very Low (Q1)	Ref	
Low (Q2)	1.30 (0.93, 1.81)	0.12
High (Q3)	1.38 (0.93, 2.04)	0.11
Very High (Q4)	1.13 (0.74, 1.71)	0.58
P for trend		0.56

[1]All models are also adjusted for individual age, gender, race/ethnicity, education, household income, marital status, political party affiliation, alignment with winning party in the county in 2000, county-level winning party in 2000, percentage Black, Hispanic, with a high school degree, in poverty, over the age of 65, median household income, and Census division of residence. *p < 0.05, **p < 0.01, ***p < 0.001.

Compared to counties with very low levels of polarization (first quartile), individuals living in counties with low polarization (second quartile), high polarization (third quartile), or very high levels of polarization (fourth quartile) had an increased risk of dying from CHD: HR = 1.30 (95% CI = 0.93–1.81), HR = 1.38 (95% CI = 0.93–2.04), and HR = 1.13 (95% CI = 0.74–1.71), respectively, although there was no significant linear trend (*P* for trend = 0.56).

Heterogeneity of effects. We tested the joint influence of binary political group density and demographic characteristics (gender, race and ethnicity, level of education, and political party affiliation) on all-cause mortality and mortality from CHD (data not shown). We observed a significant positive interaction between high political group density and identifying as Hispanic (*P* for interaction = 0.04). We then stratified these results on Hispanic ethnicity but did not observe any significant associations in individual strata. Although the remaining relationships did not attain statistical significance, high political group density appeared to be more detrimental for both mortality outcomes for women, for those with less than a high school degree, and for those identifying as an Independent/Other (all HRs >1). Identifying as a Republican appeared to have a non-significant protective association with both types of mortality in counties with high political group density: HR = 0.96 (95% CI = 0.78–1.18) for all-cause mortality and HR = 0.91 (95% CI = 0.54–1.51) for CHD mortality, respectively. We also found that high political group density exacerbated mortality outcomes for those with partisan minority status (individuals whose party affiliation did not align with the leading party in their county): HR = 1.19 (95% CI: 0.99, 1.44).

We further tested for interactions between high (vs. low) polarization and demographic characteristics for both mortality outcomes (data not shown). We did not find significant associations for interactions with gender, race and ethnicity, or education level. However, we did observe a negative interaction between Democratic political party affiliation and high polarization on mortality from all causes (*P* for interaction = 0.04), and on this basis stratified these models on political party affiliation. The stratified results are presented in Table 6, and indicate that among those identifying as Democrats, living in counties with high (vs. low) levels of polarization was associated with a 18% lower risk of dying from all causes (HR = 0.82, 95% CI = 0.71–0.94, *P* = 0.006). Among those identifying as Republicans and among those identifying as Independents, residing in counties with high (vs. low) levels of polarization was associated with 8% higher (HR = 1.08, 95% CI = 0.92–1.27, *P* = 0.34) and 9% higher (HR = 1.09, 95% CI = 0.86–1.38, *P* = 0.50) risks of dying from all causes, respectively. We additionally found that high polarization exacerbated mortality outcomes for those with partisan minority status (individuals whose party affiliation did not align with the leading party in their county): HR = 1.05 (95% CI: 0.88, 1.26).

3.1. Sensitivity analyses

We hypothesized that Democrats who lived in areas with polarization characterized by high levels of Strong Democrats could explain this apparent protective association with mortality from all causes, on the basis that living among those with shared political ideologies could have health benefits analogous to favorable ethnic group density effects seen in the context of residential segregation (see Discussion section for a further description). To investigate, we conducted sensitivity analyses by estimating the stratified models after excluding counties with high percentages of Strong Democrats. After excluding the top 30% of counties with the highest levels of Strong Democrats, we found that the association was slightly attenuated and its significance at the 5% level was lost (HR = 0.84, 95% CI = 0.70–1.01, *P* = 0.07). By contrast, removing the top 30% of counties with the highest levels of Strong Republicans led to no weakening or loss of statistical significance of the association (HR = 0.79, 95% CI = 0.66, 0.93, *p* = 0.006). Hence, the results of this sensitivity analysis supported our hypothesis and indicated that the observed heterogeneity of effects based on political party affiliation was not simply attributable to statistical power.

Table 6
Adjusted Cox proportional hazards ratios of all-cause mortality according to level of partisan polarization based on political party affiliation aggregated at the U.S. county level, stratified by party affiliation.[1]

Individual-Level Political Party Affiliation	Death from all causes	
	HR (95% CI)	P value
Democrat		
County-Level Partisan Polarization		
Low	Ref	
High**	0.82 (0.71, 0.94)	0.006
Republican		
County-Level Partisan Polarization		
Low	Ref	
High	1.08 (0.92, 1.27)	0.34
Independent		
County-Level Partisan Polarization		
Low	Ref	
High	1.09 (0.86, 1.38)	0.50

[1]All models are also adjusted for individual age, gender, race/ethnicity, education, household income, marital status, alignment with winning party in the county in 2000, county-level winning party in 2000, percentage Black, Hispanic, with a high school degree, in poverty, over the age of 65, median household income, and Census division of residence. *p < 0.05, **p < 0.01, ***p < 0.001.

4. Discussion

In this study of area-level partisanship in the United States, we observed limited evidence of positive associations between (1) higher county-level political group density and (2) higher county-level polarization, and individual mortality from all causes and CHD among all residents. Nonetheless, we found evidence to suggest that individual political party affiliation may moderate the association between county polarization and individual mortality from all causes. To our knowledge, this study is the first to investigate the long-term individual-level mortality effects of area-level political group density and partisan polarization, using multilevel, longitudinal, and nationally-representative data with a relatively long follow-up period.

Previous research has demonstrated increases in poor health around the time of elections and political events including stress, anxiety, depression, high blood pressure, suicide, and cardiovascular conditions (Anýž et al., 2019; Classen, 2009; Hagan et al., 2020; Hoyt et al., 2018; Hwang et al., 2022; Mefford et al., 2022; Nayak et al., 2021; Rosman et al., 2021). For example, the 2016 U.S. Presential election of Donald J. Trump was shown to be associated with significant reductions in sleep duration, increases in systolic and diastolic blood pressure, and clinically significant distress including intrusive thoughts and avoidance (Anýž et al., 2019; Hagan et al., 2020; Hwang et al., 2022).

In additional analyses, we found that among Democrats, high (vs. low) polarization appeared to be protective against mortality. Notably, this effect was strongest when Democrats lived in counties where polarization was primarily driven by high proportions of Strong Democrats. These findings might be explained through the health benefits of 'ethnic group density' effects in the context of residential segregation. Ethnic group density effects have most often been observed in the context of immigrant and ethnic enclaves, whereby individuals living in areas with a high density of their 'in-group' sometimes experience better health outcomes (Bécares et al., 2009; Bécares, Shaw, Nazroo, Albor, et al., 2012; Pickett & Wilkinson, 2008). Likewise, it is possible that Democrats experience better health and reduced mortality when living among those sharing similar political ideologies. Although further research is needed to understand the mechanisms of this association, possible explanations could include reduced stress and anxiety as a result of greater contact and social interaction with individuals with shared norms and values.

There were several strengths of this study. First, we operationalized two different yet related political variables at the county level: political group density and polarization. The former is a novel concept analogous to ethnic group density with demonstrated linkages to health, while county-level political polarization is an understudied area, with no standard validated measures. Future research might benefit from using these measures to explore their effects on other health outcomes. Additional strengths of this study included the use of data from the General Social Surveys, which uses in-person interviewing rather than web-based or mail-in surveys. Response rates for the waves used in this study ranged from 70 to 75% and are based on nationally-representative sampling (GSS, 2018). This is likely to have reduced non-response bias and selection bias more broadly to lend greater credence to the study's findings. Furthermore, the models accounted for major covariates at both the county and individual levels to reduce confounding bias. Finally, we relied on prospective follow-up data on mortality through linkages to the National Death Index, which has been previously demonstrated to have good ascertainment of different mortality outcomes (Cochran & Mays, 2015; Muennig et al., 2011).

Limitations of our study could potentially explain some of the main findings observed. Scholars agree that polarization and partisanship has been steadily rising and has been exacerbated in the last decade with the uptick of social media and rapid information access (Beam et al., 2018; Iyengar & Westwood, 2015; Tucker et al., 2018; Yang et al., 2016). Thus, using data from around the year 2000 may not represent the contemporary impacts of partisanship because although the levels of

divisiveness have been increasing since the 1970s, they may have still been lower in the late 1990s and early 2000s than they are now. The adverse effects of exposure to high political group density and polarization might also manifest over a longer period of time. While this study included a follow-up of 14 years, it is possible that a longer duration of follow-up could have yielded more robust findings. Our dataset also did not include measures of individual perceptions of polarization. There is some research to suggest that perceived polarization can be a strong marker for voting behaviors and ill health (Ahler, 2014; Enders & Armaly, 2019; Nayak et al., 2021). Future research should investigate whether perceived polarization acts as a confounder or effect modifier of the associations between county-level partisanship and individual mortality.

An additional weakness of this study was that participants in our analytic sample only resided in 313 of the 3,143 counties in the United States. This was due to the fact that the GSS relies on the U.S. Census to develop their sampling frame. It uses the same sampling frame and the same set of randomly selected places (counties) for approximately 10 years in between census intervals. The data for this study used waves which included two sampling frames. Therefore, there was limited variation in counties between years. It is possible that these 313 counties are not representative of counties across the country, which could have led to selection bias. Future research would benefit from data drawn from a higher proportion of U.S. counties to reduce potential bias in the estimates of the relationships between county-level partisanship and individual-level mortality. The number of events for CHD mortality was also relatively small (n = 338) and statistical power may have been more limited to detect associations between polarization and mortality.

Although we included a large number of relevant covariates at the individual and county level, it is possible that there was residual confounding from unmeasured factors. For example, whether a county was urban or rural is an important correlate of health (Probst et al., 2019; Smith et al., 2008), but was not readily available in the dataset. Future research might benefit from linking more datasets to capture a larger range of potential confounders. Lastly, the dataset did not permit measuring the length of time participants resided in a county or tracking residential mobility. It is possible that some participants moved between counties over time, and were misclassified, biasing the results. However, there is evidence from the U.S. Census that a majority of internal migration in the U.S. is within counties (Molloy et al., 2011), and so the degree of misclassification bias due to residential mobility was likely to be relatively limited.

5. Conclusions

Partisanship and affective polarization in the United States, marked by hostility towards out-partisans, show few signs of abatement. Our findings highlight the need for more studies to better elucidate how these developments affect health and mortality. Subsequent research should also investigate the potential mechanisms of action that might underlie the associations between living in areas with high political group density, polarization, and mortality. By better understanding these political determinants of health, we may identify new areas for structural interventions to promote the health and well-being of the American populace.

Ethical statement

This study was approved by the Institutional Review Board at Northeastern University.

Funding

This study was funded by a Tier 1 Award through Northeastern University (Co-PIs: D. Kim, C. Panagopoulos, and D. Aldrich).

CRediT authorship contribution statement

Sameera S. Nayak: Writing – review & editing, Writing – original draft, Formal analysis. **Timothy Fraser:** Writing – review & editing. **Daniel P. Aldrich:** Writing – review & editing, Funding acquisition. **Costas Panagopoulos:** Writing – review & editing, Funding acquisition. **Daniel Kim:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization.

Data availability

The authors do not have permission to share data. Instructions for access to the restricted GSS-NDI dataset are available at: https://gss.norc.org/Documents/other/ObtainingGSSSensitiveDataFiles.pdf

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