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ORIGINAL RESEARCH

Arrhythmia Risk During the 2016 US Presidential Election: The Cost of Stressful Politics

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BACKGROUND: Anger and extreme stress can trigger potentially fatal cardiovascular events in susceptible people. Political elections, such as the 2016 US presidential election, are significant stressors. Whether they can trigger cardiac arrhythmias is unknown.

METHODS AND RESULTS: In this retrospective case-crossover study, we linked cardiac device data, electronic health records, and historic voter registration records from 2436 patients with implanted cardiac devices. The incidence of arrhythmias during the election was compared with a control period with Poisson regression. We also tested for effect modification by demographics, comorbidities, political affiliation, and whether an individual's political affiliation was concordant with county-level election results. Overall, 2592 arrhythmic events occurred in 655 patients during the hazard period compared with 1533 events in 472 patients during the control period. There was a significant increase in the incidence of composite outcomes for any arrhythmia (incidence rate ratio [IRR], 1.77 [95% CI, 1.42–2.21]), supraventricular arrhythmia (IRR, 1.82 [95% CI, 1.36–2.43]), and ventricular arrhythmia (IRR, 1.60 [95% CI, 1.22–2.10]) during the election relative to the control period. There was also an increase in specific types of arrhythmia, including atrial fibrillation (IRR, 1.50 [95% CI, 1.06–2.11]), supraventricular tachycardia (IRR, 3.7 [95% CI, 2.2–6.2]), nonsustained ventricular tachycardia (IRR, 1.7 [95% CI, 1.3–2.2]), and daily atrial fibrillation burden ($P<0.001$). No significant interaction was found for sex, race/ethnicity, device type, age ≥65 years, hypertension, coronary artery disease, heart failure, political affiliation, or concordance between individual political affiliation and county-level election results.

CONCLUSIONS: There was a significant increase in cardiac arrhythmias during the 2016 US presidential election. These findings suggest that exposure to stressful sociopolitical events may trigger arrhythmogenesis in susceptible people.

Key Words: arrhythmia ■ implantable cardioverter-defibrillator ■ mental stress ■ pacemaker ■ triggers

Presidential elections are high-stakes, stressful political events with far-reaching implications for individuals and society. For many Americans, the 2016 presidential election between Donald Trump (Republican candidate) and Hillary Clinton (Democratic candidate) stands out as a historic event because of the unprecedented levels of anxiety, animosity, and partisan rhetoric throughout the campaign and the polarized reactions to the unexpected election results.[1] There has been considerable speculation that mental stress from political elections may have adverse effects on population health,[2,3] as a higher incidence of acute cardiovascular events, including potentially fatal cardiac arrhythmias, has been reported following natural disasters,[4,5] national tragedies,[6–8] and other large-scale population stressors.[2,9] People with underlying

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CLINICAL PERSPECTIVE

What Is New?

- Extreme stress can trigger potentially fatal cardiovascular events.
- This study is the first to demonstrate that exposure to a stressful political election, such as the 2016 US presidential election, was associated with a 77% increase in the risk of cardiac arrhythmia in people with underlying cardiovascular disease.
- There was also a significant increase in specific types of arrhythmia, including both atrial and ventricular arrhythmias, and daily atrial fibrillation burden.

What Are the Clinical Implications?

- Our findings suggest that exposure to stressful sociopolitical events may trigger arrhythmogenesis in susceptible people.
- Given that political elections occur every 2 to 4 years in the United States. and at similar frequencies in other countries around the world, the potential impact of recurrent political events on population health is not negligible and warrants further study.

Nonstandard Abbreviations and Acronyms

ATP	antitachycardia pacing
GAM	generalized additive model
IRR	incidence rate ratio

cardiovascular risk may be especially vulnerable to transient stress-induced alterations in autonomic, metabolic, inflammatory, and hemodynamic processes that can trigger arrhythmogenesis.[10,11]

In this study, we sought to determine whether the stress of a contentious political election increases the risk of arrhythmia in patients with known susceptibility using retrospective data from cardiac devices,[7,8] electronic health records, and historic voter registration records from a large, well-characterized cohort of patients with cardiac pacemakers and implantable cardioverters-defibrillators (ICDs) from 2 centers in North Carolina. We further examined whether the risk of arrhythmia differed according to political party affiliation and by the level of concordance between an individual's political affiliation and his/her community's election results.

North Carolina was a key battleground state in the 2016 election, and residents were exposed to a particularly high volume of political advertisements and campaign events leading up to the election.[12] Thus, this cohort was uniquely well suited to investigate the association between a stressful political election and the short-term risk of arrhythmia.

METHODS

The data that support the findings of this study are available from the corresponding author upon reasonable request..

Study Design

As in previous studies,[13–15] we used a case-crossover design to compare the occurrence of arrhythmia during a prespecified time interval (hazard period) with arrhythmic events during a separate control period.[14] We defined the hazard period a priori as a 6-week time interval (October 25–December 6, 2016) extending from 2 weeks before and 4 weeks after the 2016 presidential election (November 8, 2016) (Figure 1). This hazard period was selected because it ensured sufficient preelection and postelection exposure and because studies have shown an increase in arrhythmias up to 1 month after a stressful event.[5,8]

For direct comparison, a 6-week control period (June 1, 2016–July 12, 2016) was selected a priori because it was recent enough to minimize effects of time-varying confounders[15] and because the seasonal risk of arrhythmia is relatively similar in the proposed hazard and control periods (6.9% in November versus 7.4% in June).[16] Alternative control periods closer to the date of the 2016 election were not selected because the monthly incidence of arrhythmia is substantially higher in September (9.9%) than the hazard period (6.9% in November)[16] and would introduce carryover effects from the intense media coverage of the national party conventions in late July that persists until the day of the election (Figure 1). Similarly, earlier periods in 2016 were not selected because of the significantly greater incidence of arrhythmia in spring (0.86%) relative to other seasons, whereas the rates of arrhythmia are consistently lower in summer (0.70%) and fall (0.74%).[17] In addition, to further control for potential variation in temperature across seasons, a second seasonal control period from the exact same time period in the preceding year (October 25, 2015–December 6, 2015) was included in sensitivity analyses.

Study Population

Adults (aged ≥18 years) who were enrolled in remote monitoring programs at 2 large centers in North Carolina and met the following eligibility criteria were included in the analysis: (1) implantation of an ICD (subcutaneous ICD and single- and

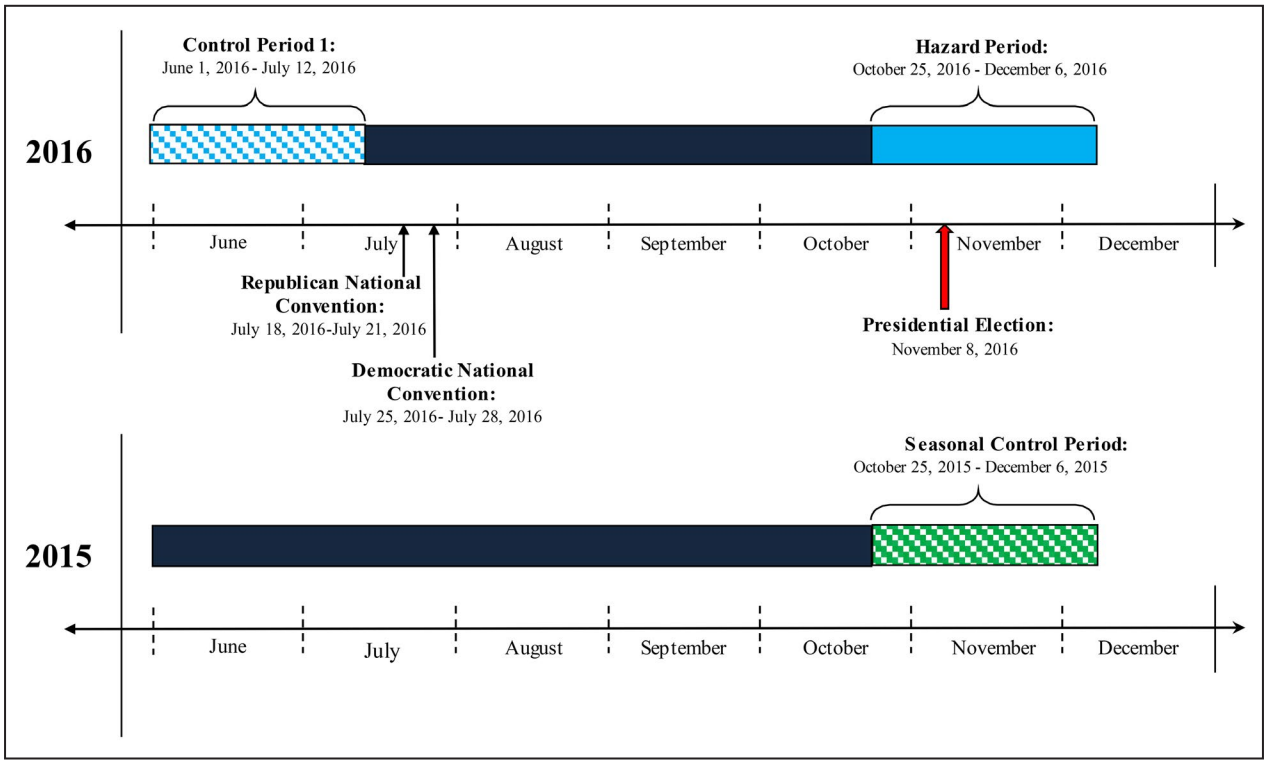

Figure 1. **Design of the case-crossover analysis.**

dual-chamber devices) or pacemaker (single- and dual-chamber devices) with or without cardiac resynchronization therapy before May 2016; (2) had a device capable of remote diagnostic monitoring that was manufactured by Medtronic (Minneapolis, MN), Boston Scientific (Marlborough, MA), or Abbott (Abbott Park, IL); and (3) had continuous device data during the study period. Patients were excluded if they underwent device reprogramming or replacement with a change of manufacturer during the study period. Institutional Review Boards at each site approved the study protocol and waiver of informed consent. No funding or other research support was provided by the device manufacturers. All authors take responsibility for the integrity of the data and analyses.

Data Sources and Definitions

Details on data sources and linkage procedures are provided in Data S1. Briefly, information on arrhythmia episodes (type, date and time of occurrence, duration, and number of events) and therapy administered (ICD shocks and antitachycardia pacing [ATP]) was obtained from remote monitoring transmissions. Episodes were classified according to established device-specific algorithms and programmed detection settings. As in prior studies,[17–19] analyses were restricted to events meeting standard diagnostic criteria for atrial fibrillation (AF), supraventricular tachycardia, nonsustained ventricular tachycardia, and ventricular tachycardia/ventricular fibrillation.[20,21] Episodes of AF were reviewed, and only clinically relevant events (eg, AF ≥30 seconds) were included in this analysis. We further examined daily AF burden, defined as the mean percentage of time each day that patients with continuous data recorded by their device experienced AF. Device detection algorithms for AF have demonstrated >95% sensitivity and specificity for detection of atrial arrhythmia episodes and measurement of atrial arrhythmia burden in prior studies.[22] Consistent with the approach used in the TRENDS study,[23] we applied a minimum threshold of ≥20 seconds of AF burden for analysis and did not distinguish between atrial tachycardias, atrial flutter, or AF. Patients with a prior diagnosis of persistent AF were excluded from analysis, as their AF could not worsen during the period of observation. For device therapies (ATP and ICD shock), only the therapy administered (and not the underlying arrhythmia) was counted to avoid overestimating event rates in analyses of composite outcomes. Multiple events occurring on the same day were counted separately; however, when multiple sustained arrhythmic events occurred with minimal separation (≤60 seconds), only the first rhythm event was included in the

analysis. Electrograms for all arrhythmia episodes treated by ICD shock were reviewed and adjudicated by a board-certified electrophysiologist in a blinded manner.

Automated computer algorithms and standard methods[24] were used to abstract demographic information, clinical history, and medications from the electronic health record (Data S1). Clinical data were linked to public voter registration records, which are updated weekly by the North Carolina State Board of Elections. We obtained the November 8, 2016, voter file, which contained personal identifiers and information on voter history and political affiliation (Democrat, Republican, Libertarian, or unaffiliated) from 6.9 million registered voters.

Statistical Analysis

Baseline characteristics are shown as frequencies and percentages for categorical variables, and as means and SDs for continuous variables. Descriptive statistics for patients with and without arrhythmic events during the hazard period were compared using *t* tests and χ^2 tests, as appropriate. Additional descriptive analyses compared patient characteristics according to political party affiliation.

In the primary analysis, the incidence of all arrhythmic events during the hazard period was compared with that of the 2016 control period using Poisson regression with generalized estimating equation, which accounts for correlation between the number of arrhythmia events in the hazard and control periods within a single patient. We also examined the incidence of specific types of arrhythmia (AF, supraventricular tachycardia, nonsustained ventricular tachycardia, and ventricular tachycardia/ventricular fibrillation) as well as composite outcomes for supraventricular arrhythmias (AF and supraventricular tachycardia) and ventricular arrhythmias (nonsustained ventricular tachycardia and ventricular tachycardia/ventricular fibrillation). Inappropriate ICD therapies were excluded from all analyses (n=11 inappropriate ICD shocks occurred in 10 patients). Multivariable analyses were conducted to refine these estimates and control for potential confounders, including demographic characteristics (age, sex, race/ethnicity, time since device implant, and device type), baseline comorbidities (prior diagnoses of congestive heart failure, hypertension, coronary artery disease, renal failure, AF/atrial flutter, diabetes mellitus, left ventricular assist device, and anxiety/depressive disorders), and medications (β blockers and antiarrhythmics). The effects of the hazard period on daily AF burden were fitted nonparametrically using a generalized additive model (GAM) with a cyclic cubic spline function. Unlike linear regression models, GAM models do not assume linearity, allowing for a more flexible fit than models assuming a strict linear association. To avoid overfitting, the optimal smoothing parameters in the GAM were chosen by minimizing the Akaike Information Criterion. The GAM was fitted by using the "mgcv" package in R.[25]

Prespecified subgroup analyses that included interaction terms were used to ascertain whether the incidence of arrhythmia differed according to sex, age, race/ethnicity, device type, and history of hypertension, coronary artery disease, and congestive heart failure. In addition, because emotional stress from the election may be influenced by political ideology,[26] separate analyses were performed in patients with matched voter registration data to assess whether the incidence of arrhythmia differed according to political party affiliation (Democrat versus Republican) and political concordance. "Political concordance" was defined as concordance between individuals' political affiliation (Democrat or Republican) and the election results from their county of residence (Democrat or Republican). An example of political concordance would be a registered Democrat living in a county won by the Democratic presidential candidate.

Sensitivity analyses were performed to assess the robustness of the primary findings. First, we modeled the risk of arrhythmia as a binary (instead of a continuous) outcome using the Mantel-Haenszel method to determine the relative risk of arrhythmias during the hazard period compared with the control period. Next, to ensure that results were not attributable to seasonal variation in arrhythmia, we repeated the primary analyses using data from a subgroup of patients with complete device data during both the hazard period and the identical 6-week period in 2015 (October 25, 2015–December 6, 2015).

All subgroup and sensitivity analyses were performed with composite outcomes for (1) any arrhythmic events, (2) supraventricular arrhythmias, and (3) ventricular arrhythmias to ensure adequate statistical power. Device therapies were not examined as a composite outcome because of the small number of events. Results are shown as relative risks or incidence rate ratios (IRRs) with 95% CIs in forest plots. Less than 1% of patients had missing data; these data were excluded from the analyses. A 2-sided $P<0.05$ was considered significant. Analyses were performed with R software, version 3.6.1 (R Core Team, 2019).

RESULTS

Among the 3047 patients who were screened for inclusion, 2449 met eligibility criteria (Figure 2). The final sample included only patients with linked clinical

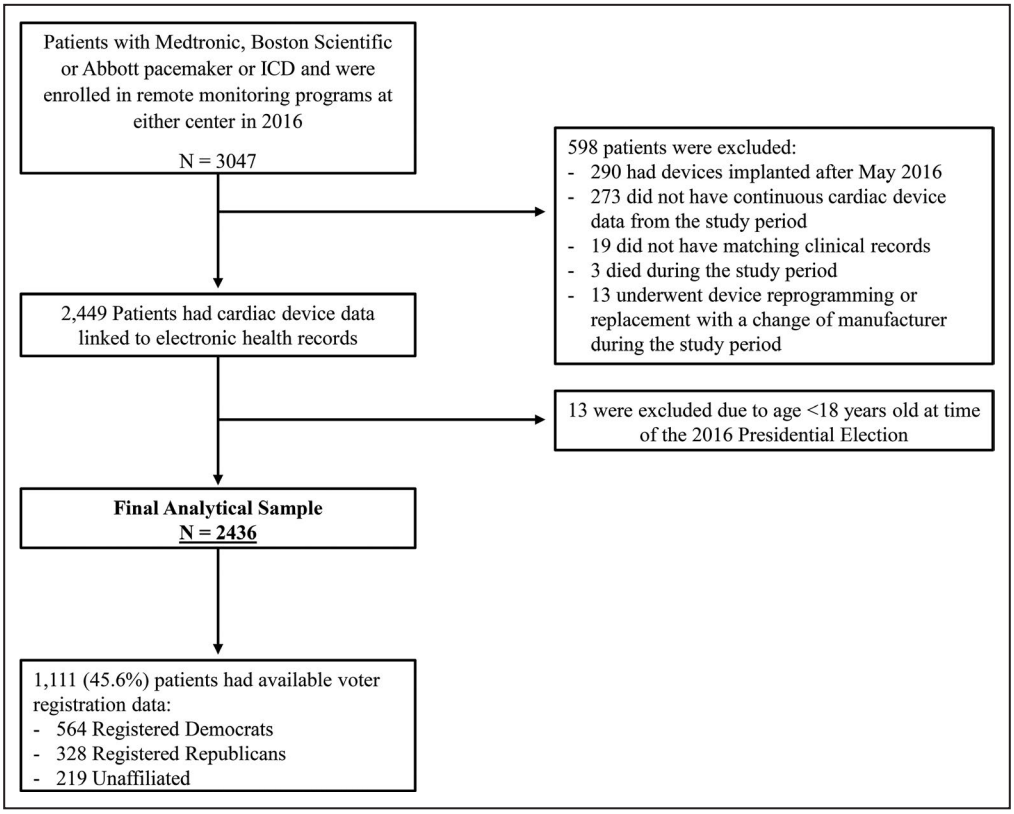

Figure 2. Cohort selection diagram.
EHR indicates electronic health record; and ICD, implantable cardioverter-defibrillator.

data from the electronic health record (n=2436). Of those patients, 1236 had an ICD (53.2%; 185 single chamber, 579 dual chamber, 517 cardiac resynchronization therapy, and 15 subcutaneous ICD) and 1140 had a pacemaker (46.8%; 73 single chamber, 1011 dual chamber, and 56 cardiac resynchronization therapy).

Baseline characteristics of the study population are shown in Table 1. Most patients were older (mean age, 70.8±12.9 years), White, men with underlying cardiovascular disease (hypertension, congestive heart failure, or AF/atrial flutter), and had prescriptions for β-blockers, statins, and angiotensin-converting enzyme inhibitors or angiotensin receptor blockers.

Risk of Arrhythmia During the 2016 US Presidential Election

A total of 2592 arrhythmic events occurred in 655 patients during the election period compared with 1533 events in 472 patients during the control period. The incidence of any arrhythmic event was significantly higher during the election relative to the control period (IRR, 1.77 [95% CI, 1.42–2.21]) (Figure 3). As for specific arrhythmias, patients were 1.5 (95% CI, 1.06–2.11) times more likely to experience AF, 3.7 (95% CI, 2.2–6.2) times more likely to experience supraventricular tachycardia, and 1.7 (95% CI, 1.3–2.2) times more likely to experience nonsustained ventricular tachycardia during the election period. They were 11.6 (95% CI, 3.2–42.0) times more likely to receive ATP therapies during the election, whereas associations with ventricular tachycardia/ventricular fibrillation (1.7 [95% CI, 0.9–3.4]) and ICD shock (2.00 [95% CI, 0.50–7.97]) were nonsignificant. Analyses of composite outcomes were consistent with the primary findings and show an elevated risk of supraventricular arrhythmia (1.82 [95% CI, 1.36–2.43]) and ventricular arrhythmia (1.60 [95% CI, 1.22–2.10]) during the election period relative to the control period. In multivariable models, the risk of any arrhythmic event (1.77 [95% CI, 1.42–2.21]; Table 2), supraventricular arrhythmias (1.82 [95% CI, 1.36–2.43]; Table S1), and ventricular arrhythmias (1.60 [95% CI, 1.22–2.10]; Table S2) remained elevated after controlling for all other demographic and clinical confounders.

Of patients, 35% had ≥20 seconds of AF burden on at least 1 day during the period of observation. Change in mean daily AF burden from the control period to the hazard period is illustrated in Figure 4. Among those

Table 1. Characteristics of the Patients Who Had an Arrhythmia During the 2016 US Presidential Election and Those Who Did Not

Characteristics	Overall Sample (N=2436)	Arrhythmia (n=655)	No Arrhythmia (n=1781)	*P* Value
Demographics				
Age, y*	70.8±12.9	69.1±12.9	71.4±12.8	<0.001
Men	1444 (59.4)	411 (63.0)	1033 (58.1)	0.029
Race/ethnicity†				0.001
White	1809 (74.5)	463 (71.0)	1346 (75.7)	
Black	516 (21.2)	171 (26.2)	345 (19.4)	
Hispanic	22 (0.9)	4 (0.6)	18 (1.0)	
Other	82 (3.4)	14 (2.1)	68 (3.8)	
Employment status (retired)	1555 (68.4)	406 (66.2)	1149 (69.1)	0.187
Device				
Pacemaker (ICD as referent group)	1140 (46.8)	245 (37.4)	895 (50.3)	<0.001
Left ventricular assist device	13 (0.6)	7 (1.1)	6 (0.4)	0.054
Time since implant, y*	3.08±3.08	2.85±3.45	3.17±2.93	0.025
Clinical history				
Hypertension	1413 (62.6)	385 (62.2)	1028 (62.8)	0.808
Previous myocardial infarction	846 (37.5)	235 (38.0)	611 (37.3)	0.770
Congestive heart failure	1147 (50.8)	348 (56.2)	799 (48.8)	0.002
Coronary artery disease	867 (38.4)	239 (38.6)	628 (38.3)	0.923
Diabetes mellitus	341 (15.1)	78 (12.6)	263 (16.1)	0.041
Obstructive sleep apnea	179 (7.9)	61 (9.9)	118 (7.2)	0.044
Stroke/TIA	141 (6.2)	37 (6.0)	104 (6.3)	0.845
Lipid disorders	532 (23.6)	139 (22.5)	393 (24.0)	0.470
Peripheral vascular disease	179 (7.9)	40 (6.5)	139 (8.5)	0.117
Valvular heart disease	242 (10.7)	56 (9.0)	186 (11.4)	0.127
Chronic kidney disease	208 (9.2)	52 (8.4)	156 (9.5)	0.463
COPD	225 (10.0)	68 (11.0)	157 (9.6)	0.345
Arrhythmias and conduction defects				
Atrial fibrillation/atrial flutter	1058 (46.9)	353 (57.0)	705 (43.0)	<0.001
Prior sudden cardiac arrest	53 (2.3)	18 (2.9)	35 (2.1)	0.278
Medications				
ACE inhibitor or ARB	1591 (65.5)	457 (70.1)	1134 (63.8)	0.004
β-Blocker	1890 (77.8)	543 (83.3)	1347 (75.8)	<0.001
Statin	1554 (64.0)	421 (64.6)	1133 (63.7)	0.739
Calcium channel blockers	713 (29.3)	207 (31.7)	506 (28.5)	0.119
Antiarrhythmic	541 (22.3)	158 (24.2)	383 (21.5)	0.169
Anticoagulation	1192 (49.1)	342 (52.5)	850 (47.8)	0.044
Antiplatelet agent/aspirin	1677 (69.0)	473 (72.5)	1204 (67.7)	0.023
Antidepressant‡	691 (28.4)	188 (28.8)	503 (28.3)	0.800
Lifestyle factors				
Body mass index, kg/m^2*	30.06±6.52	30.48±6.98	29.89±6.33	0.053
Alcohol abuse	7 (0.3)	1 (0.2)	6 (0.4)	0.681
Drug abuse	23 (1.0)	8 (1.3)	15 (0.9)	0.481
Smoking status				0.402
Current	176 (7.7)	50 (7.9)	126 (7.5)	
Former	1034 (45)	296 (47)	738 (44.2)	

(*Continued*)

Table 1. Continued

Characteristics	Overall Sample (N=2436)	Arrhythmia (n=655)	No Arrhythmia (n=1781)	*P* Value
Never	1089 (47.4)	284 (45.1)	805 (48.2)	
Psychiatric comorbidities				
Major depressive disorder	131 (5.8)	30 (4.8)	101 (6.2)	0.267
Prior anxiety or depressive disorder§	152 (6.7)	37 (6.0)	115 (7.0)	0.399

Data are given as number (percentage), unless otherwise indicated. Listed values are for the overall sample, and comparisons are made between those who had an arrhythmia during the hazard period and those who did not. All demographic and clinical data were recorded in the electronic health record before the start of the study period (June 1, 2016). ACE indicates angiotensin-converting enzyme; ARB, angiotensin receptor blocker; COPD, chronic obstructive pulmonary disease; ICD, implantable cardioverter-defibrillator; and TIA, transient ischemic attack.

*Data are presented as mean±SD.

†Data missing: race/ethnicity, n=7 (0.3%).

‡Antidepressant medications include selective serotonin reuptake inhibitors/serotonin and norepinephrine reuptake inhibitors.

§A composite variable was created for any prior diagnoses of anxiety and depressive disorders: generalized anxiety disorder, posttraumatic stress disorder, panic disorder, and major depressive disorder.

people, there was a significant increase in mean daily AF burden during the hazard period relative to the control period (0.6% higher; *P*<0.001).

Subgroup Analyses

No significant interactions were found for sex, race/ethnicity, device type, age >65 years, hypertension, coronary artery disease, and congestive heart failure for any arrhythmic event, supraventricular arrhythmia, and ventricular arrhythmia (Figure 5).

Voter registration data were available for 1111 patients (45.6%); and of those, 564 were registered Democrats, 328 were Republicans, and 219 were unaffiliated (Table S3). Data from the only registered Libertarian in our sample were excluded from analysis. Overall, Democrats were more likely to be women, to belong to a racial/ethnic minority group, and to have a left ventricular assist device, whereas Republicans were more likely to have a history of myocardial infarction and coronary artery disease. In subgroup analyses, interactions for political affiliation were nonsignificant for any arrhythmia (*P*=0.91; Figure 4), supraventricular arrhythmias (*P*=0.07; Figure S1), and ventricular events (*P*=0.52; Figure S2). Interactions for political concordance were also nonsignificant (*P* for the interaction: any arrhythmia [*P*=0.36; Figure 4], supraventricular arrhythmias [*P*=0.79; Figure S1], and ventricular events [*P*=0.33; Figure S2]).

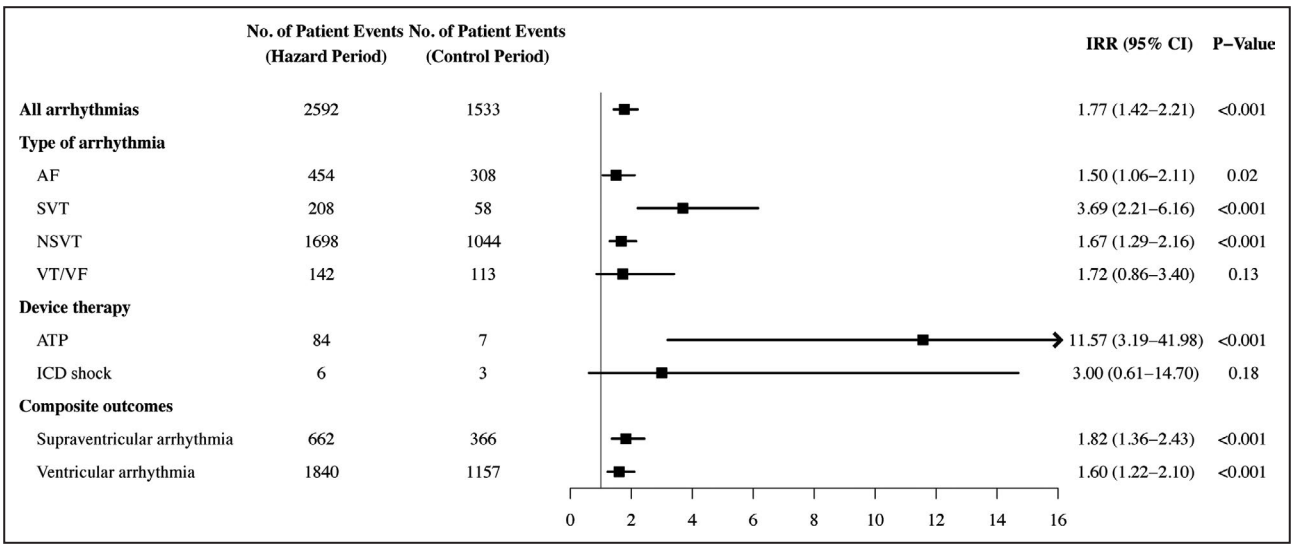

Figure 3. Incidence rate ratios (IRRs) for arrhythmic events during the 2016 US presidential election.

Notes and definitions: Listed values may include multiple arrhythmic events within a single patient and are controlled for by the analysis. IRRs were not adjusted for baseline variables. Composite outcomes: supraventricular arrhythmias (atrial fibrillation [AF] and supraventricular tachycardia [SVT]), ventricular arrhythmias (nonsustained ventricular tachycardia [NSVT] and ventricular tachycardia/ventricular fibrillation [VT/VF]), and device therapy administered (antitachycardia pacing [ATP] and implantable cardioverter-defibrillator [ICD] shocks). Because Abbott devices do not discriminate between nonsustained events (supraventricular vs ventricular), people with these devices were excluded from analyses of composite outcomes.

Table 2. IRRs for Any Arrhythmia During the 2016 US Presidential Election

Variable	IRR (95% CI)	*P* Value
Hazard period (control period reference group)	1.77 (1.42–2.21)	<0.001
Age (in decades)	0.89 (0.83–0.96)	0.003
Sex (men reference group)	0.89 (0.71–1.11)	0.288
Race/ethnicity (White reference group)	1.34 (1.04–1.73)	0.023
Time since diagnosis, y	1.07 (1.03–1.12)	<0.001
Device type (pacemaker reference group)	2.17 (1.59–2.95)	<0.001
Congestive heart failure	0.67 (0.48–0.93)	0.017
Hypertension	0.94 (0.73–1.21)	0.656
Coronary artery disease	1.04 (0.78–1.40)	0.783
Chronic kidney disease	1.25 (0.79–1.98)	0.334
Diabetes mellitus	0.75 (0.52–1.08)	0.125
AF/atrial flutter	1.62 (1.29–2.04)	<0.001
LVAD	4.97 (2.18–11.33)	<0.001
Antiarrhythmics medications	1.21 (0.91–1.60)	0.191
β-Blocker medications	1.05 (0.77–1.44)	0.744
Prior anxiety or depressive disorder	0.71 (0.47–1.07)	0.100

Listed values may include multiple arrhythmic events within a single patient. A composite variable was created for any prior diagnoses of anxiety and depressive disorders: generalized anxiety disorder, posttraumatic stress disorder, panic disorder, and major depressive disorder. AF indicates atrial fibrillation; IRR, incidence rate ratio; and LVAD, left ventricular assist device.

Sensitivity Analyses

Results of sensitivity analyses were generally consistent with the main findings of the study. In analyses that modeled the risk of arrhythmia as a binary (instead of a continuous) outcome, the findings showed a significant increase in arrhythmia during the election relative to the 2016 control period (Table S4).

To control for potential seasonal variation in arrhythmia, we repeated the primary analysis with data from a second seasonal cohort using data from a subgroup of patients (n=460) with complete device data during the hazard period and the identical 6-week period in 2015 (October 25–December 6, 2015). We found a significantly higher risk of arrhythmic events (IRR, 1.29 [95% CI, 1.04–1.59]) and supraventricular arrhythmias (IRR, 1.73 [95% CI, 1.03–2.89]) during the 2016 US presidential election compared with the identical 6-week period in 2015 (Table S5). Although differences in the occurrence of ventricular arrhythmias were not significant because of the lower number of events in this smaller subgroup of patients (IRR, 1.20 [95% CI, 0.95–1.53]), the point estimate was in the same direction as that of the primary analysis and the total number of ventricular events was higher in the hazard period (n=148) compared with the control period (n=123).

We also repeated the GAM analysis for AF burden with data from the corresponding 6-week period in 2015. These results were nearly identical to those in the primary analysis (Figure S3), with a significantly higher burden of AF during the 2016 US presidential election compared with the same period 1 year earlier (0.4% higher; $P<0.001$).

DISCUSSION

In this large cohort of patients with implanted cardiac devices, we found a significant increase in the risk of arrhythmic events, including supraventricular and ventricular arrhythmias, as well as a greater AF burden during the 2016 US presidential election compared with the control period. These associations were independent of known demographic and clinical confounders. Sensitivity analyses further allayed concerns that observed differences might be explained by the analytic approach, or seasonal variation in arrhythmia. These findings reinforce previous observations from studies of other sociopolitical events around the world (eg, the withdrawal of the United Kingdom from the European Union and sociopolitical conflict in Hong Kong),[27–30] suggesting that substantial shifts in political power may negatively affect health outcomes in vulnerable populations.

Although our study is the first to investigate the role of a stressful political election in triggering arrhythmic events, prior studies have reported a marked increase in acute cardiovascular events following natural disasters,[4,5] industrial accidents,[31] terrorist attacks,[6] and other large-scale population stressors.[2,9] A higher incidence of ventricular tachyarrhythmias has also been reported in patients with ICDs following national tragedies, such as the attacks on the World Trade Center on September 11, 2001.[7,8] Our findings extend this work by demonstrating a 77% increase in clinical arrhythmia in people with underlying cardiovascular disease exposed to a highly polarized political election. In addition, AF was detected in approximately one third of individuals during the study, and we observed a significantly higher burden of AF in those people during the election relative to the control periods in 2015 and 2016. These findings raise the possibility that acute mental stress from a political election may have more long-term consequences on cardiovascular health, as increases in the frequency and duration of tachyarrhythmias have been strongly associated with hemodynamic instability, worsening heart failure, hospitalization, and death in patients with ICDs.[32] Transient increases in daily AF burden have also been associated with a higher short-term risk of stroke and worse quality of life.[33] This study, however, was not designed to examine long-term clinical outcomes. Whether arrhythmic events trigged by sociopolitical events are associated with long-term morbidity requires further investigation.

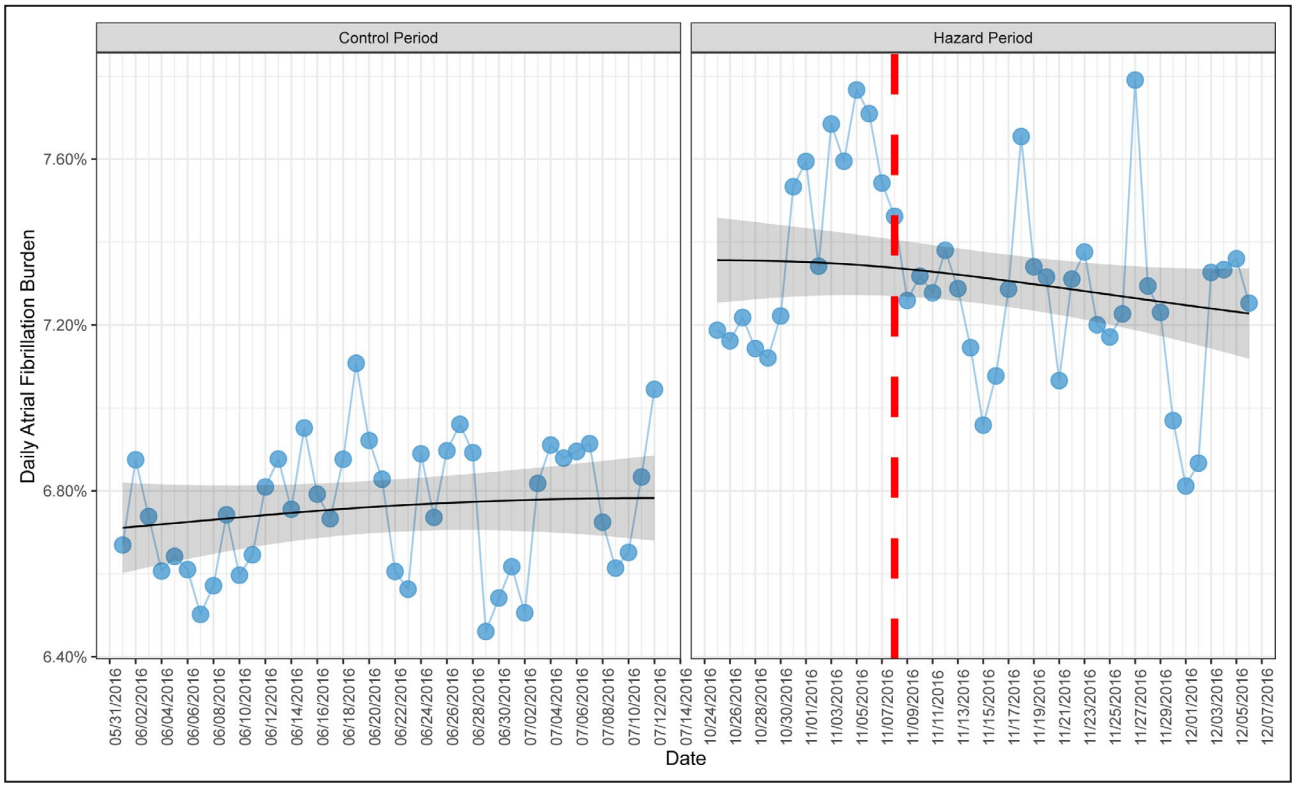

Figure 4. Daily mean atrial fibrillation burden (blue dots) during the control period (June 1, 2016 to July 12, 2016) and hazard period (October 25, 2016 to December 6, 2016).
A generalized additive model with a cyclic cubic spline function is fitted to demonstrate trends over these time periods (black line with 95% confidence interval shaded grey). The vertical red line represents the date of the 2016 U.S. presidential election.

A novel feature of this study was the examination of individual risk factors for arrhythmia as well as the social and political conditions that may influence cardiovascular health. Although negative emotions, social isolation, and loneliness have been associated with cardiovascular morbidity and mortality in previous studies,[11,34] we did not observe a higher incidence of arrhythmia among people who voted for the losing candidate (Democrats in the 2016 election) or among those who may have felt socially or ideologically disconnected from their community (politically discordant people). We also found no variation in risk according to demographic characteristics and comorbidities. Instead, our study showed that the increased risk of arrhythmia associated with the 2016 election was similar among individuals of all demographic, clinical, and ideological backgrounds. Although we may expect to see a higher incidence of emotion-triggered arrhythmia in people with underlying heart disease, previous studies have also failed to show a relationship between the type and severity of structural heart disease and anger-triggered arrhythmias.[35,36] The absence of effect modification by demographic, clinical, and political characteristics in the current analysis could also be attributed to the small number of events that occurred in this cohort during the 6-week study periods, particularly among those with matched voter registration data. It is worth noting that the total number of arrhythmic events was higher in the hazard period relative to the control period in most of the subgroup analyses. Larger, fully powered studies are needed to clarify the influence of social and political factors on arrhythmia burden.

Although mechanisms were not directly assessed in this study, acute mental stress and negative emotions are associated with increases in adrenergic activity, sympathetic activation, and reduced vagal tone, which can produce dynamic changes in cardiac electrophysiology that trigger arrhythmogenesis and maintain arrhythmogenic substrate.[10,11] Anger and severe emotional distress have also been shown to precipitate ischemia and abrupt plaque rupture, which are potent triggers of arrhythmia, especially in the context of coronary heart disease.[9] Other studies have suggested that alterations in the hypothalamus-pituitary-adrenal axis may lead to proinflammatory responses that accelerate structural remodeling secondary to an underlying disease process (eg, hypertension, renal dysfunction, or heart failure), thereby increasing susceptibility to cardiac conduction and repolarization abnormalities.[10,37] Sustained increases in stress hormones, such as cortisol, may activate biological processes that facilitate arrhymia.[9,11] Mental stress and salivary

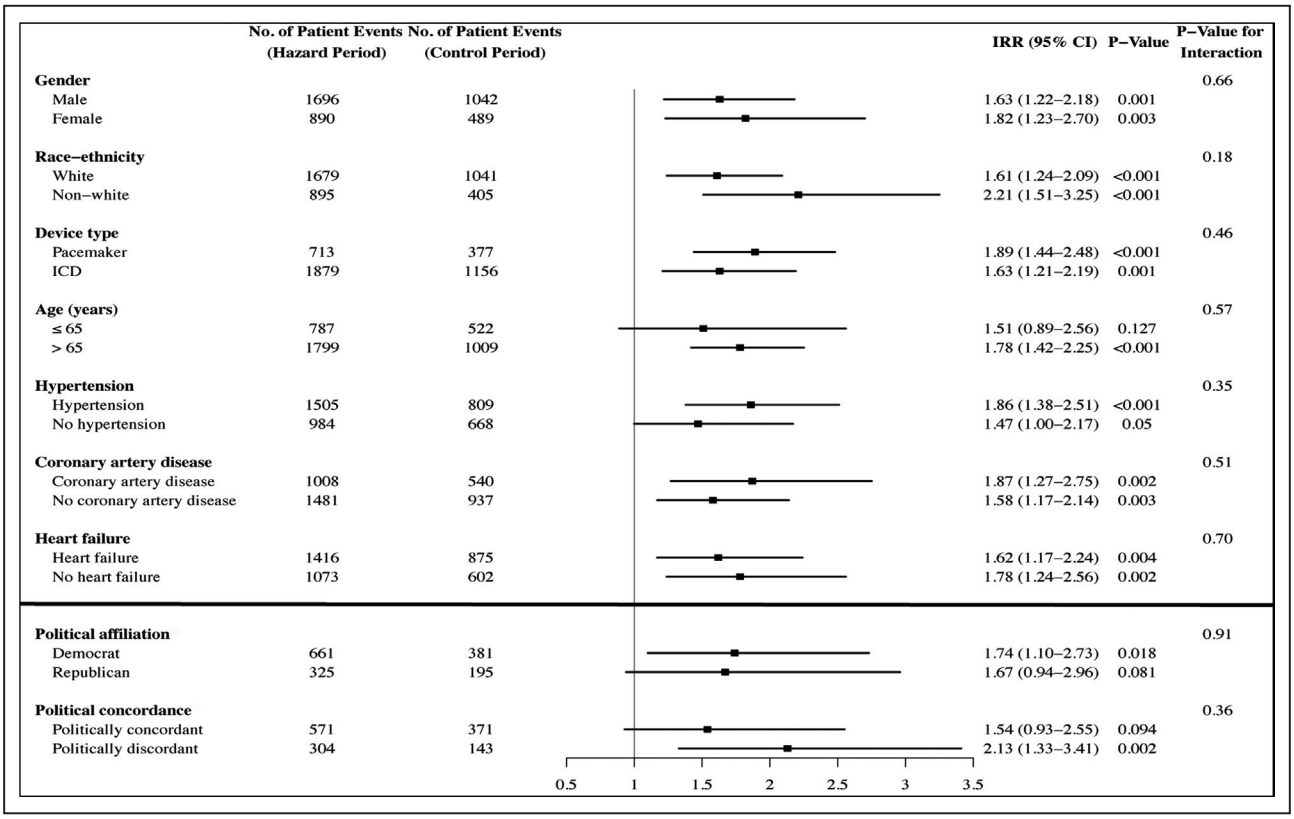

Figure 5. Subgroup analyses for arrhythmic events during the 2016 US presidential election.
Notes and definitions: Subgroup analyses for sex, race/ethnicity, device type, age, hypertension, coronary artery disease, and congestive heart failure were performed with data from the entire cohort (n=2436). Subgroup analyses for political affiliation and political concordance were limited to people with matched voter registration data (n=1111). Listed values may include multiple arrhythmic events within a single patient and are controlled for by the analysis. Incidence rate ratios (IRRs) were not adjusted for baseline variables. Composite outcomes include: supraventricular arrhythmias (atrial fibrillation and supraventricular tachycardia) and ventricular arrhythmias (nonsustained ventricular tachycardia and ventricular tachycardia/ventricular fibrillation). Because Abbott devices do not discriminate between nonsustained events (supraventricular vs ventricular), people with these devices were excluded from analyses of composite outcomes. ICD indicates implantable cardioverter-defibrillator.

cortisol have also been shown to increase during a stressful political election,[38] suggesting that a biological link between election-related stress and arrhythmia is possible.[37] Additional metabolic pathways,[10] endothelial dysfunction,[37] underlying psychiatric disorders,[39] and unhealthy behaviors (sleep disturbance, poor diet, smoking, medication nonadherence, substance abuse, excessive caffeine consumption, and decreased physical activity)[37,40] may also contribute to electrical instability in the heart and arrhythmogenesis.

Implications of Findings

Although the absolute risk of acute cardiovascular events is generally low for infrequent events and uncommon triggers (eg, earthquakes),[13] national political elections occur every 2 to 4 years in the United States (midterms and general election) and at similar frequencies in other countries around the world. The pathophysiologic consequences of stressful sociopolitical events can accumulate and may amplify the effects of other long-term stressors (eg, caregiving and marital or work-related stress) and behavioral risk factors for cardiovascular disease (eg, substance abuse). Therefore, the potential population-level health impact of recurrent political events is not negligible and warrants further study to help inform future public health strategies.

Findings from this investigation also raise important questions about whether appropriate therapeutic strategies can mitigate the risk of emotion-triggered arrhythmia in susceptible people during periods of heightened social and political stress. Cognitive-behavioral therapy, yoga, and other stress management techniques have been shown to reduce mental stress and physiological arousal, and improve health outcomes in patients with established cardiovascular disease.[41] Preliminary data suggest that β-blockers may also be effective at reducing the effect of negative emotions on arrhythmia reoccurrence.[42] Further research and randomized trials are needed to determine the clinical benefits of these tools in populations prone to emotionally triggered cardiac events.

Strengths and Limitations

A major strength of our study was its case-crossover design. Because each patient served as his or her own control, confounding by non–time-varying patient factors was eliminated.[14] Furthermore, unlike previous studies of short-term triggers of arrhythmia, which were limited to small samples of predominantly male patients and focused on a single device or outcome (eg, ICD shock), this investigation included a large sample, 40% of whom were women, and assessed multiple arrhythmia outcomes in a wide range of devices from several manufacturers.

Several limitations should be noted. First, because this was a retrospective observational study, no causal relationship should be inferred. Second, this study did not collect information on important time-varying confounders (eg, subjective emotional distress, changes in medications, New York Heart Association class, hospitalizations, and environmental factors) that may have influenced study findings. Although information on time-varying covariates is often not available in retrospective studies,[2,5–8] time-varying clinical factors should be considered in future prospective studies. A third limitation is that although ICD shocks were adjudicated, arrhythmias were assessed using validated device detection algorithms.[43] Although this may have resulted in occasional misclassification of events, programmed detection settings were consistent throughout the hazard and control periods for all patients; thus, it is unlikely to have affected risk estimates. However, because electrograms of arrhythmic events treated with ATP are not consistently stored in the device, inappropriate ATP therapies could not be removed from analyses. It is possible that the risk estimates for ATP were partly driven by a high number of inappropriate ATP therapies for atrial arrhythmias. Fourth, we cannot discount the possibility that longer or shorter periods of assessment may have led to different results. A fifth limitation was that political affiliation was ascertained from voter registration records, which may not reflect actual voter behavior. We note, however, that 92% of affiliated Republicans and 94% of Democrats in North Carolina voted with their party in the 2016 presidential election.[44]

In conclusion, exposure to a stressful political election was associated with an increased risk of both supraventricular and ventricular arrhythmias, and a higher burden of AF in people with underlying cardiovascular disease. These findings suggest that exposure to stressful sociopolitical events may promote arrhythmogenesis in susceptible people.

ARTICLE INFORMATION

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Supplementary Material

Data S1
Tables S1–S5
Figures S1–S3

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SUPPLEMENTAL MATERIAL

Data S1.

DATA SOURCES

Cardiac Device Data

Implanted cardiac devices, such as pacemakers and ICDs, have built-in arrhythmia detection algorithms that identify and classify arrhythmic events based on sensor data from rate and rate derived measurements (based on cycle-by-cycle interval measurements) include average/median cycle length, rapid deviation in cycle length (onset), minimal deviation of cycle length (stability). A third algorithm, morphology discrimination, has been implemented in the detection process in order to withhold VT therapy delivery on sinus tachycardia and supraventricular rhythms.

All ICDs and pacemakers in this analysis were capable of continuously recording daily rhythm data for up to one year. Data include information on device function, arrhythmia episodes (type, date and time of occurrence, duration, number of events) and therapy administered [ICD shocks and anti-tachycardia pacing, ATP)]. Remote home monitors automatically transmit these data to healthcare clinics at regularly scheduled intervals for clinical use and the report from each transmission is uploaded into patient's EHR. Cardiac device data from remote transmissions and in-office device interrogations during the hazard and control periods were included in the analysis.

a) *Atrial arrhythmias* were measured by the device and episodes meeting established criteria for duration (e.g., AF $\geq$ 30 seconds) were included in analysis without further adjudication. Since event counts would have been measured consistently in both the hazard and control periods, thus it is unlikely to have affected risk estimates. Device detection algorithms for atrial arrythmias have been well-validated and have demonstrated a positive predictive value >93% for true atrial tachycardia/fibrillation events in prior studies.[35]

b) *ICD shocks* were considered to be appropriate if the triggering rhythm was determined to be ventricular fibrillation or ventricular tachycardia according to standard definitions.[30] Inappropriate ICD shocks due to supraventricular tachycardias, oversensing or spontaneous termination of non-sustained ventricular tachycardia were excluded from analysis.

Electronic Health Record Data

Baseline demographic characteristics and clinical information were obtained from the Carolina Data Warehouse (CDW) which stores EHR databases for all University of North Carolina (UNC) facilities and affiliated hospitals. The CDW uses a standardized HIPAA–compliant data dictionary which is harmonized with discrete data from electronic health records through validated automated computer algorithms and standard methodology.[22] Harmonized databases include patients' demographic details, insurance status, and clinical information from all inpatient and outpatient visits to UNC and affiliated facilities.

a) *Clinical diagnoses* were considered present if the *International Classification of Diseases, 10th Revision, Clinical Modification* code for that condition was identified in a patient's EHR records, otherwise comorbidities were considered not present. Current

and historic diagnoses included in this analysis were hypertension, previous myocardial infarction, congestive heart failure, coronary artery disease, diabetes mellitus, obstructive sleep apnea, stroke/transient ischemic attack, lipid disorders, peripheral vascular disease, valvular heart disease, chronic kidney disease, obstructive pulmonary disease (COPD), and atrial fibrillation/atrial flutter.

b) *Co-existing psychiatric disorders.* A composite variable was created for any prior diagnoses of anxiety and depressive disorders: generalized anxiety disorder, post-traumatic stress disorder, panic disorder, major depressive disorder.

c) *Health trends.* Data on body mass index, current or remote history of smoking, alcohol and substance use were obtained from the inpatient or outpatient visit nearest to June 1, 2016.

d) *Medications.* Antidepressant medications included selective serotonin reuptake inhibitors/serotonin and norepinephrine reuptake inhibitors. Cardiovascular drug therapies recorded as of June 1, 2016 included any ARBs, and ACE inhibitors, beta-blockers, statins, calcium channel blockers, anticoagulation and Aspirin/antiplatelet therapy. Data regarding device indication (primary vs. secondary prevention) were not available for this analysis.

Voter Registration Records

Voter registration records are publicly available and updated weekly by the North Carolina State Board of Elections. Current and historic voter registration files can be accessed at: https://www.ncsbe.gov/results-data/election-results. The November 8, 2016 was accessed for this study (current as of the day of the election).

DATA EXTRACTION AND LINKAGE PROCEDURES

Automated computer algorithms and standard methodology[22,37] were used to abstract demographic and clinical information from the Carolina Data Warehouse. No data were manually abstracted from the electronic medical record or charts. Device data were deterministically linked to clinical data with medical record numbers (MRNs) and device ID/serial numbers. We then linked these data to voter registration records with personal identifiers that are contained in the publicly available voter files (name, sex, address, zip code). Linked records were required to match on at least 3 identifiers to be included in the analysis.

Table S1. Incidence Ratios for Supraventricular Arrhythmias During the 2016 U.S Presidential Election.

	IRR and 95%CI	P-value
Period (control period reference group)	1.82 (1.36-2.43)	< 0.001
Age (in decades)	1.00 (0.89-1.11)	0.931
Sex (male reference group)	1.02 (0.77-1.36)	0.884
Race/Ethnicity* (white reference group)	1.51 (1.09-2.08)	0.013
Time since diagnosis (years)‡	0.83 (0.78-0.89)	<0.001
Device type (pacemaker reference group)	0.66 (0.47-0.93)	0.018
Congestive heart failure	0.83 (0.63-1.09)	0.172
Hypertension	0.60 (0.43-0.84)	0.003
Coronary artery disease	1.45 (1.03-2.03)	0.031
Chronic kidney disease	0.85 (0.51-1.42)	0.529
Diabetes Mellitus	1.04 (0.66-1.64)	0.850
AF/atrial flutter	1.83 (1.36-2.47)	< 0.001
LVAD	1.85 (0.57-5.98)	0.305
Antiarrhythmics medications	1.27 (0.92-1.74)	0.150
Beta Blocker medications	0.85 (0.57-1.27)	0.433
Prior anxiety or depressive disorder	1.04 (0.61-1.77)	0.883

Listed values may include multiple arrhythmic events within a single patient and are controlled for by the analysis. A composite variable was created for any prior diagnoses of anxiety and depressive disorders: generalized anxiety disorder, post-traumatic stress disorder, panic disorder, major depressive disorder. Since Abbott devices do not discriminate between non-sustained events (supraventricular vs. ventricular), persons with these devices were excluded from analyses of composite outcomes.

Table S2. Incidence Ratios for Ventricular Arrhythmias During the 2016 U.S Presidential Election.

	IRR and 95%CI	P-value
Period (control period reference group)	1.60 (1.22-2.10)	<0.001
Age (in decades)	0.94 (0.85-1.03)	0.194
Sex (male reference group)	0.91 (0.67-1.23)	0.527
Race/Ethnicity* (white reference group)	1.38 (1.03-1.85)	0.032
Time since diagnosis (years)‡	1.11 (1.07-1.15)	<0.001
Device type (pacemaker reference group)	2.35 (1.59-3.48)	<0.001
Congestive heart failure	0.71 (0.49-1.04)	0.077
Hypertension	0.99 (0.70-1.39)	0.932
Coronary artery disease	0.86 (0.60-1.22)	0.392
Chronic kidney disease	1.32 (0.74-2.36)	0.343
Diabetes Mellitus	0.69 (0.41-1.17)	0.171
AF/atrial flutter	1.23 (0.93-1.62)	0.143
LVAD	7.03 (2.89-17.12)	<0.001
Antiarrhythmics medications	1.15 (0.80-1.67)	0.455
Beta Blocker medications	1.13 (0.73-1.74)	0.576
Prior anxiety or depressive disorder	0.68 (0.40-1.16)	0.161

Listed values may include multiple arrhythmic events within a single patient and are controlled for by the analysis. A composite variable was created for any prior diagnoses of anxiety and depressive disorders: generalized anxiety disorder, post-traumatic stress disorder, panic disorder, major depressive disorder. Since Abbott devices do not discriminate between non-sustained events (supraventricular vs. ventricular), persons with these devices were excluded from analyses of composite outcomes.

Table S3. Characteristics of the Study Population According to Political Affiliation.

	Democrat (n =564)	Republican (n =328)	Unaffiliated (n =219)	P-value
Demographics				
Age (years)‡	73.5 ± 11.4	72.7 ± 10.3	69.9 ± 13.6	0.001
Male	302 (53.5%)	226 (68.9%)	151 (68.9%)	<0.001
Race/Ethnicity*				
White/Caucasian	350 (62.1%)	319 (97.6%)	192 (87.7%)	
Black	190 (33.7%)	2 (0.6%)	16 (7.3%)	
Hispanic	0	0	1 (0.5%)	
Other	24 (4.3%)	6 (1.8%)	10 (4.6%)	
Employment status (retired)	401 (75.4%)	231 (74.8%)	143 (69.4%)	0.242
Device				
Pacemaker (ICD as referent group)	281 (49.8%)	167 (50.9%)	105 (47.9%)	0.792
Left ventricular assist device	4 (0.7%)	0	2 (1.0%)	0.24
Time since implant (years)‡	3.28 (±3.35)	3.34 (±3.37)	2.95 (±2.64)	0.339
Clinical history				
Hypertension	325 (60.1%)	219 (69.3%)	133 (64.3%)	0.024
Previous myocardial infarction	179 (33.1%)	141 (44.6%)	86 (41.5%)	0.002
Congestive heart failure	275 (50.8%)	152 (48.1%)	98 (47.3%)	0.599
Coronary artery disease	183 (33.8%)	145 (45.9%)	90 (43.5%)	0.001
Diabetes mellitus	89 (16.5%)	61 (19.3%)	34 (16.4%)	0.534
Obstructive sleep apnea	51 (9.4%)	27 (8.5%)	17 (8.2%)	0.871
Stroke/TIA	36 (6.7%)	21 (6.6%)	14 (6.8%)	1.000
Lipid disorders	129 (23.8%)	93 (29.4%)	51 (24.6%)	0.184
Peripheral vascular disease	46 (8.5%)	31 (9.8%)	15 (7.2%)	0.609
Valvular heart disease	68 (12.6%)	32 (10.1%)	18 (8.7%)	0.273
Chronic kidney disease	45 (8.3%)	26 (8.2%)	18 (8.7%)	0.978
COPD	59 (10.9%)	33 (10.4%)	21 (10.1%)	0.973
Arrhythmias and Conduction Defects				
Atrial fibrillation/atrial flutter	250 (46.2%)	162 (51.3%)	93 (44.9%)	0.257
Prior sudden cardiac arrest	8 (1.5%)	9 (2.8%)	3 (1.4%)	0.371
Medications				
ACE-inhibitor or ARB	389 (69.0%)	211 (64.3%)	143 (65.3%)	0.310
Beta-Blocker	450 (79.8%)	265 (80.8%)	173 (79.0%)	0.874
Statin	372 (66.0%)	223 (68.0%)	150 (68.5%)	0.737
Calcium channel blockers	205 (36.3%)	89 (27.1%)	55 (25.1%)	0.001
Anti-Arrhythmic	120 (21.3%)	79 (24.1%)	46 (21.0%)	0.573
Anticoagulation	297 (52.7%)	150 (45.7%)	104 (47.5%)	0.107
Antiplatelet agent/Aspirin	415 (73.6%)	227 (69.2%)	157 (71.7%)	0.374

Antidepressant[†]	162 (28.7%)	74 (22.6%)	66 (30.1%)	0.072
Lifestyle factors				
Body mass index (BMI)[‡]	29.85 ± 6.25	29.97 ± 6.94	29.57 ± 6.24	0.790
Alcohol abuse	1 (0.2%)	1 (0.3%)	2 (1.0%)	0.320
Drug abuse	3 (0.6%)	2 (0.6%)	4 (1.9%)	0.205
Smoking status				
Current	33 (5.9%)	21 (6.6%)	12 (5.8%)	
Former	239 (43.1%)	159 (50.2%)	107 (51.7%)	
Never	283 (51.0%)	137 (43.2%)	88 (42.5%)	
Psychiatric comorbidities				
Major depressive disorder	29 (5.4%)	16 (5.1%)	20 (9.7%)	0.071
Prior anxiety or depressive disorder[§]	32 (5.9%)	21 (6.6%)	21 (10.1%)	0.128

Listed values are for patients with linked voter registration data (n=1,111) from the day of the election (November 8, 2016). All demographic and clinical data were recorded in the EHR prior to the start of the study period (June 1, 2016). ICD = implantable cardioverter defibrillator; TIA = transient ischemic attack; COPD = chronic obstructive pulmonary disease; ACE = angiotensin converting enzyme; ARB = angiotensin receptor blocker.

[‡] Data are presented as mean ± standard deviation (SD).

*Data missing: race/ethnicity n=7 (0.3%).

[†]Antidepressant medications include selective serotonin reuptake inhibitors/serotonin and norepinephrine reuptake inhibitors.

[§]A composite variable was created for any prior diagnoses of anxiety and depressive disorders: generalized anxiety disorder, post-traumatic stress disorder, panic disorder, major depressive disorder.

Table S4. Sensitivity Analyses with Binary Arrhythmia Outcomes: Relative Risk of Arrhythmias During the Hazard Period and 2016 Control Period.

	Total number of events		RR (95% CI)	P-value
	Hazard Period	Control Period		
All arrhythmias	655	472	1.39 (1.22-1.57)	<0.001
Supraventricular arrhythmia	273	188	1.45 (1.18-1.79)	<0.001
Ventricular arrhythmia	465	335	1.39 (1.19-1.62)	<0.001

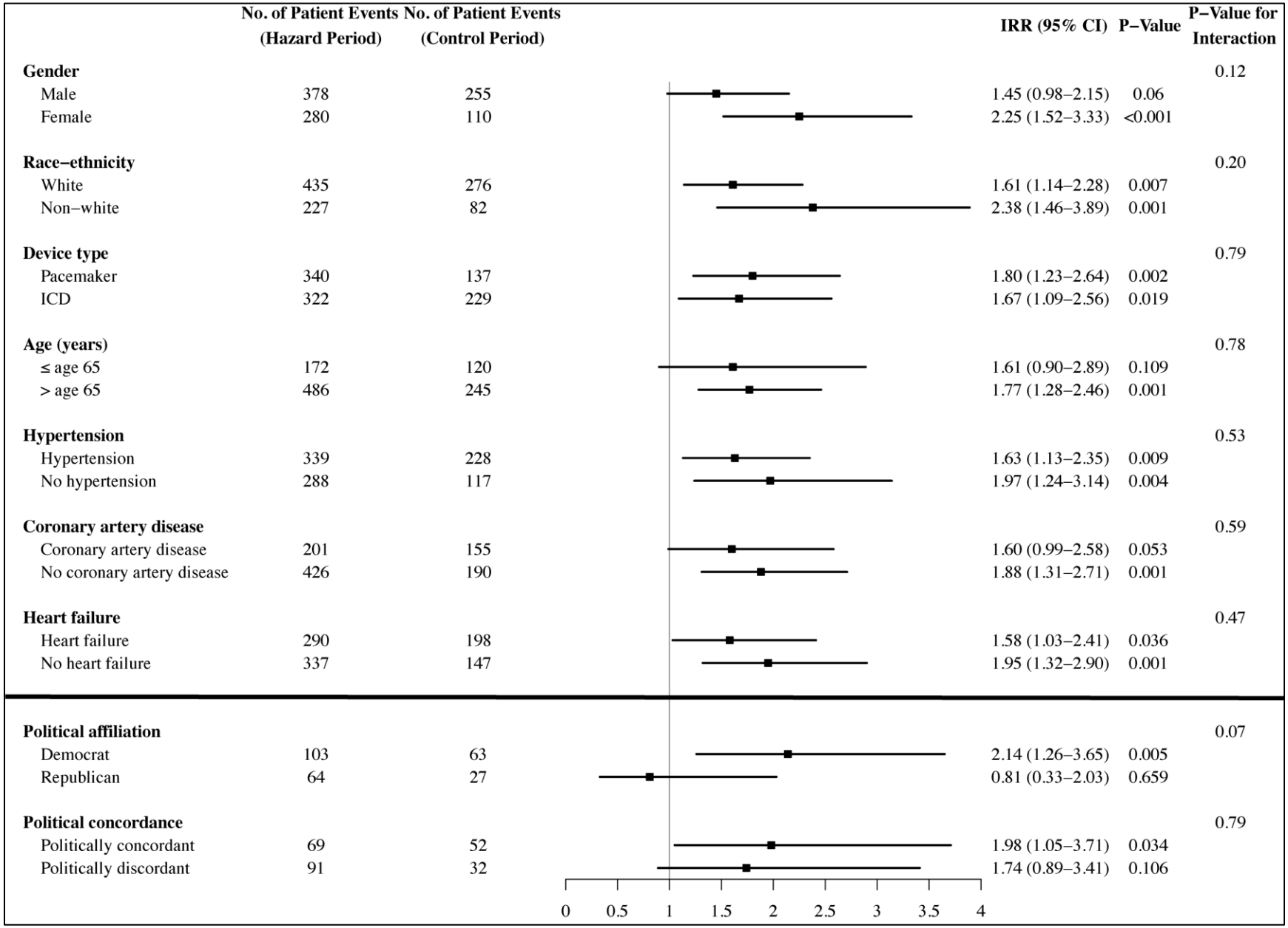
To assess the robustness of the primary findings, we modeled the risk of arrhythmia as a binary (instead of a continuous) outcome using the Mantel-Haenszel method to determine the relative risk (RR) of arrhythmias during the hazard period compared to the control period. Estimates were not adjusted for baseline variables. Definition of composite outcomes: supraventricular arrhythmias (AF and SVT), ventricular arrhythmias (NSVT and VT/VF), and device therapy administered (ATP and ICD shocks). Since Abbott devices do not discriminate between non-sustained events (supraventricular vs. ventricular), persons with these devices were excluded from analyses of composite outcomes.

Table S5. Sensitivity Analyses with Binary Arrhythmia Outcomes: Relative Risk of Arrhythmias During the Hazard Period and 2015 Control Period.

	Total number of events		RR (95% CI)	P-value
	Hazard Period	Control Period		
All arrhythmias	175	136	1.29 (1.04-1.59)	0.019
Supraventricular arrhythmia	45	26	1.73 (1.03-2.89)	0.036
Ventricular arrhythmia	148	123	1.20 (0.95-1.53)	0.127

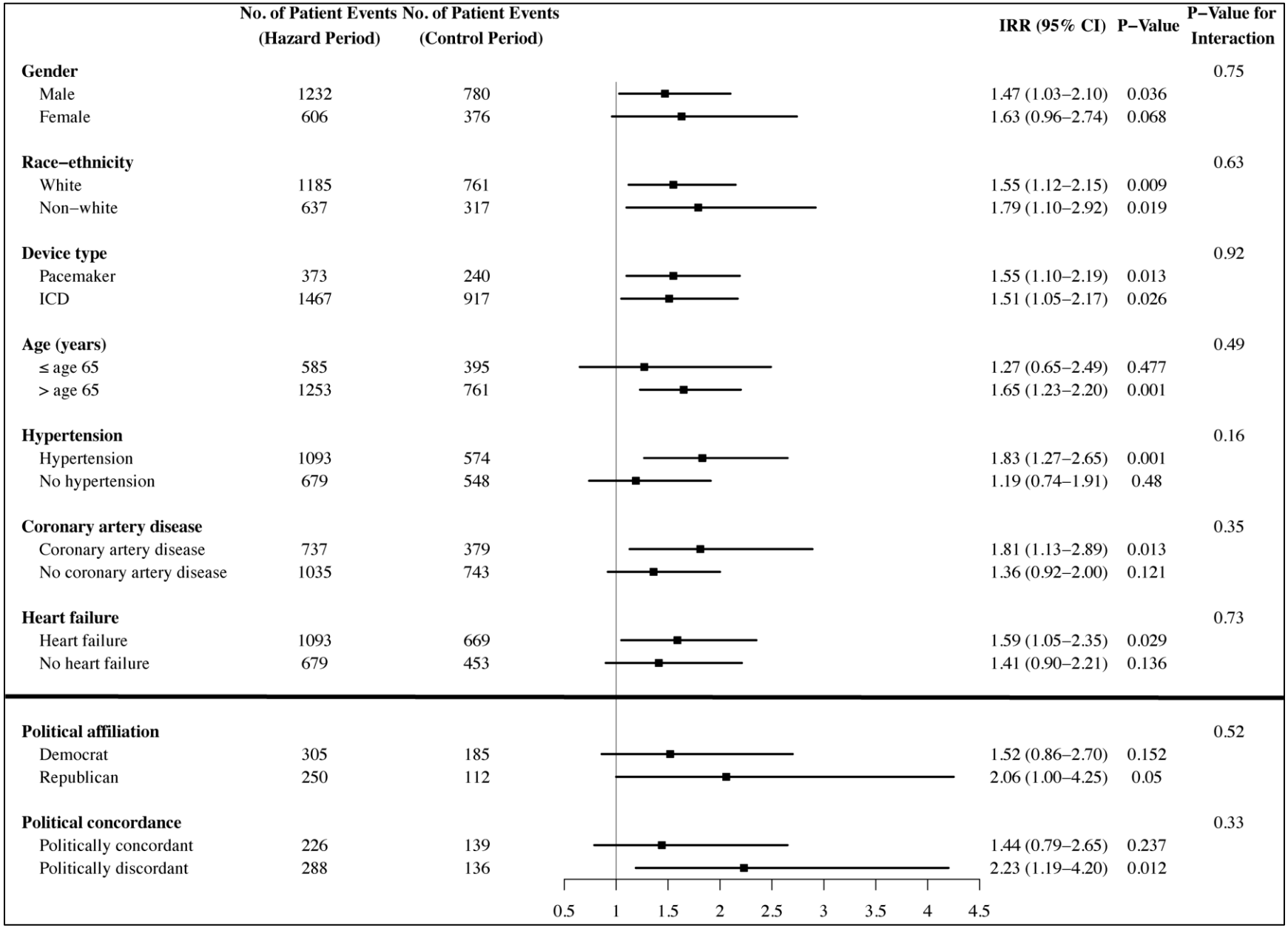
To ensure that results were not attributable to differences in temperature and season, we performed a sensitivity analysis in a subgroup of patients with Boston Scientific devices (n = 460) who had complete device data during the hazard period (October 25, 2016 to December 6, 2016) and the same time-period one year prior to the presidential election (October 25, 2015 to December 6, 2015). Continuous device data one year prior to the election were not available for Medtronic or Abbott devices. Relative risk (RR) estimates were not adjusted for baseline variables. Definition of composite outcomes: supraventricular arrhythmias (AF and SVT) and ventricular arrhythmias (NSVT and VT/VF).

Figure S1. Subgroup Analyses for Supraventricular Arrhythmias During the 2016 Presidential Election.



Subgroup analyses for gender, race/ethnicity, device type, age, hypertension, coronary artery disease and congestive heart failure were performed with data from the entire cohort (n=2,436). Subgroup analyses for political affiliation and political concordance were limited to persons with matched voter registration data (n=1,111). Listed values may include multiple arrhythmic events within a single patient and are controlled for by the analysis. Incidence ratios were not adjusted for baseline variables. Composite outcomes include: supraventricular arrhythmias (AF and SVT) and ventricular arrhythmias (NSVT and VT/VF). Since Abbott devices do not discriminate between non-sustained events (supraventricular vs. ventricular), persons with these devices were excluded from analyses of composite outcomes.

Figure S2. Subgroup Analyses for Ventricular Arrhythmias During the 2016 Presidential Election.



Subgroup analyses for gender, race/ethnicity, device type, age, hypertension, coronary artery disease and congestive heart failure were performed with data from the entire cohort (n=2,436). Subgroup analyses for political affiliation and political concordance were limited to persons with matched voter registration data (n=1,111). Listed values may include multiple arrhythmic events within a single patient and are controlled for by the analysis. Incidence ratios were not adjusted for baseline variables. Composite outcomes include: supraventricular arrhythmias (AF and SVT) and ventricular arrhythmias (NSVT and VT/VF). Since Abbott devices do not discriminate between non-sustained events (supraventricular vs. ventricular), persons with these devices were excluded from analyses of composite outcomes.

Figure S3. Sensitivity Analysis for AF Burden During the 2016 U.S Presidential Election Compared to the Same Time-Period One Year Earlier.