The Impact of the 2016 US General Election on Adult Sleep in Seattle, WA

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Abstract

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Objectives: This study used data from an ongoing sleep study to assess whether the sleep of adults in Seattle, WA was affected by the US general election in November 2016. Furthermore, this study assessed whether any observable difference in sleep was moderated by family race, participant age, or study arm. **Methods:** Fixed effects multilevel regression models were used to analyze time period as a predictor of sleep duration and sleep onset latency within participants as well as after stratifying by race, age group, study arm, and study arm X race. Season was included as a time-varying covariate. **Results:** Study participants slept 8.8 minutes (95% CI 1.6 to 16.0) less per night in the post-election period between November 8, 2016 and February 28, 2017 as compared to the baseline period of October 14, 2014 – June 30, 2016, after controlling for seasonal effects. Sleep loss was most pronounced in the youngest group (ages 24-32): 21.7 minutes (95% CI 1.2 - 42.1) less in the post-election period than during baseline. We also observe a trend towards increased sleep loss among those who identify as US underrepresented minorities; however, these results were not statistically significant (p = 0.16). Importantly, the intervention appears to have a protective effect against the loss of sleep incurred around the election; the control group lost more sleep than the intervention group, 11.6 minutes (95%CI 0.6 to 22.6) as compared to 6.9 minutes (95% CI +2.8 to -16.5). **Discussion:** This study suggests that large scale political events have an impact on adult sleep in the short term, an effect which can be buffered somewhat by family-centered sleep health interventions.

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Introduction

Sleep has been linked to multiple health outcomes, for both children and adults. In recent decades, as average nightly sleep has decreased,[1,2] interest has grown in sleep as an important determinant of various health outcomes. Sleep has short-term impacts, including injury risk,[3–7] attention, cognition and memory,[8–13] mood regulation,[9,14–17] and immune function.[18–20] Studies have also linked poor sleep quality or inadequate sleep duration to a range of long-term ill health effects, including all-cause mortality,[21–23] stroke,[24] coronary heart disease,[25] obesity,[26] and diabetes.[27,28] Parent sleep impacts parent well-being[29–33] as well as family functioning and parenting practices.[33–35]

Numerous factors are known to affect individual sleep, ranging from light exposure and smartphone use to food intake and air temperature.[36–41] A range of medical conditions and symptoms, including pain,[42] depression,[43,44] restless legs syndrome,[45] and breathing problems,[46–48] can also affect sleep. Additionally, psychosocial variables have a significant impact on sleep;[49] shift work and stress negatively impact individual sleep, while social support and familial relationships may have a positive effect on sleep quality and duration.[50–56] The impact of historical and political events on individual sleep is less well studied. In one important exception, Anýž et. al. conducted an analysis using data from *Sleep as Android*, an accelerometry-based sleep application, and found that users of the application in the United States slept on average nearly 13 minutes less on the night following the 2016 election.[57] Using the same methodology, they found a 16 minute 21 second drop in average sleep of British users the night after the Brexit poll.[57] This suggests strongly what has also been widely posited anecdotally, that people lose sleep thinking, reading, worrying, and communicating about larger social, political, and natural events.

The route by which these wider public events influence sleep may be manifold (see Figure 1). Public events influence public mood, the "diffuse affective state, having distinct positive and negative components that citizens experience because of their membership in a particular political community"[57–60] (Rahn p. 29). Public mood affects both individual mood[61] as well as news and media consumption.[62] News consumption and social media use are linked to individual mood, including to increases in anxiety, depression, and insomnia.[63,64] News and social media also affect sleep directly because some of the time people spend on social media is taken from sleep; social media use is linked to shortened sleep duration and later onset, and insomnia.[65–67,64,63] Evidence also is substantial that public events influence individual mood directly, and that these effects vary depending upon the social position of the individual.[61,68–72] For instance, Bor et al found that police killings of Black Americans have a negative impact on the mental health of Black Americans in the 1-2 month period after the killing.[68] The same negative impact is not seen in white Americans. Studies have shown that the 2016 U.S. election specifically had an impact upon individual mood; it was associated with increased stress and anxiety.[61,70,72] The charged and inflammatory nature of the Trump campaign were likely to be related to higher levels of stress, rumination, and anxiety in those targeted by his attacks, and those most vulnerable to his proposed policies, including immigrants, racial minorities, LGBTQ+ people, and people living with disabilities.[70,72] Individual mood, in turn, is associated both positively and negatively with sleep duration, onset, and insomnia[73–77]; stress, anxiety, and trauma in particular are negatively associated with healthy sleep.[50,51,55,56,60,72,78–80]

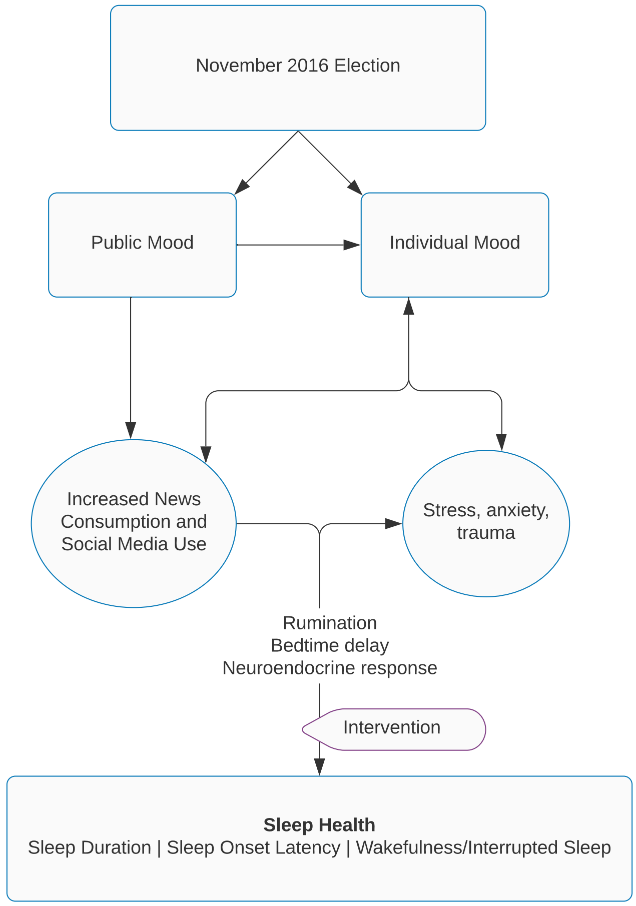

Figure 1: Conceptual model

The objective of this study is to contribute to our understanding of the impact of large-scale political and social events on adult sleep patterns, which are an important physiological indicator of both individual wellbeing and population behavior. We had an interesting opportunity to look at this phenomenon in more detail in Seattle, WA because a randomized controlled trial of a sleep intervention was ongoing at the time of the 2016 election. This provided an opportunity to explore whether these external political events could have an impact on individual sleep. Furthermore, this natural experiment allowed us to examine whether the intervention program itself, which was aimed at sleep health in children and adults, had a buffering effect against any negative impact on sleep in and after November 2016. This is of particular import if the impact of these events is exacerbating existing sleep health disparities. We know that sleep health corresponds with social determinants of health, and that the impact of political events and natural disasters is likewise felt unevenly. If sleep interventions can mediate the negative impact of large events, particularly on more vulnerable populations, that has important implications for community resilience, as well as intervention and policy design. Drawing upon data from self-reported sleep diaries collected in Seattle, Washington between 2014 and 2019, this study focuses on two primary questions: 1) Do the events of 8 November 2016 (the US election) show any impact on adult sleep when we compare the months leading up to the election and the months immediately after the election to the periods before and after these time periods? And 2) Are these effects moderated by family race, parent age, or intervention study arm?

Methods

Study Setting and Population

The Sleep Health in Preschoolers (SHIP) study is a longitudinal randomized controlled trial (RCT) of the Seattle Children's Research Institute. Parent-child dyads were recruited from the Seattle area on a rolling basis from 2014-2017, with follow-up still ongoing. The study aims to examine the impact of a sleep intervention delivered over the course of three years on child and parent sleep as well as a range of health and behavior indicators; participating families were randomly allocated to either the SHIP sleep intervention or to an active control intervention targeting oral health, child safety, and environmental health. Both study arms are included in these analyses.

Participants were recruited for the SHIP study using flyers, message boards, and advertisements in doctors' offices, community centers, childcare centers, and churches. Postings were also placed in local parenting magazines and on social media including Facebook and Twitter. Researchers aimed for a demographic sample that was representative of Seattle's racial, age, and socioeconomic makeup. Eligible families needed to have a child between the ages of 2y6m and 5y11m who screened positive on the Child Sleep Habits Questionnaire (CSHQ); family structure was not restricted, though multiple-caregiver/parent households chose one caregiver to enroll in the study, attend all intervention sessions (although other caregivers could attend as well if they chose), and complete study assessments. Children were excluded if they screened positive for untreated sleep-disordered breathing on the CSHQ, or had other co-morbid conditions that may impact sleep (i.e. cancer, diabetes, ADHD, developmental disabilities). Participants were also excluded if they did not feel comfortable speaking and reading English, as the intervention was not available in other languages at the time.

Intervention

After establishing consent, baseline assessments of both the parent and child were conducted. The intervention was implemented over the course of 12 months by trained case managers who contacted families through an initial home visit and follow-up phone calls. In the first three months (the active phase of the intervention), case managers educated parents in the intervention group about sleep, and helped them set goals and problem-solve how to improve their child's sleep. In the maintenance phase (months 3 to 12), case managers contacted parents monthly to provide additional support and sleep skills management. Families in the control arm received the same intensity, frequency, and format of contact, but with an active control intervention targeting improved oral health, child safety, and environmental health instead of child sleep.

Data Collection

Data collected from the study included one-week parent-report diaries to prospectively capture child and parent sleep timing and related behaviors at study entry and 3, 12, 24, and 36 months later. Given the rolling enrollment and the multiple diary timepoints, this paper was able to utilize diary data from October 2014 to August 2019 in addition to baseline survey data, with participants contributing data at various times depending on their date of enrollment. Parent sleep items in the diary utilized for this analysis include: "what time did you start trying to fall asleep?" "What time did you fall asleep last night?" And "this morning, what time did you wake up for the day?"

Study Variables

Dependent Variables: Sleep outcomes

Sleep duration and sleep onset latency (SOL, the time between going to bed and falling asleep) were the primary outcomes. These were calculated based upon the diary answers given by participants; data was reshaped so that each day was a single data point, rather than using a mean of the entire week's diary entries. Times were recorded as decimals to ease in calculation (so 10:30pm was recorded as 22.50). Duration was defined as the difference between time awake and time asleep; latency was defined as the difference between time asleep and time to bed. Data were cleaned for entry errors and am/pm errors. No imputation was used for missing data. However, sleep diary data is generally considered valid report if at least 5 days of data were available, and 94.9% of diary cycles had at least 5 diary days with parent sleep information completed.

Independent Variables: Calendar time

Data were grouped into four time periods based on calendar time as follows:

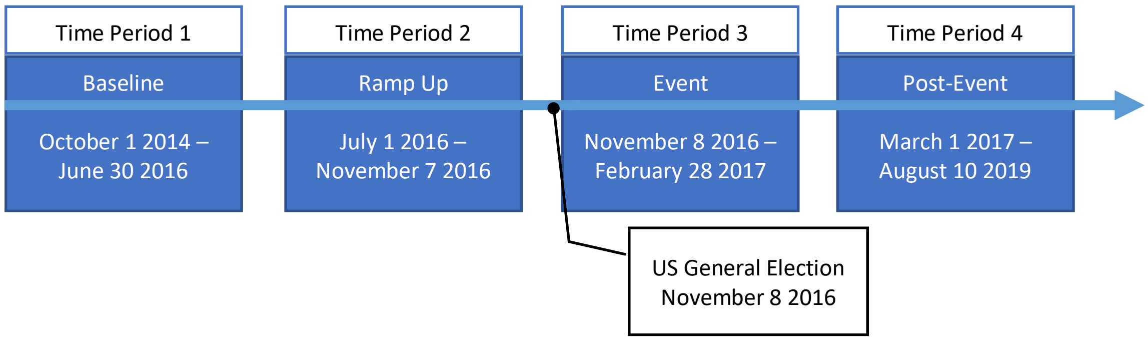

Figure 2: Time period groupings

We did not do a simple pre- post- analysis for several reasons. First, the run-up to the 2016 election was itself quite contentious, and we hypothesized that it may have had an impact on sleep even prior to election day. Second, and relatedly, we assumed that if there were an effect on sleep, although it might be most acute on 8 November, it would persist into the following weeks and months. Furthermore, we did not have enough data points on November 8 to see a measurable effect on that day itself, or in the week following. The number of data points and of individuals contributing data was also important to the division of the time periods.

Time Varying Covariates

Season has a large effect on sleep,[81–83] particularly in an area of high latitude like Seattle, where differences in summertime and wintertime daylight hours can be extreme. We therefore controlled for season by adding the absolute value of the number of days from the summer solstice as a time-varying covariate in our model.

Effect Moderators

To answer our secondary questions, we created strata of parent/child race (underrepresented minority (URM) vs not), parent age, and study arm. If either the respondent parent or the enrolled child (the other parent, siblings, grandparents and other affines were not taken into account) identified as African American, Latinx/Hispanic, and/or Alaska Native/American Indian on the baseline survey they were categorized as a URM. These categories were not exclusive; more than one answer could be selected. If a respondent selected a URM category in addition to white and/or Asian, they were included in the URM group. Non-URM families are those who selected only white and/or Asian (Table 1).

We calculated the primary parent/respondent's age in 2016. We hypothesized that younger parents might be more likely to lose sleep due to higher rate of social media use, therefore, we categorized parents as 32 years and under, those 33-39 years old, and those 40 years old and above.

To examine whether the sleep intervention had a protective effect against any sleep disturbance associated with the election, we stratified participants by study arm (yes, received the intervention/no, did not). Because our literature review indicated that any sleep disturbance might be more extreme in vulnerable populations, we also stratified by both study arm and URM status to do an exploratory analysis to see whether the intervention might have any buffering effect against this disparity.

Table 1: Data Distribution

	All time periods	1: Baseline Oct 1 2014 - Jun 30 2016	2: Ramp-up Jul 1 2016 – Nov 7 2016	3: Event Nov 8 2016 – Feb 28 2017	4: Post-event Mar 1 2018 – Aug 10 2019
All Participants					
Individual Participants	430	241	129	147	322
Days of data	10,212	3278	826	1030	5120
Ages 21-32					
Individual Participants	76	38	23	24	62
Days of data	1651	579	218	261	1394
Ages 33-39					
Individual Participants	227	125	62	83	177
Days of data	5547	1889	484	681	3302
Ages 40 and above					
Individual Participants	90	66	27	29	61
Days of data	2173	1162	206	302	1306
URM					
Individual Participants	73	40	26	29	55
Days of data	1732	548	198	205	910
Non-URM					
Individual Participants	350	198	89	118	265
Days of data	8327	2772	642	839	4266
Intervention Group					
Individual Participants	211	121	60	74	162
Days of data	5249	1662	445	524	2707
Control Group					
Individual Participants	212	120	55	73	160
Days of data	4810	1616	381	506	2413

Analysis

All analyses were conducted using the statistical software Stata. To assess the relationship between time period and sleep characteristics, we began by running two multilevel models: time period as a predictor of sleep duration and sleep onset latency for all participants. Time was specified as a categorical variable, with period 1 (October 1 2014 to June 30 2016) set as the referent period. Participants contributed data to multiple time periods and, because a person's sleep in one period is not independent from their own sleep in another period, our multilevel models included a fixed effect for person to account for this non-independence of our observations. Relatedly, because of the cross over analyses used by fixed effects models, participants who only contributed to one time period do not contribute to the final analysis. As stated above, season as absolute value of days from the summer solstice was included as a continuous covariate. To answer our study's secondary questions, we then stratified by family race, parental age, and study arm and again examined time period as a predictor of sleep duration and sleep onset latency (SOL). Last, we stratified by study arm plus family race and again modeling the relationship between time and sleep duration. Although our study was likely underpowered to observe a three-way relationship, we planned this as an exploratory analysis to explore whether and for whom the intervention offered a protective effect. Days for which a sleep duration or sleep latency could not be calculated (I.E. the respondent did not enter time to bed, time asleep, and/or time awake) were deleted (n=466 days). We found no evidence that these errors occurred in a systematic way.

Results

Descriptive Statistics

Because our sample was drawn from a parent-child study, all of our participants were parents of young children, the mean age was 36, and our sample was predominately female (94%) and married (94%). The sample skews somewhat white and educated relative to Seattle's demographic makeup (Table 2).

Table 2: Participant demographics

Participant demographics	%
Female	95
Parent age in years in 2016	
Median (IQR)	36 (33-39)
Age Quintile	
< 33	20
33-34	15
35-36	19
37-39	23
> 40	23
Highest education	
High school diploma/GED	6
2-year degree	10
4-year college degree	39
Graduate or professional degree	45
Annual Income	
Less than $50k	9
$50-75k	12
$75-100k	18
>$100k	60
Parent Race/Ethnicity*	
White	86
Black	1
Latinx/Hispanic	6
Asian	10
Pacific Islander/Native Hawaiian	1
American Indian/Alaska Native	2
Other	2
No answer	1
Child race/ethnicity*	
White	88
Black	4
Latinx/Hispanic	9
Asian	16
Pacific Islander/Native Hawaiian	2
American Indian/Alaska Native	3
No answer	2
Household Composition	
Respondent Marital Status	
Single	2
Married/Partnered	94
Divorced	2
In a relationship, not married/partnered	1
Widowed	0
Number of children in household (mean)	1.9

430 individual participants contributed 10,212 days of data to our analysis, averaging 23.7 days of data per person, these days being spread over at least two time periods. Our smallest time period, Ramp-up, has 826 individual days of data, contributed by 129 participants (Table 1). All 430 participants are included in the Table 1 results; none were deliberately or systematically excluded from the analysis. However, as stated above, participants who contributed data to only one time period were excluded from the fixed effects model. The mean sleep duration across all participants for the duration of the study under investigation was 7.62 hours (SD 1.34). For most participants, sleep duration declined during ramp up and event, and rose again in the post-event period. See Figure 3; Table 5 in the appendix contains descriptive data in more detail.

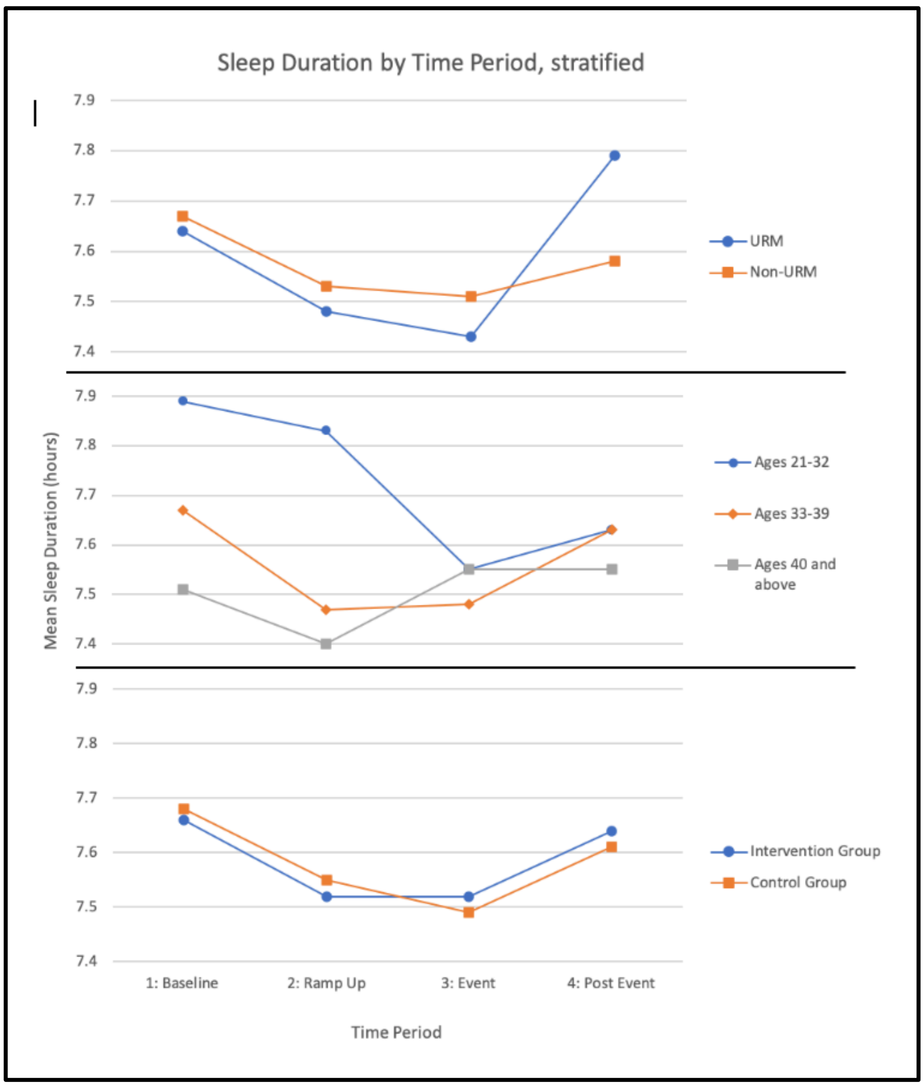

Figure 3: Sleep duration

Figure 3 shows that sleep declined on average during Periods 2 and 3, and that this decline was more pronounced in younger participants who went from sleeping an average of 7 hours and 53 minutes during the baseline to just 7 hours and 33 minutes in Period 3. This figure also shows that those who identified as an underrepresented minority lost more sleep as compared to white and/or Asian participants and suggests that the intervention may have had a buffering effect against sleep loss. It also shows that all groups recovered to various degrees in the Post-Event Period (after February 2017), suggesting that large-scale events can have an acute, measurable impact on sleep, which then normalizes. This is similar to what other studies have found, for instance, in the wake of natural disasters.[69,71,84]

Regression Analysis

The results above are descriptive and based on aggregate, unadjusted data. The trend we see there is clarified by the regression analysis. Based on this analysis, after controlling for seasonal effects, we found that study participants slept 8.8 minutes less per night in the period between November 8, 2016 and February 28, 2017 (Event) as compared to Baseline (October 14, 2014 – June 30, 2016) (95% CI 1.6 – 16.0). We saw no impact on sleep onset latency in the analysis.

Table 3: Regression Results, all participants

Dates	Period	Difference in sleep compared to baseline, in minutes (95% CI)	p-value
Jul 1 2016 - Nov 7 2016	Ramp-up	-1.7 (-8.5 – +5.1)	0.62
Nov 8 2016-Feb 28 2017	Event	-8.8 (-16.0 – -1.6)	0.02
Mar 1 2017-Dec 31 2018	Post	-0.5 (-7.9 – +6.9)	0.89

Stratifications

As the descriptive results suggested, underrepresented minorities lost more sleep during the months after the election as compared to participants who identified as white and/or Asian: 12.0 minutes (95% CI -28.8 – +4.8) as compared to 8.2 minutes (95% CI -16.2 – -0.1). In real terms, this means that the average URM participant slept 7 hours and 26 minutes per night in the months following the election, compared to 7 hours and 38 minutes just a few months before. The wide confidence interval for the URM group is most likely due to the small sample size for that grouping (73 participants, 1,732 days of data).

When we stratified by parent age, we did indeed see the strongest effect in the youngest group. Those 32 years of age and under lost the most sleep of any group in the months following the election: 21.7 minutes (p-value 0.04, 95% CI -42.1 – -1.2). Those in the middle, and largest, group (ages 33-39) lost 9.6 minutes of sleep (p-value 0.05, 95% CI -19.3 – 0.0), while those in the oldest group, 40 years of age and up, lost 7.4 minutes (p-value 0.35, 95% CI -22.9 – +8.0).

The intervention did seem to have a protective effect against the loss of sleep incurred around the election. Those participants not receiving the sleep intervention lost, on average, 11.6 minutes (95% CI -22.6 – -0.6) after the election, while their fellows who were receiving the intervention, lost 6.9 minutes (95% CI -16.5 – +2.8). Importantly, this gulf between intervention and control widened for underrepresented minorities, although again, because of the small sample size, this analysis was exploratory in nature and results are merely suggestive of a relationship. URMs receiving the intervention lost 8.1 minutes of sleep (95% CI -30.1 – +13.9) while those in the control group lost twice that, 16.7 minutes (95% CI -42.9 – +9.6).

Table 4: Regression Results, stratified

Participants | Time		Difference in sleep duration from baseline, minutes (95% CI)	p-value
Ages 21-32			
Jul 1 2016 - Nov 7 2016	Ramp-up	+1.9 (-14.3 – +18.1)	0.82
Nov 8 2016-Feb 28 2017	Event	-21.7 (-42.1 – -1.2)	0.04
Mar 1 2017-Dec 31 2018	Post	-10.3 (-28.8 – +8.1)	0.27
Ages 33- 39			
Jul 1 2016 - Nov 7 2016	Ramp-up	-11.3 (-20.6 – -1.9)	0.02
Nov 8 2016-Feb 28 2017	Event	-9.6 (-19.3 – 0.0)	0.05
Mar 1 2017-Dec 31 2018	Post	-2.8 (-12.9 – +7.4)	0.59
Ages 40 and above			
Jul 1 2016 - Nov 7 2016	Ramp-up	+8.4 (-6.3 – +23.1)	0.27
Nov 8 2016-Feb 28 2017	Event	-7.4 (-22.9 – +8.0)	0.35
Mar 1 2017-Dec 31 2018	Post	-0.3 (-16.6 – +15.9)	0.97
URM			
Jul 1 2016 - Nov 7 2016	Ramp-up	+7.2 (-8.0 – +22.7)	0.35
Nov 8 2016-Feb 28 2017	Event	-12 (-28.8 – +4.8)	0.16
Mar 1 2017-Dec 31 2018	Post	+18.8 (+0.4 – +37.1)	0.05
Non-URM			
Jul 1 2016 - Nov 7 2016	Ramp-up	-3.4 (-11.0 – +4.3)	0.38
Nov 8 2016-Feb 28 2017	Event	-8.2 (-16.2 – -0.1)	0.05
Mar 1 2017-Dec 31 2018	Post	-5.1 (-13.3 – +3.0)	0.22
Intervention Group			
Jul 1 2016 - Nov 7 2016	Ramp-up	-6.9 (-16.0 – +2.2)	0.14
Nov 8 2016-Feb 28 2017	Event	-6.9 (-16.5 – +2.8)	0.16
Mar 1 2017-Dec 31 2018	Post	+1.3 (-8.7 – +11.2)	0.80
Control Group			
Jul 1 2016 - Nov 7 2016	Ramp-up	+3.7 (-6.6 – +14.0)	0.49
Nov 8 2016-Feb 28 2017	Event	-11.6 (-22.6 – -0.6)	0.04
Mar 1 2017-Dec 31 2018	Post	-4.4 (-15.8 – +6.9)	0.44
URMs in Intervention Group			
Jul 1 2016 - Nov 7 2016	Ramp-up	+4.0 (-15.3 – +23.3)	0.69
Nov 8 2016-Feb 28 2017	Event	-8.1 (-30.1 – +13.9)	0.47
Mar 1 2017-Dec 31 2018	Post	+21.4 (-2.9 – +45.8)	0.09
URMs in Control Group			
Jul 1 2016 - Nov 7 2016	Ramp-up	+12.8 (-12.9 – +38.4)	0.33
Nov 8 2016-Feb 28 2017	Event	-16.7 (-42.9 – +9.6)	0.21

Mar 1 2017-Dec 31 2018	Post	+15.5 (-12.3 – +43.4)	0.27
Non-URMs in Intervention Group			
Jul 1 2016 - Nov 7 2016	Ramp-up	-9.2 (-19.6 – +1.3)	0.09
Nov 8 2016-Feb 28 2017	Event	-6.3 (-17.1 – +4.4)	0.25
Mar 1 2017-Dec 31 2018	Post	-2.5 (-13.4 – +8.4)	0.65
Non-URMs in Control Group			
Jul 1 2016 - Nov 7 2016	Ramp-up	+2.2 (-9.1 – +13.4)	0.71
Nov 8 2016-Feb 28 2017	Event	-9.9 (-22.0 – +2.3)	0.11
Mar 1 2017-Dec 31 2018	Post	-8.4 (-20.8 – +4.0)	0.19

Discussion

This study adds to our understanding of the relationship between large scale events and individual sleep. We found that the 2016 US election caused adults in Seattle to lose sleep. Few other studies have specifically explored the relationship between large scale events and sleep, but anecdotal evidence suggests that in the run-up to and the wake of the US presidential election, stress, anxiety, social media use, and demand for therapy all rose.[85–90] The American Psychological Association's nationwide *Stress in America* survey, conducted throughout fall 2016 and into January 2017 found that 49% of respondents cited the outcome of the election as a significant source of stress.[85,91] Broken down by political affiliation, the same survey found that 72% of Democrats and 26% of Republicans found the election a source of stress, and adults who use social media were more likely than those who did not to say that the election was a significant source of stress (54% versus 45%).[85,91] While the average sleep loss of 8.8 minutes may seem small, as an aggregate measure across hundreds of people it indicates that some people likely lost little to no sleep while others lost more significant amounts of sleep. The Anýž et. al. study found "the ratio of short and very short sleep periods…almost doubled in the case of the US presidential election,"[57] lending credence to this notion that some people experienced significantly shorter sleep, and others less so (p. 119). This change also is spread out over several months, and since sleep durations rose during period 4 (March 1 2017 and after), presumably the effect was greater closer to the election and tapered off over time. To give additional context to the scale of difference in sleep duration that we saw, in sleep research studies examining the use of therapies to address insomnia in adults, group level differences in sleep duration are often not much more than that, typically around 15 minutes;[92–95] although in a few studies differences of 30-60 minutes have been observed.[96–98]

When we break our sample down by age and race, we can see that younger respondents and people who identified themselves or their children as US underrepresented minorities accounted for more of these minutes of lost sleep. This shows that the impact of large-scale events on various populations is likely exacerbated by unequal sleep loss. Because sleep itself is an important correlative of both mental and physical health, this impact is significant when considering policy and intervention responses to political events and, we can extrapolate, natural disasters and other incidents. Other studies have shown that the impact of the election-related stress was worse for younger adults (<30), women, those in lower socioeconomic strata, and US underrepresented minorities.[86,99]

One important limitation of the present study is that the sample was not random. Drawn from an RCT designed to study child-parent sleep in Seattle, our sample cannot claim to be representative of the general Seattle population, or certainly the US population as a whole. Seattle, as a socially and politically liberal place, was perhaps more likely to see an impact from this particular event. Similar studies from other parts of the country would offer interesting opportunities for comparison. And, more studies with broader sample populations are needed to explore these effects in more detail. However, the present study is largely suggestive of this causative relationship and, we believe, a similar relationship between other large-scale events and individual sleep is likely observable.

Another limitation is that, in testing multiple stratifications, some of the significance we found may be due to chance alone. We have not done formal interaction testing but may consider it for future work with this dataset. We consider our results exploratory and suggestive, rather than definitive. Our study suggests that the ongoing intervention had a buffering effect against the negative impact of the 2016 election on sleep for those receiving sleep health coaching and guidance. This is of importance for considering multiple and creative ways to bolster community resilience to negative events. Further research is needed to explore these impacts in more detail.

Appendix

Table 5 : Sleep Characteristics (unadjusted)

	All time periods	1: Baseline Oct 1 2014 - Jun 30 2016	2: Ramp Up Jul 1 2016 – Nov 7 2016	3: Event Nov 8 2016 – Feb 28 2017	4: Post Event Mar 1 2018 – Aug 10 2019
All participants					
Sleep duration (hrs)					
Mean (SD)	7.62 (1.34)	7.67 (1.35)	7.53 (1.33)	7.5 (1.36)	7.62 (1.32)
Median (IQR)	7.67 (6.87-8.49)	7.67 (6.92-8.50)	7.5 (6.83-8.33)	7.58 (6.75-8.33)	7.67 (6.85-8.42)
Sleep onset latency (hrs)					
Mean (SD)	0.37 (0.49)	0.37 (0.53)	0.4 (0.57)	0.43 (0.53)	0.35 (0.45)
Median (IQR)	0.25 (0.08-0.50)	0.25 (0.08-0.50)	0.25 (0.08-0.50)	0.25 (0.15-0.50)	0.25 (0.08-0.50)
Ages 21-32					
Sleep duration (hrs)					
Mean (SD)	7.71 (1.37)	7.89 (1.33)	7.83 (1.30)	7.55 (1.40)	7.63 (1.38)
Median (IQR)	7.80 (6.92-8.50)	8.00 (7.10-8.67)	7.93 (7.00-8.6)	7.50 (6.92-8.42)	7.75 (6.83-8.50)
Sleep onset latency (hrs)					
Mean (SD)	0.39 (0.47)	0.47 (0.57)	0.44 (0.50)	0.47 (0.54)	0.33 (0.39)
Median (IQR)	0.25 (0.17-0.50)	0.33 (0.17-0.50)	0.25 (0.15-0.50)	0.33 (0.17-0.50)	0.25 (0.12-0.50)
Ages 33-39					
Sleep duration (hrs)					
Mean (SD)	7.615 (1.30)	7.67 (1.31)	7.47 (1.37)	7.48 (1.27)	7.63 (1.28)
Median (IQR)	7.67 (6.92-8.41)	7.67 (7.00-8.50)	7.50 (6.67-8.33)	7.50 (6.75-8.25)	7.67 (6.92-8.41)
Sleep onset latency (hrs)					
Mean (SD)	0.37 (0.50)	0.37 (0.53)	0.37 (0.61)	0.41 (0.51)	0.35 (0.46)
Median (IQR)	0.25 (0.08-0.50)	0.25 (0.08-0.50)	0.25 (0.08-0.50)	0.25 (0.08-0.50)	0.25 (0.08-0.50)
Age 40 and above					
Sleep duration (hrs)					
Mean (SD)	7.52 (1.35)	7.51 (1.4)	7.4 (1.16)	7.55 (1.52)	7.55 (1.27)
Median (IQR)	7.56 (6.75-8.33)	7.5 (6.75-8.33)	7.5 (6.92-8.18)	7.67 (6.67-8.68)	7.58 (6.83-8.33)
Sleep onset latency (hrs)					
Mean (SD)	0.36 (0.5)	0.35 (0.53)	0.39 (0.48)	0.52 (0.64)	0.32 (0.4)
Median (IQR)	0.25 (0.08-0.5)	0.25 (0.08-0.5)	0.25 (0.08-0.5)	0.25 (0.17-0.5)	0.25 (0.08-0.5)
URM					
Sleep duration (hrs)					
Mean (SD)	7.67 (1.30)	7.64 (1.28)	7.48 (1.20)	7.43 (1.30)	7.79 (1.32)
Median (IQR)	7.70 (6.92-8.5)	7.58 (6.95-8.37)	7.50 (6.67-8.25)	7.50 (6.75-8.17)	7.83 (7-8.5)
Sleep onset latency (hrs)					
Mean (SD)	0.37 (0.53)	0.33 (0.57)	0.39 (0.45)	0.38 (0.46)	0.39 (0.53)

Median (IQR)	0.25 (0.08-0.50)	0.25 (0.08-0.37)	0.25 (0.16-0.50)	0.25 (0.83-0.50)	0.25 (0.08-0.50)
Non-URM					
Sleep duration (hrs)					
Mean (SD)	7.6 (1.34)	7.67 (1.36)	7.53 (1.35)	7.51 (1.37)	7.58 (1.31)
Median (IQR)	7.67 (6.83-8.42)	7.75 (6.92-8.5)	7.58 (6.92-8.42)	7.59 (6.75-8.33)	7.58 (6.83-8.42)
Sleep onset latency (hrs)					
Mean (SD)	0.37 (0.49)	0.38 (0.52)	0.39 (0.58)	0.43 (0.53)	0.34 (0.43)
Median (IQR)	0.25 (0.08-0.50)	0.25 (0.08-0.50)	0.25 (0.08-0.50)	0.25 (0.17-0.50)	0.25 (0.08-0.50)
Intervention Group					
Sleep duration (hrs)					
Mean (SD)	7.62 (1.33)	7.66 (1.37)	7.52 (1.27)	7.52 (1.28)	7.64 (1.32)
Median (IQR)	7.67 (6.92-8.42)	7.67 (7-8.5)	7.58 (6.92-8.25)	7.58 (6.75-8.33)	7.75 (6.92-8.50)
Sleep onset latency (hrs)					
Mean (SD)	0.36 (0.5)	0.38 (0.57)	0.43 (0.66)	0.42 (0.5)	0.33 (0.44)
Median (IQR)	0.25 (0.08-0.5)	0.25 (0.08-0.50)	0.25 (0.10-0.50)	0.25 (0.13-0.5)	0.25 (0.08-0.42)
Control Group					
Sleep duration (hrs)					
Mean (SD)	7.61 (1.34)	7.68 (1.33)	7.55 (1.40)	7.49 (1.43)	7.61 (1.32)
Median (IQR)	7.62 (6.83-8.50)	7.74 (6.86-8.50)	7.50 (6.70-8.50)	7.50 (6.6-8.42)	7.58 (6.83-8.42)
Sleep onset latency (hrs)					
Mean (SD)	0.38 (0.48)	0.37 (0.49)	0.36 (0.44)	0.44 (0.55)	0.37 (0.46)
Median (IQR)	0.25 (0.08-0.50)	0.25 (0.08-0.50)	0.25 (0.08-0.50)	0.25 (0.16-0.50)	0.25 (0.08-0.50)

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