

Suicides Before, During, and After Daylight Savings Time in the United States

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Abstract

This study was designed to investigate differences in the number of suicides committed in the United States before, during, and after daylight savings time (DST). Conflicting results in the literature suggest both a positive and negative effect of DST in the physical, mental, behavioral aspects society. As a result, some states are proposing legislation to abolish DST while others are trying to make DST permanent. This study is designed to investigate whether DST has a positive negative, or no effect on the frequency of suicide. Archival data from a governmental public database containing the total number of suicides by year and month from 2000-2017 was used. Daylight savings time was defined as the months of March through October while non-DST consisted of the remaining 4 months. The data were organized into 3 groups of 4 months beginning in November, 2007 and ending in October, 2017. The results demonstrated a statistically significant increase in suicides during DST. Most suicides were committed during July-October ($M = 74.69$, $SD = 68.86$), compared to March-June ($M = 73.56$, $SD = 67.89$), and November-February ($M = 67.00$, $SD = 61.41$). Despite disagreement in the literature, this study would suggest eliminating DST altogether. These results support other evidence which suggest a detrimental effect of DST, especially with respect to the psychological and behavioral aspects of public health. Nevertheless, there is still a need for more research to determine the impact of these one hour time shifts in the Spring and Fall.

Keywords: circadian rhythm, daylight savings time, legislation, public health, suicide, United States

1. Introduction

Suicide is a topic that has been studied for decades in the field of psychology. Research continues to progress in order to find answers or clues that may be identified as precursors to completed suicides. It continues to be an unanswered and puzzling question as to why, when there are approximately 130 causes of death that are now identified by the Centers for Disease Control, someone would take their own life? Is there any way to prevent such tragedies or is there anything contributing to these deaths?

Psychologists and psychiatrists are always researching ways to uncover information that will lead to an awareness of risk factors that could help prevent suicides, despite the interesting caveat in doing so. Author and psychiatrist David Viscott (1972) did provide us with a very interesting thought that often goes unsaid and that is:

Should a psychiatrist, should anyone have the right to prevent someone from taking his own life? I have seen some lives so full of pain and darkness for such a long time that I felt like an oppressor just by asking the patient to endure more of what was horrible to him. Who has the right to tell someone he must live a life of pain and hell? (p. 173).

Interestingly, there is an abundance of risk factors that certainly could play a role in the number of completed suicides. These could include demographics such as age, race, gender, and marital status (Popoli, Sobelman, & Fox-Kanarek, 1989). But one factor identified in that study that continues to be a source of investigation, intrigue, and mystery to this day is the concept of seasonality. This study of suicides in the state of Maryland from 1970-1980 demonstrated that more suicidal deaths occurred in the spring and fall months than the summer and winter months. And that seems to contradict public opinion that it is the dark and cold months of November,

December, January, and February for much of the U.S. that would be the logical choice for having the highest suicide rates. However, the research does not support this viewpoint.

This topic of seasonality continues to be a frequent topic of research. Many studies have reported both positive and negative effects Daylight Savings Time (DST), of this one hour shift in time that begins in March and ends in November. It is this factor of the seasonal effects of suicide, specifically DST in the United States, that is the basis for this study.

Daylight savings time goes as far back as 1916 and has continued to this day. There has been considerable debate about whether it should be abolished in the United States. Every state participates in DST except for Arizona and Hawaii, but Missouri, Alaska, Texas, and Michigan are also considering abolishing daylight savings time while states such as Florida are legislating to make DST permanent. This is not an easy decision to make given the literature surrounding DST.

Despite the practical or impractical implications of having or not having daylight savings time, the question for this study is whether the time shifts that begin and end DST are affecting the physical, psychological or social health of individuals, and thus suicides. Some research indicates that DST has beneficial effects and other research suggests it is very detrimental to public health.

In March, 2019 and again in September, 2019, Senator Marco Rubio introduced legislation to make DST permanent in the United States at least until November, 2021. He proposed that keeping DST permanent would benefit children going to and from school and that research has “shown many benefits of a year round Daylight Savings Time” (Rubio, 2020). These included reduced automobile crashes, reduced car accidents involving pedestrians, reduced cardiac issues and strokes, and reduced depression. Jin and Ziebarth (2015) found that an extra hour of sleep in the fall for those who are sleep deprived may have beneficial health effects but only for a period of four days. They found no significant increases or decreases in health when the clocks are set ahead one hour in the spring.

However, there is more than enough research to support the exact opposite. For example, Meira e Cruz, et al., (2019) and *Psychology Today* (2020) argued that the negative effects of DST are enough to have it eliminated. According to *Psychology Today*, the American Academy of Sleep Medicine suggested that “half-a-dozen studies have found a 5% to 15% increased risk of having a heart attack during the days after shifting to DST, and a 24% increase alone on the day after the switch.” It also reported increases in traffic accidents, visits to emergency rooms, depression, and suicide. “Perhaps the risk stays elevated throughout the months we stay on daylight saving time.” Another study also reported that the spring transition to DST showed increases in atrial fibrillation admissions, not decreases (Chudow et al., 2020).

Poteser and Moshammer (2020) found an increase in mortality rates after the spring transition, but not the fall. Coren (1996) reported an increase in accidental deaths with the spring transition, but no such effects with the fall shift. Hicks, Davis, and Hicks (1998) found significant increases in traffic accidents for both transitions of DST and that alcohol-related crashes increased for the seven days following both shifts. And Varughese (2001), reported that in the spring there is an increase in fatal accidents on the Monday following the shift, however, in the fall, the increase in fatal accidents is on the Sunday following the shift.

In addition to these unfortunate events, there is evidence in the research that DST presents a higher risk for mental disorders (Zhang, Dahlen, Khan, Edgren, & Rzhetsky, 2020) and, hence, an increased risk for suicide. One reason might be that the brain produces more serotonin with longer periods of sunlight (Lambert, Reid, Kaye, Jennings, & Esler, 2002) and people who attempt suicide may (or may not) have higher levels of the neurotransmitter serotonin (Kohyama, 2012; Menon & Shivanand, 2015). Other evidence suggests that sleep disruptions during the Spring transition to DST cause the risk of suicide to increase by as much as 6.25% as well as all Deaths of Despair (Osborne-Christenson, 2020). Even neurologists have suggested eliminating DST because of the harmful health effects caused by disruptions in a person’s circadian rhythm (Malow, Veatch, & Bagai, 2020).

Although this study includes only U.S. suicides, there appears to be some evidence that this may be a global phenomenon. Although Shapiro, Blake, Fossey, and Adams (1990) found no evidence that suicides increase during DST in the United Kingdom, suicides in Australia from 1971-2001 showed evidence of increasing after the beginning of DST in the spring and after the return to standard time in the fall. In Germany, researchers found that suicides are low before DST but high after the introduction of DST in the spring but not in the fall (Lindenberger, Ackermann, & Parzeller, 2019). Nevertheless, the spring transition seems to present an increased risk for suicide.

1.1 Purpose of the Present Study

The conflicting and inconsistent findings reported in the literature prompted this study. There is no consensus among researchers, and after decades of investigating this cause of death, there is still no definitive answer as to whether these one hour shifts in daylight have any significant physiological, psychological, or social consequences or benefits. It is an area that needs to be broadened and studied in much greater detail.

The shifts in time appear to have some effect on the behavior and/or mental processes of individuals, but it is still uncertain whether it is a positive effect or a negative effect. The purpose of this study will be to determine if, based solely on archival quantitative data, there are significant differences in the number of suicides committed before, during, and after DST in the United States. The nature of this study is purely statistical, and it will examine a large sample of public data in an effort to answer this question. It is hypothesized that there are statistically significant differences between the number of suicides committed during DST and the number committed before and after DST. Whether those differences are positive or negative remain to be seen.

2. Method

There is a plethora of public databases that allow researchers to investigate many different areas of interest. The Centers for Disease Control and Prevention (CDC) is a federal agency that provides public health data in many different areas and formats. The data is published and open to the public for analysis. For this investigation, public archival data from the cdc.wonder.gov databases were used.

The data for this study utilized the CDC database containing information on all causes of death by year and month for all states. Since Arizona and Hawaii do not observe daylight savings time, the number of suicides by year and month for the 48 states that observe DST was analyzed for the years 2006-2017. In order to compare the number of suicides before and after DST, the data were arranged into three groups. However, comparing the number of suicides committed in 8 months versus 4 months presented a problem statistically. One expert suggested that "One way to compare the two different size data sets is to divide the large set into an N number of equal size sets" (Zekry, 2019). Daylight savings time, give or take a few days, included the months of March through October and was divided into two groups, each containing four months. The months of March, April, May and June comprised the first four months of DST while July, August, September, and October comprised the second half of DST. The remaining four months of November, December, January, and February represented the non-DST group. These four months, November through February served two purposes. On the one hand, they represented the four months after the shift back to standard time, but also served as the four months prior to the spring shift to begin DST. The result was three equal groups of four months that would be compared to each other for this study. For statistical purposes, November through February was coded as group "1", March through June as group "2", and July through October as group "3".

The total number of suicides for each month beginning with November, 2006 and ending in October, 2017 were compiled from the data, thus creating 33 separate periods of four months. For example, the first "group 1" was the total suicides for November, 2006 through February, 2007, while the first "group 2" was the total number from March, 2007 through June, 2007, and the first "group 3" was the total for July, 2007 through October, 2007. This process was replicated until the final "group 3" representing the total number of suicides from July, 2017 through October, 2017.

Once all of the data points were compressed into the appropriate cell, what remained was a table comprised of two columns and 5,929 rows. The first column was the total number of suicides committed by month and year for the period November, 2006 through October, 2017. The second column represented the category for each of the groups. All November -February months were coded "1", all March-June months were coded "2", and all July-October months were coded "3". Group "1" was the non-DST group while group "2" was the first four months of DST, and group "3" was the last four months of DST.

For this study, data were analyzed using the IBM SPSS Statistics for Windows, Version 27. Descriptive statistics, one-way ANOVA, a test for homogeneity of variance (Levene's Test), a test for equality of means (Welch Test), and a Kruskal-Wallis one-way analysis of variance were used to analyze the data. The Null Hypothesis was that there was no statistical difference between the number of suicides committed during the three time periods. The alternate hypothesis was that there are significant differences within the three time periods.

3. Results

A grand total of 425,574 suicides were reported in the U.S. by state by month by year from November, 2006 - October, 2017. There were 130,647 suicides committed during the "Group 1" months of November, December, January, and February ($M = 67.00$, $SD = 61.41$). For the "Group 2" months of March, April, May, and June,

146,449 suicides were reported ($M = 73.56$, $SD = 67.89$). During the “Group 3” months of July, August, September, and October, there were a total of 148,478 suicides committed ($M = 74.69$, $SD = 68.86$).

The results of the one-way analysis of variance (ANOVA) are presented in Table 1. The ANOVA showed that group (of 4 months) had an effect on the number of suicides $F(2,5926) = 7.727$, $p = .000$, $\eta^2 = .003$. Table 2 provides the post-hoc analyses using the Tukey HSD. Results indicated that the mean number of suicides committed during the “Group 1” months was significantly lower than the number committed during the “Group 2” months ($p = .005$) and during the “Group 3” months ($p = .001$). However, the number of suicides committed during the “Group 2” months and the “Group 3” months did not differ significantly ($p = .852$).

Table 1. One-way analysis of variance for “groups”

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	67660.785	2	33830.392	7.727	.000
Within Groups	25945078.003	5926	4378.177		
Total	26012738.788	5928			

Table 2. Multiple comparisons of “groups” using the Tukey HSD

Dependent Variable: Deaths

Tukey HSD

(I) DSTgroup	(J) DSTgroup	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	-6.557*	2.108	.005	-11.50	-1.61
	3.00	-7.689*	2.109	.001	-12.63	-2.74
2.00	1.00	6.557*	2.108	.005	1.61	11.50
	3.00	-1.132	2.098	.852	-6.05	3.79
3.00	1.00	7.689*	2.109	.001	2.74	12.63
	2.00	1.132	2.098	.852	-3.79	6.05

The results of the one-way ANOVA should be used with caution because the assumption of homogeneity of variances was not met. This was indicated by both *Levene's Test*, $F(2,5926) = 7.406$, $p = .001$ and *Welch's adjusted F ratio*, $F(2,3944.82) = 8.275$, $p = .000$. The results of these tests are most likely due to the positively skewed data.

When assumptions of the parametric statistics are violated, it is often recommended that analysis is done with the nonparametric equivalent of the one-way ANOVA, the *Independent Samples Kruskal-Wallis test*. The results of this analysis can be seen in Table 3. This test also demonstrated that time of year significantly affects the number of suicides that are committed, $H(2) = 18.199$, $p = .000$. Pairwise comparison revealed the non-DST group and the first 4 months of DST were significantly different, $p = .001$, the non-DST group and the last 4 months of DST were significantly different, $p = .000$, but the 2 DST groups were not different, $p = .496$.

Table 3. Independent-Samples Kruskal-Wallis Test Summary

Total N	5929
Test Statistic	18.199 ^a
Degrees of Freedom	2
Asymptotic Sig.(2-sided test)	.000

a. The test statistic is adjusted for ties

4. Discussion

The purpose of this study was to determine whether there was a statistically significant difference between the number of suicides committed during the first four months of DST, the last four months of DST, and the four non-DST in the United States. The results of this investigation support the hypothesis that there are significant differences between the non-DST months and both periods of DST, but not between the two DST periods. These findings demonstrate that there are significantly more suicides committed during the DST months (March - June)

and (July - October) than during the non-DST months (November - February). This does show that DST has a moderate negative effect with respect to the number of suicides committed.

It was not the purpose of this study to determine why this difference exists, but as explained above, a variety of explanations have been suggested ranging from sleep deprivation to increases in certain neurotransmitters. However, it was performed to add some substance to the claims that DST should be eliminated. Arizona and Hawaii have refused to incorporate the one hour shifts in their standard time, however, some states are proposing legislation to make DST permanent while other states are considering eliminating DST. Based on the results of this study, DST is having a negative impact on the physical, psychological, and behavioral health of the United States, especially on the number of suicides committed during the course of a year. Given the choice of making DST permanent or eliminating the time shifts altogether, this investigation would certainly recommend the total elimination of DST and a return to standard time permanently.

Daylight Savings Time was originally instituted in 1918 to save energy during wartime, however, it did undergo some changes until 1966, but in 1966 a Uniform Time Act was passed which made DST mandatory. In 2007, DST was extended another 4 to 5 weeks, basically, to save barrels of oil. In none of these decisions did the government ever consider the safety, physical health, or mental health implications of such time changes. Today, the research is filled with conflicting results as to physiological and psychological effects of changing time twice a year for one hour. However, despite some practical implications of keeping DST such as children attending school during daylight hours and people leaving for and returning from work with more daylight, the decision to make DST permanent appears counterproductive. Rather than changing from standard time to DST and then from DST to standard time, this study would support making no changes at all and keeping the entire country on standard time.

The research to date seems to unequivocally support eliminating DST. Although there are some claims cited in this study suggesting that by making DST permanent, it would have an overall positive effect on public health, but those studies are greatly outnumbered by studies that assert DST is having a negative effect on society. There is undoubtedly more credible and reliable evidence to undermine and discredit the notion that making DST permanent would be a positive change. Recently, there certainly appears to be more evidence to support the claims that DST is having a much more negative impact on society than positive. What is even more impressive is the fact that the research claiming that DST is detrimental, comes from a variety of businesses and not just from the health field. Daylight savings time is not only having negative impact on public health. It appears to be adversely affecting the industries such as economics and energy.

Despite the controversy surrounding DST and the two one hour shifts in time that 48 states continue to make in this country, this study demonstrates that there are definitely more suicides committed during the DST months than during the rest of the year. Although there are undoubtedly many reasons and many variables that must be considered when trying to understand why people take their own lives, it is safe to say that there is a statistically significant difference in the number committed during DST than non-DST. Whether the time changes associated with DST are the reason for this significant increase in suicides is unknown, but this study does strongly suggest that, at a bare minimum, it may be one of a multitude of factors that disrupts the biological, psychological, and behavioral well-being of some individuals to the point that they choose to end their life. Maybe it is time that the individuals suggesting a permanent change to DST consider all factors that could be affected by their decision instead of only a few and that they consider all research instead of the few studies that appear to support their decision. Today, there are more effective ways of saving energy than just adding and subtracting one hour of time during the year. An alternative would be to find more effective ways of saving lives.

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