DAYLIGHT SAVINGS TIME CHANGES AND CONSTRUCTION ACCIDENTS

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ABSTRACT: Recent research has shown that the frequency of traffic accidents is influenced by changes in clocks from standard time to daylight savings time. A study was conducted to determine if a similar phenomenon existed with the occurrence of injuries in the construction industry. Data relating to injury claims of construction workers in the state of Washington for 1990–1996 were analyzed to determine if stress due to the change in time from standard to daylight savings in the spring and from daylight savings to standard time in the fall, respectively, resulted in an increase and decrease in construction accidents. For spring and fall, with respect to injury frequency, the injury frequency for the Monday following the change of time was compared with that of the Monday before the change, and the Monday 1 week later. No statistical differences were found to exist. In addition, injury statistics for the week before the change were compared with the week following the change. Again, no statistical differences between the two were found to exist.

INTRODUCTION

The use of the term ''accident'' often implies that there is no guilt associated with the occurrence of the event. This meaning is often translated to also apply to the occurrence of injuries, this notion being that chance or luck plays a significant role in injury occurrence. This is a fatalistic view and, if adopted in the corporate culture of a firm, would lead firms to feel helpless in altering accident occurrence. Of course, many firms have taken the positive steps to aggressively promote safety and have realized astounding successes.

Some firms may doubt that all accidents can be avoided, believing that elements external to the firm may cause some accidents to happen. For example, there is a well known statistic that more injuries occur on Mondays than on other days of the week. This is one of the reasons that safety tool box meetings are often held on Monday mornings as a standard practice. The higher occurrence of injuries on Mondays is supported by various studies, but exceptions can still be noted. What is so unique about Mondays that makes it associated with more injuries? Is there a unique weekend effect that carries over to the job? This could be the case if workers party excessively on weekends and then arrive on the jobsite in a condition that increases their propensity to be injured. This compromised condition could be the result of excessive consumption of alcohol over the weekend, the deprivation of sleep, or some other related factor.

The loss of sleep might well be expected to cause a worker to be less attentive and alert. Thus, the deprivation of sleep might then increase that worker's chance of being injured. Therefore, the question to be answered is: What is the impact of some sleep deprivation on the safety performance of workers? This does occur, at least to some extent, every year when most of the United States changes from standard time to daylight savings time in the spring of each year. This shortened day occurs on a Saturday night, but the adjustment to the time change may take several days. Is there an increase of injuries on those Mondays immediately following this time change? This was explored in the following study of worker injuries.

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RELATED STUDIES

Recent parallel studies have shown a link between traffic accidents and the changes associated with standard time and daylight savings time. In the spring, the first Sunday in April marks the change from standard time to daylight savings time with clocks being set forward by 1 h, therefore, everyone loses 1 h of sleep on Saturday night. In the fall, daylight savings time changes back to standard time on the last Sunday in October when everyone has an extra hour of sleep.

Stanley Coren conducted a study of all traffic accidents in Canada for 1991 and 1992 (Coren 1996). The Coren study concluded that there was a statistically significant increase in traffic accidents following the April change to daylight savings time as well as a statistically significant decrease in traffic accidents in October following the change back to standard time. Coren suggested that the changes in accident statistics are due to disruptions in the normal circadian rhythms. In addition, Hinze (1997) has suggested that the disruption of circadian rhythms can impact construction worker injury rates when performing shift work. Thus, the spring increase in traffic accidents is thought to be due to a loss of 1 h of sleep when the clocks are set forward by 1 h. Conversely, the fall decrease in traffic accidents is due to a gain of 1 h of sleep when the clocks are set back by 1 h. Numerous other studies also connect stress and sleep deprivation with an increase in accidents (Capell 1985; Jones 1988; Shanley 1997).

A study by The Insurance Institute for Highway Safety for 1987–1991 (Ferguson et al. 1995) concluded that the changes in light intensity due to the changes to and from daylight savings to standard time account for the changes in the number of traffic accidents. During daylight savings time, the additional daylight hour is shifted to the busier evening traffic period, thus, reducing the number of accidents for that period. The study also concluded that a substantial number of traffic accidents could be prevented if daylight savings time were extended through winter. Note that this study made conclusions that were quite different from those of the Coren study.

Whether the changes in the number of accidents is due to stress caused by sleep deprivation or changes in the time of day associated with daylight hours, the question becomes, does this finding carry over to the workplace, especially the construction work site? No research publications were identified that addressed the impact of time changes on construction worker safety in any industrial setting.

METHODOLOGY

To examine this question, the authors analyzed construction accident data from the State of Washington, Department of Labor and Industries, Industrial Insurance Division for 1990–1996. The analysis consisted of performing a paired two sam-

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TABLE 1. Injury Claim Data for April Change to Daylight Savings Time for Years 1990–1996

(1)	Monday, one week before (2)	Monday, immediately after (3)	Monday, one week later (4)	Monday–Friday, week before (5)	Monday–Friday, week after (6)
Number of data points	7	7	7	35	35
Total number of accident claims	861	848	897	3,985	3,914
Average number of claims	123.0	121.14	128.14	113.85	111.82
Standard deviation	13.3480	20.6028	23.4480	21.8795	17.6259
Variance	336.6667	424.4762	549.8095	478.7143	310.6756

ple t-test at the 95% significance level in which the number of injuries occurring on the Monday immediately after the time change was compared to that of the Monday prior to the change and the Monday 1 week after the time change. In addition, the number of injury claims for the Monday through Friday before the time change was compared with those of the Monday through Friday following the time change using the same procedure. These comparisons were made for both the spring and fall time changes.

SPRING TIME CHANGE TO DAYLIGHT SAVINGS TIME

A summary of the 1990–1997 data related to the spring change from standard time to daylight savings time is presented in Table 1, and graphically in Fig. 1. As can be seen, there was a decrease in the number of accidents between the Monday prior to the Sunday time change (861 claims) and the Monday immediately after the Sunday time change (848 claims). For the Monday 1 week after the time change, the number of accident claims increased to 897. During the week prior to the change there were 3,985 claims, however, there were only 3,914 claims during the week following the spring time change.

To determine if there was a statistically significant difference between these data, a two-way paired two-sample t-test was performed at the 95% level of significance where: H0: $\mu 1 = \mu 2$ and H1: $\mu 1 \neq \mu 2$. When the number of claims on the Monday before the daylight savings time change was compared with claims on the Monday immediately after the daylight savings time change, it was found that the null hypothesis (H0: $\mu 1 = \mu 2$) could not be rejected, and thus, leads one to conclude that at the 95% level of significance no statistical difference exists between the two (t-observed = 0.241058 < t-critical = 2.446914). When the Monday immediately after the time change was compared with the Monday 1 week later, again, no statistical difference between the two was noted (t-observed = 2.04939 < t-critical = 2.446914).

When the injury claims for the week prior to the time change and the week following the time change were compared using the same procedure, no statistical difference between the means for the two samples was observed (t-observed = 0.639319 < t-critical = 2.032243).

FALL TIME CHANGE TO STANDARD TIME

A summary of the 1990–1997 data related to the fall change from daylight savings time to standard time is presented in Table 2, and graphically in Fig. 2. As can be seen, there was an increase in the number of accidents between the Monday prior to the Sunday time change (908 claims) and the Monday immediately after the Sunday time change (963 claims). However, on Monday, 1 week after the time change, the number of accident claims decreased to 881. During the week prior to the change there were 4,278 claims, however, there were only 4,166 claims during the week following the fall time change.

Again, to determine if there was a statistically significant difference between the number of these claims, a two-way paired two-sample t-test was performed at the 95% level of significance where: H0: $\mu 1 = \mu 2$ and H1: $\mu 1 \neq \mu 2$. When the

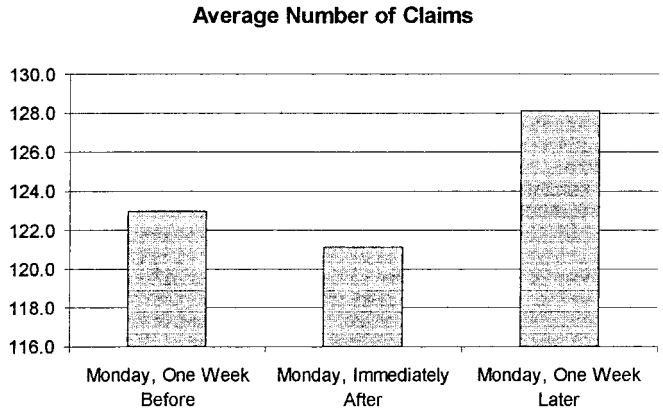

FIG. 1. Injury Claims and the April Change to Daylight Savings Time, 1990–1996

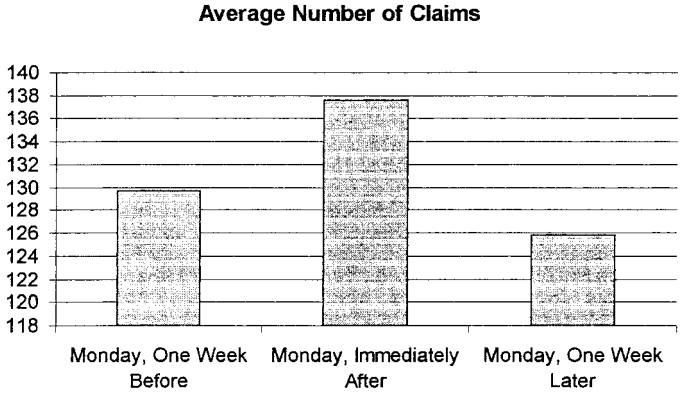

FIG. 2. Injury Claims for October Change to Standard Time, 1990–1996

TABLE 2. Injury Claim Data for October Change to Standard Time for Years 1990–1996

(1)	Monday, one week before (2)	Monday, immediately after (3)	Monday, one week later (4)	Monday–Friday, week before (5)	Monday–Friday, week after (6)
Number of data points	7	7	7	35	35
Total number of accident claims	908	963	881	4,278	4,166
Average number of claims	129.71	137.57	125.85	122.28	119.02
Standard deviation	19.3452	20.0819	19.4544	18.8797	23.6587
Variance	374.2381	403.2857	378.4762	356.4454	559.7345

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number of accident claims on the Monday before the change to standard time was compared with the Monday immediately after the standard time change, no statistical difference between the two was found (t-observed = 1.04052 < t-critical = 2.446914). When the injury claims for the Monday immediately after the time change were compared with the Monday 1 week later no statistical difference between the two was found (t-observed = 2.206833 < t-critical = 2.446914).

When the injury claims for the week prior to the fall time change and the week following the time change were compared using the same procedure, again, it was found that there was no statistical difference between the means for the two samples (t-observed = 0.960701 < t-critical = 2.032243).

CONCLUSION

The findings of this study show that time changes between daylight savings time and standard time do not significantly influence the occurrence of construction worker injuries. Thus, efforts should be focused on other areas known to impact construction worker injuries. Efforts that have been shown to be particularly effective in improving construction safety performances include random drug testing, top management commitment to safety (Hinze 1997), orientation of new workers (Hinze 1978), adopting a zero accident philosophy (*Zero* 1993), and generally treating workers with dignity and respect (Hinze 1978).

While others have found there to be an increase in traffic accidents following the April change from standard time to daylight savings time and a decrease in traffic accidents following the change from daylight savings time to standard time in the fall, this phenomenon does not appear to carry over to the construction industry workplace. Had the pattern carried over to the workplace, it would allow one to predict days that have a higher probability of accident occurrence, thus, suggesting efforts be intensified on given days.

It should be noted that the findings related to traffic accidents differed from those of the study on construction worker injuries. Perhaps there are two different issues reflected by the statistics. The traffic accidents may be due not only to the change in the amount of sleep, but also the number of traffic accidents may be influenced more by the relative position of the sun during the commute to work. This issue has not been explored. Note that for the study on construction workers the variable of concern was the issue of fatigue caused by sleep deprivation. Since most construction work takes place during normal daylight hours the darkness or brightness is not a serious concern. The position of the sun, as altered by the change in the time from daylight savings to standard time and vice versa, probably does not impact construction workers in a noticeable manner.

This study of construction accident claims in the State of Washington for 1990–1996 indicates that no statistical difference exists between the mean number of claims on the Mondays 1 week before, immediately after, and 1 week later, as well as the five work days before and the work days after the time change for the spring and fall time changes.

RECOMMENDATIONS

While the findings of this study are fairly compelling, a similar study should be conducted in one or more other regions within the United States. Although it is not anticipated that regional variations would make a difference on the research findings, this issue should be examined in order to make conclusions with greater confidence.

Data of the type examined in this study should be collected in all the states. The data could be used in many studies beneficial to the industry. State budget allocations should be expanded so that not only is such data collected in each state, but that the state agencies collaborate so that there is consistency between the data.

APPENDIX. REFERENCES

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