Work-related accidents and daylight saving time in Finland

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Background Recent research has indicated that transitions into and out of daylight saving time (DST) unbalance the physiological circadian rhythm and may lead to sleep disturbance. Sleep deprivation may have negative effects on motivation, attention and alertness and thus it is possible that transitions into and out of DST may increase accident rates.

Aims To explore the impact of DST transitions on the number of occupational accidents in Finland.

Methods For the study, we analysed all occupational accidents that happened in Finland 1 week before and 1 week after DST transitions during the years 2002–06.

Results Transitions into and out of DST did not significantly increase the number of occupational accidents.

Conclusions It seems that sleep deprivation after DST transition is not harmful enough to impact on occupational accident rates.

Key words Accident; DST; occupational injuries; SCN; sleep deprivation.

Introduction

Transition into and out of daylight saving time (DST) is used to balance the activity peaks of a population with the daylight hours. In Finland, DST has been used since 1981. Spring transition into DST begins on the last Sunday of March, when the clocks are turned forwards by 1 h. Transition into DST increases the available daylight in the evening. From year 1981 to 1995, DST ended on the last Sunday of September and from 1996 onwards, the autumn transition has happened on the last Sunday of October. In autumn, the clocks are turned backwards by 1 h, which increases available daylight in the morning.

Sleep is vulnerable to summertime–wintertime clock transitions which change the timing of day and night and the timing of sleep, waking, light and dark. Changes in these variables impact our biological master clock, the suprachiasmatic nucleus (SCN) a cluster of 20 000 neurons, situated in the anterior hypothalamus in the brain [1,2]. SCN is synchronized via light–dark transitions and it coordinates the timing of metabolism, hormone secretion, cell proliferation, behaviour and sleep. Thus, sudden changes in SCN synchronization may cause symptoms depending on how big the disruption is. It is known that night-shift work and jet-lag cause multiple symptoms such as changes in metabolism and fatigue [3]. Also transitions into and out of DST cause minor jet-lag symptoms. Our recent research has shown that transitions into and out of DST cause sleep disruption and unbalances our circadian rhythm [4–6]. Since sleep deprivation decreases motivation and attention, DST may increase the number of accidents during the days following the transition. Only a few studies have explored the impact of DST transitions on accident rates and their results are contradictory [7–12]. One study showed that transitions into and out of DST do not increase the amount of hospital-treated accidents [10]. However, transitions may increase the amount of less severe accidents such as occupational accidents, which do not require hospital treatment.

Earlier studies have shown that sleep deprivation increases the number of accidents [13, 14]. According to previous studies by our research group, DST transitions lead to sleep deprivation and it is possible that sleep deprivation caused by DST transitions may cause lack of attention and alertness leading to higher accident rates during the days following the transitions [4–6]. Hence,
our aim was to assess whether DST transitions increase the amount of occupational accidents during the first week after the transition.

Methods

For the study, we analysed the number of occupational accidents 1 week before and 1 week after DST transitions. Data was gathered from the registry of Federation of Accident Insurance Institutions (FAII). The FAII collects statistics on work accidents and occupational diseases in Finland. The statistical data on workplace accidents used in this study was compiled with the online database interface. All compensated work accidents (which are covered by the Finnish statutory accident insurance) are included in this database. A work accident is defined as an accident due to an unexpected, sudden external event which causes injury or illness to an employee while he or she is working, in circumstances related to the employee’s work, workplace or when going on errands for the employer or while protecting or trying to protect property of the employer or while saving or trying to save human lives in the course of the work. An accident is included in the database even if it did not cause absence from work. Each accident is a single workplace accident affecting one worker. For example, if two workers were injured in the same accident, it results in two separate compensated accidents in the statistics. A single worker can lead to several compensated accidents. Conditions caused by work movements leading to pain in the muscles and tendons and developing within 24 h are also compensated as work accidents. Commuting accidents and occupational diseases are compensated but excluded from the data used in this study.

The follow-up period was 1 week before and 1 week after DST transition. A week was selected as the relevant time span as previous results show that sleep–wake rhythm rebalances slowly, usually within 1 week after disruption caused by DST transitions [4–6].

The number of accidents was analysed using a Poisson regression model with log-link function that is the standard method for analysing frequency data [15] (Table 1).

Table 1. The total number of occupational accidents that occurred before and after transitions into DST for years 2002–06 in Finland

<table>
<thead>
<tr>
<th></th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 week before</td>
<td>1 week after</td>
</tr>
<tr>
<td>2003</td>
<td>834</td>
<td>825</td>
</tr>
<tr>
<td>2004</td>
<td>781</td>
<td>778</td>
</tr>
<tr>
<td>2005</td>
<td>654</td>
<td>647</td>
</tr>
<tr>
<td>2006</td>
<td>984</td>
<td>932</td>
</tr>
</tbody>
</table>

Number of accidents was used as response and year (2003–06), season (spring or autumn) and period of time shift (before or after) as categorical explanatory variables. Significance of explanatory variables was tested by likelihood ratio test.

Results

Analyses of deviance showed that time shift did not have a significant effect on the accident numbers (Table 2). However, we noticed that there was an annual and seasonal variation, $P < 0.001$ for both. In 2006, there were more accidents compared with previous years and there were significantly more accidents in the autumn DST transition than in the spring transition (Table 2).

Discussion

According to our results, sleep deprivation caused by DST did not significantly increase the number of occupational accidents after DST transitions. As our results show, there is variation in the number of accidents between seasons and years. This is most probably caused by changes in weather conditions as the number of workers has been roughly constant from year to year and season to season and the injury reporting requirements have not changed during the study period.

Since personal injuries are a major health problem, it is important to develop effective accident prevention systems. Even small reduction in accidents rates can produce significant savings; if the number of hospital-treated accidents can be reduced by even 5%, 10 billion Euros will be saved from treatment and social expenditures inside the European Union area [16]. To prevent accidents, we should update our knowledge of epidemiological determinants of accidents and do risk analyses for populations.

Table 2. Parameter estimates of Poisson regression model with log-link function

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Standard error</th>
<th>Z value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>Reference</td>
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<td></td>
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<tr>
<td>2004</td>
<td>−0.0006</td>
<td>0.0246</td>
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<tr>
<td>2005</td>
<td>0.0197</td>
<td>0.0244</td>
<td>0.81</td>
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<tr>
<td>2006</td>
<td>0.2196</td>
<td>0.0233</td>
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<tr>
<td>Season</td>
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</tr>
<tr>
<td>Spring</td>
<td>Reference</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Fall</td>
<td>0.1815</td>
<td>0.0169</td>
<td>10.75</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Day time shift</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Before</td>
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<td></td>
<td></td>
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<tr>
<td>After</td>
<td>−0.0120</td>
<td>0.0168</td>
<td>−0.71</td>
<td>NS</td>
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</tbody>
</table>
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Conflicts of interest
None declared.

References

Key points
- Transitions for daylight saving time affect millions of people annually and the phenomenon is an important public health concern.
- Transitions for daylight saving time cause minor sleep deprivation.
- Transitions for daylight saving time do not increase the number of occupational accidents.