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SPECIAL ARTICLES

Permanent standard time is the optimal choice for health and safety: an American Academy of Sleep Medicine position statement

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The period of the year from spring to fall, when clocks in most parts of the United States are set one hour ahead of standard time, is called daylight saving time, and its beginning and ending dates and times are set by federal law. The human biological clock is regulated by the timing of light and darkness, which then dictates sleep and wake rhythms. In daily life, the timing of exposure to light is generally linked to the social clock. When the solar clock is misaligned with the social clock, desynchronization occurs between the internal circadian rhythm and the social clock. The yearly change between standard time and daylight saving time introduces this misalignment, which has been associated with risks to physical and mental health and safety, as well as risks to public health. In 2020, the American Academy of Sleep Medicine (AASM) published a position statement advocating for the elimination of seasonal time changes, suggesting that evidence best supports the adoption of year-round standard time. This updated statement cites new evidence and support for permanent standard time. It is the position of the AASM that the United States should eliminate seasonal time changes in favor of permanent standard time, which aligns best with human circadian biology. Evidence supports the distinct benefits of standard time for health and safety, while also underscoring the potential harms that result from seasonal time changes to and from daylight saving time.

Keywords: daylight saving time, standard time

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INTRODUCTION

The American Academy of Sleep Medicine (AASM) is a professional society that advances sleep care and enhances sleep health to improve lives. The AASM advocates for policies that recognize that sleep is essential to health. The period of the year from spring to fall, when clocks in most parts of the United States are set 1 hour ahead of standard time (ST), is called daylight saving time (DST), and its beginning and ending dates and times are set by federal law. DST begins on the second Sunday in March at 2:00 AM and ends on the first Sunday in November at 2:00 AM. The remaining period from fall to spring is called ST.[1]

Human activities are affected by three clocks: the internal biological rhythm, also known as the circadian clock; the solar clock; and the social clock, which dictates when activities such as school and work begin and end. Under ideal conditions, all three clocks would be aligned to allow for optimal health and performance. The human biological clock is regulated by the timing of light and darkness, which then dictates sleep and wake rhythms. In daily life, the timing of exposure to light is generally linked to the social clock. When the solar clock is misaligned with the social clock, desynchronization occurs between the internal circadian rhythm and the social clock. The yearly change between ST and DST introduces this misalignment, which has been associated with risks to physical and mental health and safety, as well as risks to public health.[2]

BACKGROUND

In 2020, the AASM published a position statement advocating for the elimination of seasonal change to and from DST, suggesting that evidence best supports the adoption of ST. As evidence supporting this position continued to grow, the National Sleep Foundation,[3] Sleep Research Society,[4] American Medical Association,[5] and other professional societies also voiced support for the establishment of permanent ST to optimize health and safety.

Meanwhile, contrary to this chorus of support, and despite a similar attempt in 1973 that was short-lived due to overwhelming unpopularity, a bill proposing to establish year-round DST (S. 623) was passed by the US Senate in 2022. However, this bill did not advance in the House. Current US federal law allows individual states to exempt themselves from observing DST.[1] For example, Hawaii, Arizona, and US territories observe year-round ST. Moving to permanent DST, however, requires federal congressional approval. In the United States, the Congressional Research Service identified many states in which legislative proposals supported the elimination of seasonal time changes.[6] These proposals were divided, with some advocating for permanent DST and a nearly equal number advocating instead for permanent ST.

Internationally, in 2021, the European Parliament voted to eliminate mandatory DST within its jurisdiction,[7] and Mexico went even further and eliminated DST completely in 2022.[8]

POSITION

It is the position of the AASM that the United States should eliminate seasonal time changes in favor of permanent ST, which aligns best with human circadian biology. Evidence supports the distinct benefits of ST for health and safety, while also underscoring the potential harms that result from seasonal time changes to and from DST.

DISCUSSION

Light is the most powerful exogenous zeitgeber, or cue, to the regulation of the endogenous circadian rhythm.[2] More specifically, the typical, daily sleep-wake cycle in humans relies on bright light exposure in the morning and its absence (ie, darkness) in the evening. The circadian clock responds to timed light in a predictable fashion: delaying phase (ie, onset of endogenous biological sleep to a later clock time) when exposed to light in the evening or deprived of light in the morning.[7]

By increasing the exposure to both morning darkness and evening light, DST impacts sleep-wake patterns adversely.[2] The recommendation in support of permanent ST is based on a review of existing literature, which describes the acute, adverse effects of switching between ST and DST twice yearly, and of experimental modeling data that quantify the chronic effects of DST for 8 months each year.

Acute effects of switching between ST and DST

The 1-hour time shift in the spring results in the loss of 1 hour of sleep opportunity, due to the presence of continuing social or occupational demands in early morning hours. This sleep loss accrues daily, resulting in ongoing sleep debt.[9] DST also leads to acute circadian misalignment,[2] due to the effect of later-evening light and morning darkness on the circadian rhythm.[10,11] Later-evening light and morning darkness cause a delay in the circadian clock, so that the individual would have a later preferred time to fall asleep at night and wake in the morning.

The major acute effect of the time change in the spring, therefore, is reduced sleep.[12] Additional effects include lower vagal tone resulting in higher heart rate and blood pressure,[13] immune system alterations,[14] and a variety of cellular derangements, including altered myocyte gene expression,[15] altered epigenetic and transcriptional profile of core clock genes,[16] and increased production of inflammatory markers,[17] all of which have been observed with the 1-hour spring time shift.

Shifting from ST to DST in the spring has also been associated with an increased risk of multiple adverse health outcomes. Indeed, in large-claims datasets, a variety of health effects have been reported across multiple organ systems and disease states.[18] Cardiovascular event rates are increased.[19] The risks of myocardial infarction,[20,21] stroke,[22] and hospital admissions due to acute atrial fibrillation[23] increase during the spring time change. Consequences to mental health include death secondary to suicide and overdose.[19,24] An increased risk of pregnancy loss following in vitro fertilization has also been observed.[19] The impact on health care utilization includes increased emergency room visits and return visits to the hospital,[25] missed medical appointments,[26] medical injuries,[18] and medical errors.[27]

Additionally, in the days following the ST to DST transition, significant increases in motor vehicle accidents,[28] injuries, and fatalities have been observed, both in and outside the United States.[29,30] Fatal crashes were shown to increase up to 6% in the United States.[31] Objectively measured driving metrics indicate that the impact of DST includes altered situational awareness, increased risk behavior, and poorer reaction time.[32] Other adverse behavioral impacts include an increase in human-associated wildfire accidents[33] and volatility in US stock markets on the Monday after the transition to DST.[34] While reasons for some of these specific outcomes are not entirely clear, proposed mechanisms include the impact of sleep deprivation on frontal lobe functioning, which may result in impaired judgement and decision-making capacity.[35]

Although many acute effects have been identified when transitioning from ST to DST in the spring, the seasonal time change alone has adverse impacts. For example, transitioning from DST to ST in the fall has been associated with sleep disruption,[9] mood disturbance,[36] patient safety-related incidents,[27] suicide,[13] and traffic accidents.[37] Furthermore, the autumn DST-to-ST transition, while commonly thought to be beneficial because it is associated with "an extra hour of sleep," still elicits significant variations in serum lymphocytes, cortisol, thyroid-stimulating hormone (TSH), and melatonin, which may be associated with the abrupt transition.[14] The DST-to-ST shift also has been associated with increased incidence of unipolar depressive episodes[36] and frequency of medical leave due to ulcerative colitis and Crohn's disease (a surrogate marker of acute flares of inflammatory bowel disease).[38]

Chronic effects of DST

Evidence regarding the chronic effects of DST arises from naturalistic studies, retrospective reviews, and experimental models. For example, in one report, when temporary, year-round DST was adopted in response to an Organization of the Petroleum Exporting Countries (OPEC) oil embargo, increased fatalities among school-aged children in the morning were noted between January and April.[36] These findings may have been due to darkness lasting longer in the morning when children are traveling to school.[39] Conversely, one report suggested that DST may be associated with a decrease in crime rate,[40] while other studies indicated an overall negligible[41] or modest decrease in the risk of motor vehicle crashes, possibly due to hours of daylight lasting longer in the evening when most accidents occur, along with other, less apparent reasons.[6]

Evidence indicates that the body clock does not adjust to DST even after several months, so that ongoing sleep debt and circadian misalignment continue to persist.[42] Studies have compared the eastern and western aspects of a single time zone in the United States, in which clock time is the same but solar light/dark exposure differs by about 1 hour or more.[43] This naturalistic model found that an extra hour of natural light in the evening reduced sleep duration chronically by an average of 19 minutes and increased the likelihood of self-reported insufficient sleep; individuals with early morning work times bear a larger impact of this phenomenon.[44] Western longitudinal position in the time zone is also associated with increased cancer risk,[45,46] with a significantly increased risk with even a 5° westward position in the time zone. Relatedly, data from similar longitudes (sun time) but different clock time indicate that misalignment of clock time and solar time is associated with greater desynchronization of body temperature, activity, and mealtimes.[47] Finally, economic models of an extra hour of evening light indicate productivity losses equivalent to 4.4 million lost days of work.[48]

Under DST, the chronic misalignment between the timing of the internal clock and the timing of social or occupational obligations can result in significant differences in sleep duration between workdays and days off. This condition has been called "social jet lag."[49] Studies have shown that social jet lag is associated with an increased risk of obesity,[50] metabolic syndrome,[51] cardiovascular disease,[52] depression,[53] and poorer academic performance.[54] Some evidence indicates that adolescents and young adults are most impacted by the dissociation between solar and social time, as they already have a biological drive toward later bedtime and wake-up time compared with adults, and because they require a longer sleep duration than adults for optimal health and daytime alertness. In adolescence, this problem is exacerbated by early school start times, which prevent many teens from getting sufficient sleep on school nights. Therefore, adopting permanent DST may reduce the benefits of delaying start times for middle schools and high schools.[55] Persistent, augmented social jet lag and mood disturbance have been demonstrated with permanent DST,[56] and those with an evening chronotype ("night owls") may be more impacted.[55] Social jet lag associated with DST may be worse in the western-most areas within a given time zone, where sunset occurs at a later clock time.[57]

During the 1973 OPEC oil embargo, Congress established permanent DST, with the assumption that more evening light would lead to energy savings. But minimal, if any, of the purported energy savings were observed in the United States. Other studies have also suggested negligible energy savings during DST.[58,59] The 1973 permanent DST policy was short-lived because it was highly unpopular,[60] especially in rural areas of the United States. After a single winter, the policy was reversed by an overwhelming congressional majority. The unpopularity of the act was likely because, despite greater evening light, the policy resulted in a greater proportion of days that required waking up on dark mornings, particularly in the winter.[61]

Future directions

The adverse effects of switching from ST to DST are well described, and newer evidence continues to demonstrate the chronic harmful effects of DST on human physiology, health, performance and safety, and on economics. Evidence describing the potential impact of temperature, length of the photoperiod, latitude in relation to longitude, and individual factors such as age, health status and chronotype would further enrich discussions.

CONCLUSIONS

Existing data support the elimination of seasonal time changes in favor of fixed, year-round ST. DST can exacerbate misalignment between the internal biological clock, which follows light-dark cycles, and the external (social) clock, resulting in significant health, public safety, and economic repercussions.

ABBREVIATIONS

AASM, American Academy of Sleep Medicine
DST, daylight saving time
ST, standard time

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DISCLOSURE STATEMENT

The authors are the 2022–2023 members of the AASM Public Safety Committee and the 2023–2024 members of the AASM Board of Directors. This statement is published by the AASM as an advisory that is to be used for educational and informational purposes only. The authors report no conflicts of interest.