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SPECIAL ARTICLES

Daylight saving time: an American Academy of Sleep Medicine position statement

Muhammad Adeel Rishi, MD[1]; Omer Ahmed, MD[2]; Jairo H. Barrantes Perez, MD[3]; Michael Berneking, MD[4]; Joseph Dombrowsky, MD[5]; Erin E. Flynn-Evans, PhD, MPH[6]; Vicente Santiago, MD[7]; Shannon S. Sullivan, MD[8,9]; Raghu Upender, MD[10]; Kin Yuen, MD, MS[11]; Fariha Abbasi-Feinberg, MD[12]; R. Nisha Aurora, MD, MHS[13]; Kelly A. Carden, MD, MBA[14]; Douglas B. Kirsch, MD[15]; David A. Kristo, MD[16]; Raman K. Malhotra, MD[17]; Jennifer L. Martin, PhD[18,19]; Eric J. Olson, MD[20]; Kannan Ramar, MD[20]; Carol L. Rosen, MD[21]; James A. Rowley, MD[22]; Anita V. Shelgikar, MD, MHPE[23]; Indira Gurubhagavatula, MD, MPH[24,25]

[1]Department of Pulmonology, Critical Care and Sleep Medicine, Mayo Clinic, Eau Claire, Wisconsin; [2]Department of Medicine, Division of Pulmonary, Critical Care and Sleep Medicine, New York University School of Medicine, New York, New York; [3]Baylor College of Medicine, Houston, Texas; [4]Concentra, Inc., Grand Rapids, Michigan; [5]8 Hour Sleep Clinic, El Paso, Texas; [6]Fatigue Countermeasures Laboratory, Human Systems Integration Division, NASA Ames Research Center, Moffett Field, California; [7]Sleep Medicine, The Permanente Medical Group, Manteca, California; [8]Department of Pediatrics, Division of Pulmonary, Asthma & Sleep Medicine, Stanford University School of Medicine, Palo Alto, California; [9]Eval Research Institute, Palo Alto, California; [10]Department of Neurology, Division of Sleep Medicine, Vanderbilt Medical Center, Nashville, Tennessee; [11]Sleep Disorders Center, UCSF Health, San Francisco, California; [12]Sleep Medicine, Millennium Physician Group, Fort Myers, Florida; [13]Department of Medicine, Rutgers Robert Wood Johnson Medical School, New Brunswick, New Jersey; [14]Saint Thomas Medical Partners - Sleep Specialists, Nashville, Tennessee; [15]Sleep Medicine, Atrium Health, Charlotte, North Carolina; [16]University of Pittsburgh, Pittsburgh, Pennsylvania; [17]Sleep Medicine Center, Washington University School of Medicine, St. Louis, Missouri; [18]Veteran Affairs Greater Los Angeles Healthcare System, North Hills, California; [19]David Geffen School of Medicine at the University of California, Los Angeles, California; [20]Division of Pulmonary and Critical Care Medicine, Center for Sleep Medicine, Mayo Clinic, Rochester, Minnesota; [21]Department of Pediatrics, Case Western Reserve University, Cleveland, Ohio; [22]Wayne State University, Detroit, Michigan; [23]University of Michigan Sleep Disorders Center, University of Michigan, Ann Arbor, Michigan; [24]Division of Sleep Medicine, Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania; [25]Corporal Michael Crescenz VA Medical Center, Philadelphia, Pennsylvania

The last several years have seen intense debate about the issue of transitioning between standard and daylight saving time. In the United States, the annual advance to daylight saving time in spring, and fall back to standard time in autumn, is required by law (although some exceptions are allowed under the statute). An abundance of accumulated evidence indicates that the acute transition from standard time to daylight saving time incurs significant public health and safety risks, including increased risk of adverse cardiovascular events, mood disorders, and motor vehicle crashes. Although chronic effects of remaining in daylight saving time year-round have not been well studied, daylight saving time is less aligned with human circadian biology—which, due to the impacts of the delayed natural light/dark cycle on human activity, could result in circadian misalignment, which has been associated in some studies with increased cardiovascular disease risk, metabolic syndrome and other health risks. It is, therefore, the position of the American Academy of Sleep Medicine that these seasonal time changes should be abolished in favor of a fixed, national, year-round 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 between spring and fall, when clocks in most parts of the United States (U.S.) are set one hour ahead of standard time, is called daylight saving time (DST), and its beginning and ending dates and times are set by federal law (the second Sunday in March at 2:00 AM and the first Sunday in November at 2:00 AM, respectively), while the remaining period between fall and spring of the following year is called standard time.[1]

The light/dark cycle is key in circadian entrainment. The acute alterations in timing due to transitions to and from DST contribute to misalignment between the circadian biological clock and the light/dark cycle (or photoperiod), resulting in not only acute personal disruptions, but significant public health and safety risks.[2]

BACKGROUND

Scientific, public and political debate about DST abounds. In response, the European Biological Rhythms Society (EBRS), European Sleep Research Society (ESRS), and Society for Research on Biological Rhythms (SRBR) published a joint statement, declaring that permanent standard time is the best option for public health.[3] In fact, the following year the SRBR published the position paper, "Why Should We Abolish Daylight Saving Time?"[2] Also, the European Parliament voted to end the mandatory DST change by 2021.[4]

In the U.S., the Congressional Research Service has identified dozens of states that have introduced legislation that would support changes to the observance of DST.[5] While

broad support exists for the elimination of the spring and fall time changes, proposed solutions are conflicting: Some states have introduced legislation proposing variations of permanent DST, and a nearly equal number of states have introduced legislation to establish permanent standard time. Although U.S. statute allows state-level exemption from DST,[1] and the exemption was claimed by Hawaii and Arizona, moving to permanent DST nationwide would require legislative approval by the U.S. Congress.

POSITION

It is the position of the AASM that the U.S. should eliminate seasonal time changes in favor of a national, fixed, year-round time. Current evidence best supports the adoption of year-round standard time, which aligns best with human circadian biology and provides distinct benefits for public health and safety.

DISCUSSION

Light is the most powerful exogenous *zeitgeber*, or cue, to the regulation of the endogenous circadian rhythm.[2] The human circadian phase responds to light in a predictable fashion, by delaying phase (with endogenous biological sleep onset and offset preferences occurring at a later clock time) in the setting of both morning darkness and evening light.[6] DST, therefore, induces phase delay by increasing the exposure to both morning darkness and evening light.[2]

The recommendation in support of permanent standard time is based on a review of existing literature that describes the acute, adverse effects of switching between standard time and DST twice yearly, and the chronic effects of DST during the spring, summer and fall months.

Acute effects of switching between standard time and DST

Shifting from standard time to DST has been associated with increased cardiovascular morbidity, including risk of myocardial infarction,[7,8] stroke,[9] and hospital admissions due to the occurrence of acute atrial fibrillation.[10] An increase in missed medical appointments and increased emergency room visits and return visits to the hospital are also seen only during the spring transition from standard time to DST.[11,12] The one-hour time shift in the spring results in less exposure to light in the morning and greater exposure to evening light. In the presence of continuing social or occupational demands in early morning hours, this delay results in sleep loss and resultant sleep debt,[13] in addition to circadian misalignment.[2] The end result is a variety of cellular derangements, including altered myocyte gene expression,[14] altered epigenetic and transcriptional profile of core clock genes,[15] increased production of inflammatory markers,[16] lower vagal tone resulting in higher heart rate and blood pressure, and reduced sleep.[17]

Although most acute health-related effects are noted only when transitioning from standard time to DST, transitions both into and out of DST have been associated with sleep disruption,[13] mood disturbances and suicide.[18] Traffic accidents increase in the first few days after the change from standard time to DST,[19] with an increase in fatal crashes of up to 6% in the United States.[20]

On the Monday after the transition to DST, volatility in stock markets in the U.S. has been observed.[21] While reasons for this 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.[22]

Chronic effects of DST

There is little direct evidence regarding the chronic effects of DST. Most studies have either been retrospective or have addressed the issue indirectly. DST has been associated with a decrease in crime rate,[23] and it may be associated with a modest overall decrease in risk of motor vehicle crashes, possibly due to hours of daylight lasting longer in the evening when most accidents occur, along with other, less obvious reasons.[5] However, 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. These findings may be due to darkness lasting longer in the morning when children are traveling to school, while other factors also may be at play.[24]

DST is less well-aligned with intrinsic human circadian physiology, and it disrupts the natural seasonal adjustment of the human clock due to the effect of late-evening light on the circadian rhythm.[25] DST results in more darkness in the morning hours, and more light in the evening hours. Both early morning darkness and light in the evening have a similar effect on circadian phase, causing the endogenous rhythm to shift to later in the day. There is evidence that the body clock does not adjust to DST even after several months.[26] Permanent DST could therefore result in permanent phase delay, a condition that can also lead to a perpetual discrepancy between the innate biological clock and the extrinsic environmental clock, as well as chronic sleep loss due to early morning social demands that truncate the opportunity to sleep. The chronic misalignment between the timing of demands of work, school, or other obligations against the innate circadian rhythm is called "social jet lag."[27] Studies show that social jet lag is associated with an increased risk of obesity,[28] metabolic syndrome,[29] cardiovascular disease,[30] and depression.[31] One study found that in the fall, during the shift from DST back to standard time, there was a reduction in the rate of cardiovascular events,[7] suggesting that the risk of myocardial infarction may be elevated because of chronic effects of DST.[32] 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.[33] Adopting permanent DST also would undo the benefits of delaying start times for middle schools and high schools.[34]

During the 1973 OPEC oil embargo, minimal, if any, of the purported energy savings were actually observed in

the U.S., and the policy was highly unpopular,[35] especially in rural areas of the U.S. 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.

FUTURE DIRECTIONS

Although the acute, adverse effects of DST are well-described, few studies have evaluated the chronic effects of DST on physiology, performance, health, economics and safety. Such studies should attempt to address confounding seasonal effects, including the length of the photoperiod. In addition, more studies are needed to determine how eastward or westward position in a time zone influences health and safety outcomes. Studies that compare the impacts of permanent standard time to permanent DST are also needed.[36]

CONCLUSIONS

Existing data support the elimination of seasonal time changes in favor of a fixed, year-round time. DST can cause misalignment between the biological clock and environmental clock, resulting in significant health and public safety-related consequences, especially in the days immediately following the annual change to DST. A change to permanent standard time is best aligned with human circadian biology and has the potential to produce beneficial effects for public health and safety.

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Address correspondence to: M. Adeel Rishi, MD, Department of Pulmonology, Critical Care and Sleep Medicine, Mayo Clinic Health System, 1221 Whipple Street, Eau Claire, WI, 54703; Tel: (715) 838-1900; Email: rishi.muhammad@mayo.edu

DISCLOSURE STATEMENT

The authors are the 2019–2020 members of the AASM Public Safety Committee and the 2019–2020 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.