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SCIENTIFIC INVESTIGATIONS

Medical malpractice litigation and daylight saving time

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Study Objectives: Daylight saving time (DST) constitutes a natural quasi-experiment to examine the influence of mild sleep loss and circadian misalignment. We investigated the acute effects of spring transition into DST and the chronic effects of DST (compared to standard time) on medical malpractice claims in the United States over 3 decades.

Methods: We analyzed 288,432 malpractice claims from the National Practitioner Data Bank. To investigate the acute effects of spring DST transition, we compared medical malpractice incidents/decisions 1 week before spring DST transition, 1 week following spring DST transition, and the rest of the year. To investigate the chronic effects of DST months, we compared medical malpractice incidents/decisions averaged across the 7–8 months of DST vs the 4–5 months of standard time.

Results: With regard to acute effects, spring DST transitions were significantly associated with higher payment decisions but not associated with the severity of medical incidents. With regard to chronic effects, the 7–8 DST months were associated with higher average payments and worse severity of incidents than the 4–5 standard time months.

Conclusions: The mild sleep loss and circadian misalignment associated with DST may influence the incidence of medical errors and decisions on medical malpractice payments both acutely and chronically.

Keywords: sleep deprivation, performance, medical errors, emotional reactivity, cognition, health care policy

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BRIEF SUMMARY

Current Knowledge/Study Rationale: The transition into daylight saving time (DST) causes mild sleep loss and circadian misalignment. Using 3 decades of medical malpractice incident data in the United States, we investigated the acute effects of spring transition into DST and the chronic effects of sustained DST months on medical malpractice payment decisions and incident severity.

Study Impact: The acute transition to DST was associated with higher medical malpractice payment decisions. In addition, higher payment decisions and greater incident severity occurred during sustained DST months relative to sustained standard time months. Our findings converge with evidence that DST has health and economic consequences.

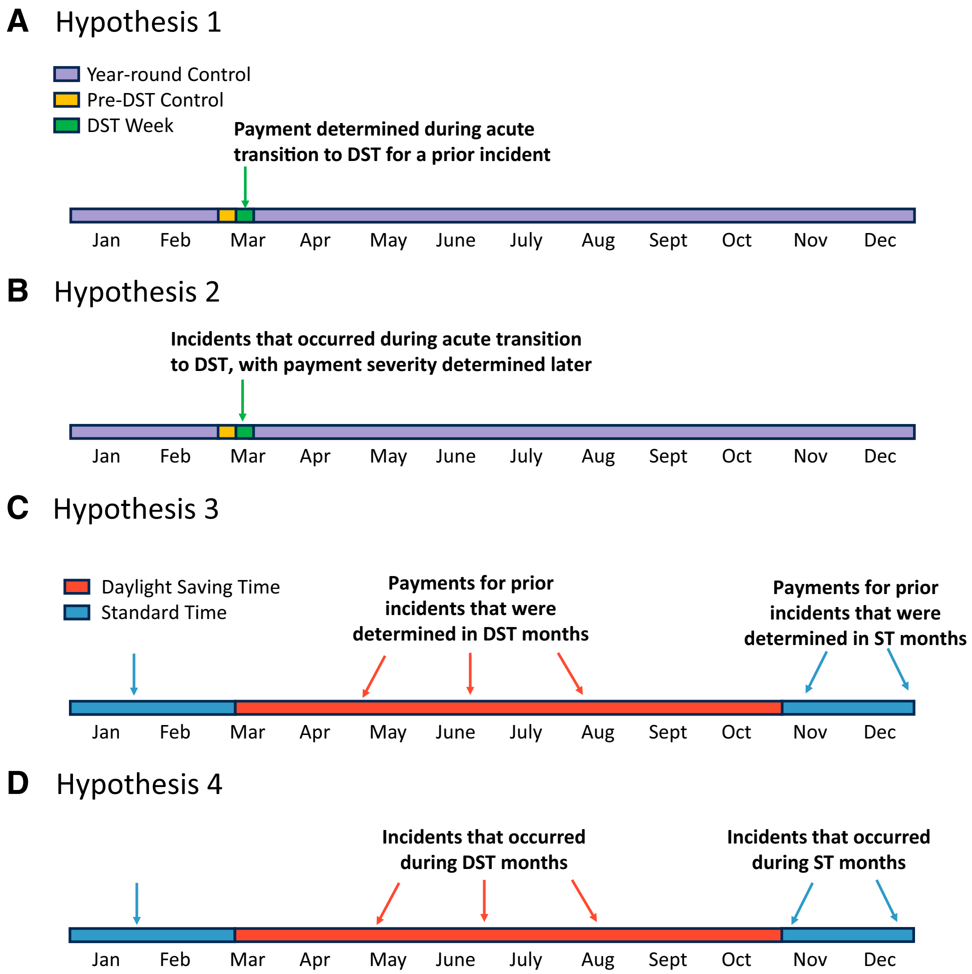
INTRODUCTION

Approximately half of physicians, and nearly all surgeons, have faced a medical malpractice lawsuit at least once in their career.[1] In addition to the severity of a medical mistake/event, the decision by patients/families to pursue litigation is driven by socioemotional processes, such as the desire to assign responsibility for injuries and to blame others rather than forgive mistakes.[1,2] Sleep loss may influence such socioemotional processes.[3] For example, experimental studies have found that sleep deprivation alters emotional reactivity,[4] decreases trust in others,[5] reduces interpersonal connectedness,[6] and lowers empathy.[7] Of particular relevance to the current topic, one experiment randomly assigned healthy adults to sleep normally (7.7 hours/night) or mildly restrict sleep (6.2 hours/night) for 4 consecutive nights prior to reading medical error vignettes, such as a surgeon who forgot to remove all surgical instruments.[8] Although the 2 groups rated the medical errors to be of similar severity, sleep-restricted participants were significantly more likely than well-rested participants to assign maximum punishment for the physicians and maximum financial compensation for the patients.

Building on this laboratory finding, we analyzed medical malpractice data in the United States for the past 3 decades to investigate the acute and chronic effects of daylight saving time (DST). Specifically, we first investigated whether the transition to DST—which incurs mild sleep loss[9]—was associated with acute changes in the judgment of final compensation for medical errors (**Figure 1A**). Based on evidence that judges issue harsher punishments to criminal defendants following DST transitions,[10] we predicted that there would be an acute elevation in the medical malpractice compensation amount when it was determined following the spring DST transition (Hypothesis 1).

We additionally investigated whether health care professionals made more severe mistakes when the incidents occurred following the spring DST transition (**Figure 1B**).[11] Based on evidence that safety-related incidents due to human errors are acutely elevated in the United Kingdom following the spring

Figure 1—Illustration of the malpractice incident and payment decision process.



Hypothesis 1 compares payments that were determined during the daylight saving time (DST) week, pre-DST control, and year-round control periods **(A)**. Hypothesis 2 compares malpractice incidents that occurred during the DST week, pre-DST control, and year-round control periods **(B)**. Hypothesis 3 compares averaged payments that were determined during the DST months and standard time months **(C)**. Hypothesis 4 compares malpractice incidents that occurred during the DST months and standard time months **(D)**.

transition into DST, we hypothesized that medical mistakes that occurred shortly after the spring DST transition in the United States would be more severe (operationalized as a higher payment; Hypothesis 2).

Two additional, exploratory hypotheses stem from recent policy discussions regarding whether to adopt permanent standard time (ST) or permanent DST.[12–14] Few studies have tested whether outcomes differ across the 7–8 months of DST vs the 4–5 months of ST (hereafter referred to as "chronic effects" of DST). Some work has concluded that permanently expanding DST from 7–8 months to 12 months would be economically beneficial and reduce traffic accidents in the evening hours.[15] On the other hand, some sleep/circadian researchers have argued that 12 months of permanent DST would exaggerate the misalignment between social and biological clocks, leading to chronic social jetlag.[16] To further inform this debate, we averaged medical malpractice payment data across all DST months (depending on the year, DST months ranged from early March/early April–late October/early November). We then compared averaged outcomes between states that did observe vs did not observe DST. If DST introduces chronic and mild circadian misalignment that is detrimental to information processing and executive functions,[16,17] then payment decisions on malpractice incidents should result in higher payments during DST months than during ST months (**Figure 1C**; Exploratory Hypothesis 3). Similarly, malpractice incidents occurring during DST months would be expected to be more severe than those occurring during ST months (**Figure 1D**; Exploratory Hypothesis 4).

Beyond acute or chronic influences of DST, various external factors could lead to variations in payment decision amounts across seasons, collectively referred to as "seasonal effects." To delineate the seasonal effects from the influence of DST, across all hypotheses we compared states that observed DST with states that did not. Because seasonal effects are expected in both types of states, differential changes across the year (state × time period interactions) would implicate the influence of DST.

METHODS

We obtained data on 373,806 malpractice claims between January 1990 and September 2018 from the National Practitioner Data Bank, a repository managed by the Health Resources and Services Administration.[18] Health care organizations in the United States must report all medical malpractice payments to the National Practitioner Data Bank, including payments resulting from court judgments or settlements. The dataset included information on time (year, month, and week) of the malpractice incidents and payment determination, approximated payment amount, and state (coded as control or DST states). All other information about the claims was kept private by the National Practitioner Data Bank to ensure confidentiality. Of the 373,806 cases, there were 85,374 cases with unspecified or ambiguous dates that had to be excluded. The final analysis focused on the remaining 288,432 cases.

Control states were those that did not switch between DST and ST, which included Arizona and Hawaii, as well as Indiana during and before April 2006. All other states were DST states (including Indiana after 2006). The National Practitioner Data Bank provided payment amounts as ranges rather than exact values because the latter could be personally identifying information. Value ranges were recoded as the midpoint of the range (see **Table 1**). We accounted for inflation by adjusting all payment amounts to 2018 December dollars using the seasonally adjusted Consumer Price Index.[19] In addition, because payment data were positively skewed (skewness = 13.16, kurtosis = 419.53), we took 2 approaches for statistical analyses: (1) we log10-transformed the payment amounts to improve normality (skewness = −0.67, kurtosis = 0.56 after transformation) and (2) we created a binary variable for whether each case resulted in a high payment amount (ie, > $500,000 after inflation adjustment; 20.69% of all cases).

Statistical analysis

The first goal was to describe general characteristics of payments, including general differences in payments across DST states vs control states and whether the timing of medical incidents was related to the timing of payment determinations (using independent samples *t* tests and chi-squared tests). The next goal was to test Hypotheses 1 and 2 by comparing incidents and payment determinations during the week immediately after the spring DST transition (hereafter DST week) to the week before DST (pre-DST control) and the rest of the year (year-round control; see **Figure 1A** and **Figure 1B** for illustration).[11,20] Analysis of variance was conducted on log-transformed payment amounts and logistic regression was conducted on proportion of payments over $500,000, with time (DST week, pre-DST control, year-round control), state (DST states, control states), and the time × state interaction as the independent variables. A significant omnibus analysis of variance interaction would indicate that the effect of time on payment amounts differed across DST states vs control states. Following a significant omnibus interaction outcome, we further explored these relationships through post hoc interaction tests and simple main effects tests, which allowed for a more detailed understanding of how payment amounts changed over time in both control and DST states.

To test Exploratory Hypotheses 3 and 4 on the chronic effects of DST, incidents and payment determinations during the 7–8 months of DST were compared to those during the 4–5 months of ST (see **Figure 1C** and **Figure 1D** for illustration). Analyses of variance were conducted on log-transformed payment amounts and logistic regressions were conducted on

Table 1—Payment amounts by the national practitioner data bank.

Payment Levels ($)	Coding for Original Payments (Before Inflation Adjustment) at Each Level	Original Payments Coding Example	Frequency (%) of Payments at Each Level After Inflation Adjustment
1–100	$50	N/A	371 (0.13%)
101–500	$300	N/A	531 (0.18%)
501–1,000	$750	N/A	749 (0.26%)
1,001–5,000	The midpoint of each $1,000 increment	Payments between $1,001 and $2,000 coded as $1,500; payments between $2,001 and $3,000 coded as $2,500.	9,530 (3.30%)
5,001–100,000	The midpoint of each $5,000 increment	Payments between $5,001 and $10,000 coded as $7,500.	101,431 (35.17%)
100,001–500,000	The midpoint of each $10,000 increment	Payments between $100,001 and $110,000 coded as $105,000	116,147 (40.27%)
500,001–1 million			36,125 (12.52%)
1 million 1–10 million	The midpoint of each $100,000 increment	Payments between $1,000,001 and $1,100,000 coded as $1,050,000	23,436 (8.13%)
10 million 1–20 million	The midpoint of each $1 million increment	Payments between $10,000,001 and $11,000,000 coded as $10,500,000	91 (0.03%)
20 million 1–50 million	The midpoint of each $5 million increment	Payments between $20,000,001 and $25,000,000 coded as $22,500,000	21 (0.01%)

N/A = Not applicable.

proportion of payments over \$500,000, with time (DST, ST), state (DST states, control states), and the time × state interaction as the independent variables. If the interaction was significant, we conducted post hoc independent samples *t* tests and logistic regressions to understand the differential change across control and DST states.

For all of our statistical tests, we focused on the time × state interaction effects, with the assumption that variations across time in control states are influenced by seasonal effects whereas the variations across time in DST states are influenced by both seasonal effects and acute/chronic DST effects. All statistical tests were 2-tailed with alpha set to 0.05. Analyses were conducted in JMP Pro 16 (JMP Statistical Discovery, Cary, North Carolina). The University Institutional Review Board exempted this study from review because we only performed deidentified secondary data analyses.

RESULTS

General characteristics of payment decisions across states

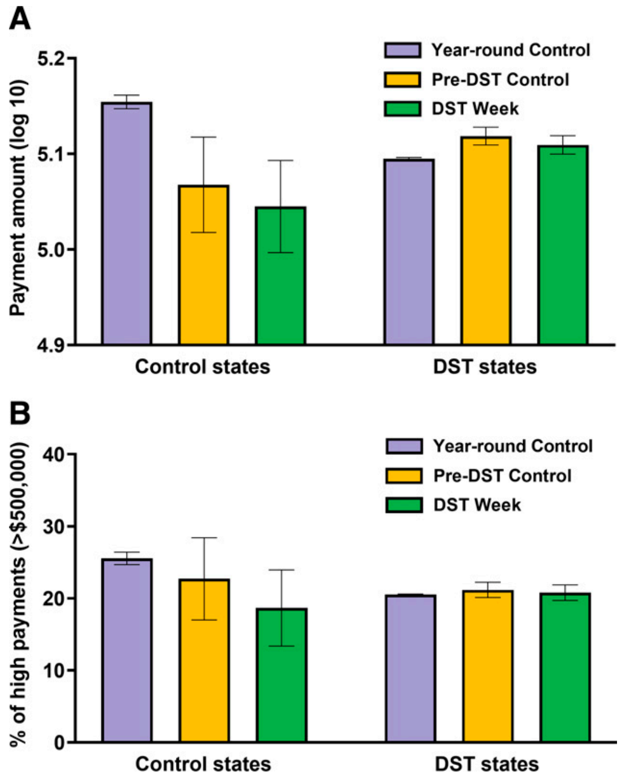
Prior to testing Hypotheses 1–4, we conducted independent samples *t* tests and chi-squared tests to provide an overview of malpractice payment characteristics. On average, log-transformed payments in the control states (mean = 5.15, standard deviation = 0.70) were higher than in the DST states (mean = 5.10, standard deviation = 0.71) [$t(288430) = 7.76$, $P < .001$]. The control states also showed a greater proportion of high payments (25.35%) than DST states (20.52%) [$\chi^2(1) = 140.36$, $P < .001$]. If DST has no influence on payment decisions, then this pattern should be observed across all stages of the year, as will be addressed in the following sections on differential change in payments for the DST and control states.

To inform whether the timing of medical malpractice incidents needed to be adjusted by the timing of payment decisions (or vice versa), we evaluated whether these 2 outcomes were related. The timing of medical malpractice incidents was not significantly associated with the timing of payment decisions in DST states [$\chi^2(4) = 6.06$, $P = .195$], control states [$\chi^2(4) = 3.53$, $P = .473$], or all states [$\chi^2(4) = 5.31$, $P = .257$]. Therefore, we did not adjust for the timing of initial incidents in the analyses of the timing of final payment decisions (or vice versa).

Spring DST transition was associated with payment decisions (Hypothesis 1)

In DST states, the payments decided in the week after the spring DST transition were higher than expected. We first examined whether the spring DST transition was associated with payment decisions, with the 3 × 2 analysis of variance showing a significant omnibus interaction on log-transformed payment amounts, $F_{2,\ 288426} = 5.28$, $P = .005$ (**Figure 2A**). This omnibus interaction was driven by the differences between the spring DST week and year-round control in DST states vs control states, $F_{1,\ 282580} = 6.03$, $P = .014$. Specifically, the payment amount was reduced during the DST week relative to the year-round control in control states (seasonal effect), $t(10029) = 2.25$, $P = .026$.

Figure 2—For Hypothesis 1, we tested whether compensation amount determined would be elevated following the spring daylight saving time (DST) transition, measured by log-transformed payment amounts **(A)** and the proportion of high payments **(B)**.



Error bars represent standard error (for log-transformed payment amounts) and 95% confidence interval (for proportion of high payments). In DST states, 267,092, 5,641, and 5,461 cases were determined during the year-round control period, pre-DST control week, and DST week, respectively. In control states, 9,822, 207, and 209 cases were determined during the year-round control period, pre-DST control week, and DST week, respectively.

If the spring DST transition did not affect payment amounts, we would see a similar reduction in the payment amount between these time groups in DST states. However, this pattern was absent in DST states [nominally reversed; $t(272551) = 1.50$, $P = .134$], suggesting that payment amounts were higher than expected after the DST transition.

Next, we examined whether the spring DST transition was associated with the proportion of high payments; this analysis also showed a significant 3 × 2 omnibus interaction between time and state, $\chi^2(2) = 6.98$, $P = .031$ (**Figure 2B**). The omnibus interaction was also driven by the divergence between spring DST week and year-round control within DST states vs the pattern observed in the control states, $\chi^2(1) = 5.31$, $P = .021$. In control states, the proportion of high payments was lower during the spring DST week than the year-round control (odds ratio [OR] = 0.67, $P = .025$), but this pattern was absent in DST states (OR = 1.02, $P = .605$), suggesting that the proportion of high payments was higher than expected after the DST transition.

Spring DST transition was not associated with incident severity (Hypothesis 2)

We next tested whether spring DST transitions were associated with the severity of malpractice incidents. We found no significant time × state interactions on log-transformed payment amounts [Figure 3A; $F(2, 288426) = 0.19$, $P = .828$] or high payment proportions, $\chi^2(2) = 0.78$, $P = .679$ (Figure 3B), suggesting that DST transitions were not associated with severity of malpractice incidents.

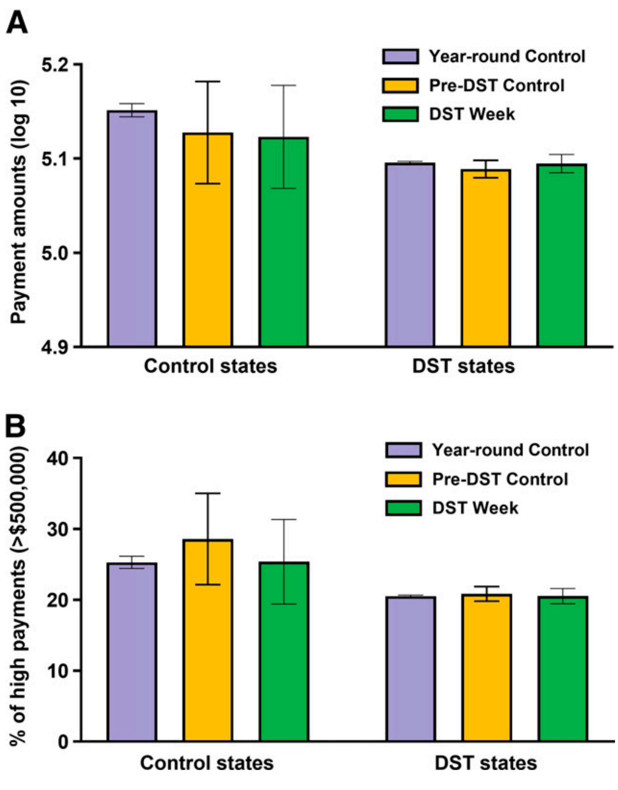
Chronic DST may be associated with payment decisions (Exploratory Hypothesis 3)

We next tested the exploratory hypothesis that malpractice incident payments determined during any of the 7–8 DST months would be higher than those determined during any of the 4–5 ST months (Figure 1C). We observed a nonsignificant time × state interaction for log-transformed payment amounts [Figure 4A; $F_{1,\ 288428} = 0.24$, $P = .626$] but a significant time × state interaction for proportion of high payments issued, $\chi^2(1) = 4.21$, $P = .040$ (Figure 4B). During DST months, the proportion of high payments did not change significantly in control states (OR = 0.94, $P = .150$) but increased in DST states (OR = 1.03, $P = .002$).

Chronic DST was associated with incident severity (Exploratory Hypothesis 4)

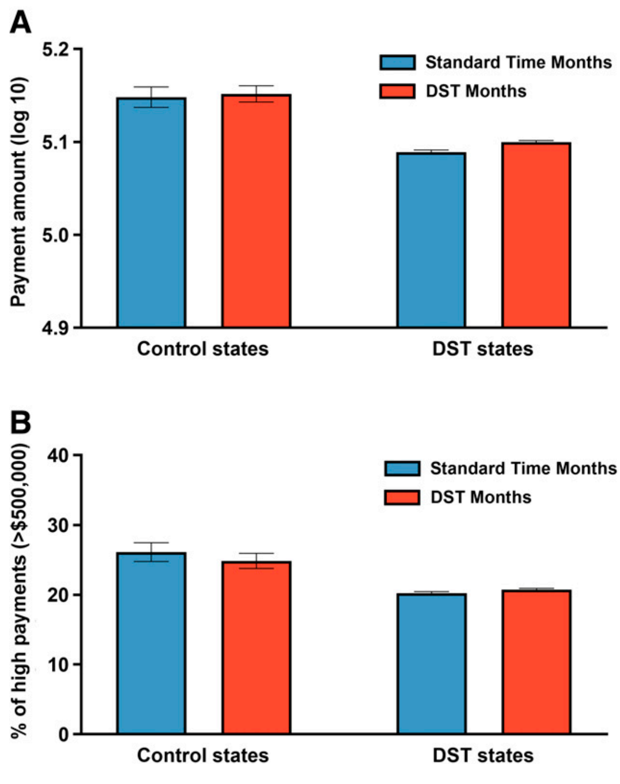
Finally, for the exploratory hypothesis that malpractice incidents occurring during the 7–8 months of DST would be more severe than incidents occurring during the 4–5 months of ST (Figure 1D), we found significant state × time interactions for both log-transformed payment amounts [Figure 5A; $F_{1,\ 288428} = 4.43$, $P = .035$] and proportion of high payments, $\chi^2(1) = 7.51$, $P = .006$ (Figure 5B). In control states, log-transformed payment amounts were significantly lower for incidents that occurred during the 7–8 DST months than incidents that occurred during the 4–5 ST months [mean difference = 0.038,

Figure 3—For Hypothesis 2, we tested whether health care professionals would make more severe mistakes (ie, represented by higher payments) when the incidents occurred following the spring daylight saving time (DST) transition, measured by log-transformed payment amounts **(A)** and the proportion of high payments **(B)**.



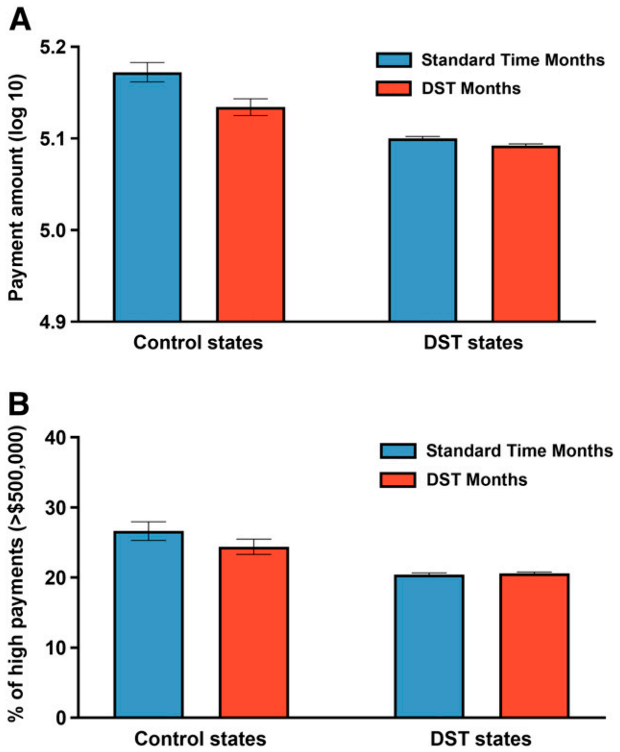
Error bars represent standard error (for log-transformed payment amounts) and 95% confidence interval (for proportion of high payments). In DST states, 266,827, 5,904, and 5,463 incidents occurred during year-round control period, pre-DST control week, and DST week, respectively. In control states, 9,844, 189, and 205 incidents occurred during year-round control period, pre-DST control week, and DST week, respectively.

Figure 4—For Exploratory Hypothesis 3, we tested whether malpractice incident payments determined during the 7–8 daylight saving time (DST) months would yield higher payments than those determined during the 4–5 standard time months, measured by log-transformed payment amounts **(A)** and the proportion of high payments **(B)**.



Error bars represent standard error (for log-transformed payment amounts) and 95% confidence interval (for proportion of high payments). In DST states, 109,501 and 168,693 cases were determined during standard time months and DST months, respectively. In control states, 4,103 and 6,135 cases were determined during standard time months and DST months, respectively.

Figure 5—For Exploratory Hypothesis 4, we tested whether malpractice incidents occurring during the 7–8 daylight saving time (DST) months would be more severe (ie, yielding higher payments) than those occurring during the 4–5 standard time months, measured by log-transformed payment amounts **(A)** and the proportion of high payments **(B)**.



Error bars represent standard error (for log-transformed payment amounts) and 95% confidence interval (for proportion of high payments). In DST states, 115,474 and 162,720 incidents occurred during standard time months and DST months, respectively. In control states, 4,332 and 5,906 incidents occurred during standard time months and DST months, respectively.

$t(10236) = 2.73$, $P = .006$]; **Figure 5A** illustrates that this seasonal decrease was much lower in DST states (mean difference = 0.008, $t(278192) = 2.84$, $P = .005$). The proportion of high payments in control states was also significantly lower for incidents during the 7–8 DST months than during the 4–5 ST months (OR = 0.89, $P = .010$), whereas there was no seasonal reduction in states that observed DST (OR = 1.01, $P = .272$).

DISCUSSION

Sleep deprivation causes cognitive errors and altered emotional reactivity in laboratory settings,[4,8,21,22] but demonstrating that these laboratory effects translate to complex, real-world settings has not always been easy.[23,24] The present study demonstrates the real-world generalizability of prior laboratory work[8] in observing that the transition to spring DST was associated with medical malpractice payments that were higher than expected (Hypothesis 1), even though there was minimal or no acute effect of DST on the severity of medical incidents (Hypothesis 2). This finding on civil medical malpractice claims also converges with DST work on criminal cases, in which judges rendered longer sentences following the spring DST transition.[10] Multiple mechanisms are worth consideration. One potential explanation is that the acute sleep loss from DST altered socioemotional processing in the judges, leading to stronger emotional reactions and decreased empathy for mistakes,[3,4,7] which subsequently resulted in determinations of higher compensation for patients. A second potential explanation is that sleep deprivation might have affected the negotiation process of the settlements,[25] with the sleep-deprived patients/families less willing to accept a lower compensation, thereby resulting in higher payment amounts. This potential explanation arises from Anderson and Dickinson's study[5] in which sleep-deprived participants were more likely to reject unequal-split offers from their partners in a bargaining game. There are likely other possible explanations worth exploring in targeted studies. From a practical standpoint, though, the consistency of results across laboratory and real-world observational studies emphasizes the need to mitigate sleep loss in individuals tasked with making significant judgments or decisions.[26–30]

We originally hypothesized that the severity of medical incidents (that later led to malpractice claim payments) would be acutely affected by the spring DST transition, but it was not (Hypothesis 2). The acute effect of transitioning to DST may produce sleep deprivation that is mild enough (~40 minutes of sleep loss)[9] that it does not influence performance errors or safety.[24,31] In a recent study of 60 surgeons, Quan et al found that medical errors did not differ for surgical procedures between postcall groups (4.98 ± 1.41 hours of sleep) and non-post-call groups (6.68 ± 0.88 hours of sleep).[24] A second possibility is that the system-wide safeguards against medical mistakes (eg, checklists, automated monitors/alarms) work effectively to mitigate the effects of very mild sleep restriction.[32] A third possible explanation is that patients are more likely to miss medical appointments following the spring DST transition, which reduces health care providers' workload and in turn may counteract the effects of health care professionals' sleep loss on medical mistakes.[33,34]

Although there is likely some overlap in the cognitive processes used in legal adjudication settings and in medical practice, the differences in cognitive processes engaged across medical and legal situations may inform the divergent outcomes for payment decisions (Hypothesis 1) and malpractice incident severity (Hypothesis 2). For example, safe medical practice is dependent on semantic memory retrieval for connecting symptoms to diagnoses, considering treatment approaches likely to work for individual patients, and remembering medication side effects. Health care providers must also remember to take a detailed patient history, order further testing, and use the test results to inform decision-making.[35] Some health care situations may also require procedural memory, such as completing all steps of a physical examination or fine motor skills for surgical procedures. By contrast, in legal adjudication, there may be no demands on procedural memory and lower demands on semantic memory recall (except for recalling similar cases to inform payments). Instead, legal adjudication may more heavily emphasize socioemotional and executive function processes such as those used in negotiation techniques and moral reasoning.

An area of contemporary importance is whether societies should switch to 12 months of permanent DST or 12 months of permanent ST, rather than the 7- to 8-month DST/4- to 5-month ST split currently used by dozens of countries.[36–38] We therefore explored differences in malpractice incidents and payment decisions across the 7–8 sustained months of DST (early March/early April–late October/early November) relative to the remaining months of ST. We found that the DST months were associated with higher payment decisions (Exploratory Hypothesis 3) and higher severity of incidents (Exploratory Hypothesis 4) relative to ST months when accounting for whether a state observed DST or not. These findings suggested a potential negative impact of DST's mild but chronic misalignment between social and biological clocks on medical practice outcomes. Policy decisions, of course, weigh a range of health, safety, economic, and other factors, and the current findings should be considered alongside outcomes that would favor permanent DST such as better lighting in the evening for traffic[15] and more physical exercise for children.[39]

Interpretations of DST-related changes across the year should be considered within the context of medical malpractice payment amounts being higher on average in control states. While the cause of this state-based difference is difficult to pinpoint, potential contributing factors that vary across states could include historical precedents for malpractice payments within that state, caps for noneconomic damages established by state laws, the availability of legal assistance, cost of litigations, income levels that affect the compensation for lost wages, and the cost of medical care or trust in health care that affected the initial likelihood of seeking treatment.[40,41] Although average payment amount in the control states was higher than in the DST states, the control states also showed seasonal effects. Seasonal effects could reflect changes in photoperiod that are known to affect sleep,[42] which could have downstream effects on the socioemotional processes underlying judgments or the cognitive-motor processes underlying some medical mistakes.[43] Seasonal effects could also reflect that people's generosity and prosocial tendencies change across the year, often increasing near religious and work/school holidays[44]; of note, spring DST transitions occur near spring break, Ramadan, and Easter holidays. Furthermore, across different seasons, there are fluctuations in health care professionals' workloads and sleep patterns, fluctuations in the likelihood of adverse outcomes postsurgery,[45] and fluctuations in the prevalence of different diseases,[46] each of which could potentially represent or influence the severity of medical mistakes. Targeted investigations would be necessary to confirm any of these possibilities as mediating mechanisms for the seasonal effects for payment decisions.

Limitations of the current study included the lack of details on each incident that would provide information on type of mistake (eg, surgical), the experience level of the person making the mistake (eg, resident), the experience level of the individual(s) who negotiated/determined the payment account, and possible covariates (demographics), all information that was kept private in the database to ensure legal confidentiality. Another limitation is that even though changes in DST constitute a quasi-experimental design, such changes should be interpreted as associations rather than as the basis for establishing causality. Despite these limitations, this study had some strengths, including access to the most extensive database of malpractice incidents in the United States to provide a generalizable test of a controlled laboratory finding.[8] In addition, the American Academy of Sleep Medicine,[37] the Sleep Research Society,[36] and the American Medical Association House of Delegates[38] have advocated for an end to DST. Although additional work is needed to inform the advantages and disadvantages of switching to permanent DST vs permanent ST, the current findings on medical incident severity and malpractice payments align with these societies' advocacy for permanent ST.

ABBREVIATIONS

DST, daylight saving time
OR, odds ratio
ST, standard time

REFERENCES

1. Kane L, Shute D. Medscape Malpractice Report 2019. https://www.medscape.com/slideshow/2019-malpractice-report-6012303. Accessed March 15, 2024.
2. Saitta N, Hodge SD Jr. Efficacy of a physician's words of empathy: an overview of state apology laws. *J Am Osteopath Assoc.* 2012;112(5):302–306.
3. Ben Simon E, Vallat R, Barnes CM, Walker MP. Sleep loss and the socio-emotional brain. *Trends Cogn Sci.* 2020;24(6):435–450.
4. Tempesta D, Salfi F, De Gennaro L, Ferrara M. The impact of five nights of sleep restriction on emotional reactivity. *J Sleep Res.* 2020;29(5):e13022.
5. Anderson C, Dickinson DL. Bargaining and trust: the effects of 36-h total sleep deprivation on socially interactive decisions. *J Sleep Res.* 2010;19(1 Pt I):54–63.
6. Palmer CA, John-Henderson NA, Bawden H, et al. Sleep restriction reduces positive social emotions and desire to connect with others. *Sleep.* 2023;46(6):zsac265.
7. Guadagni V, Burles F, Ferrara M, Iaria G. The effects of sleep deprivation on emotional empathy. *J Sleep Res.* 2014;23(6):657–663.
8. Nguyen S, Corrington A, Hebl MR, Scullin MK. Endorsements of surgeon punishment and patient compensation in rested and sleep-restricted individuals. *JAMA Surg.* 2019;154(6):555–557.
9. Barnes CM, Wagner DT. Changing to daylight saving time cuts into sleep and increases workplace injuries. *J Appl Psychol.* 2009;94(5):1305–1317.
10. Cho K, Barnes CM, Guanara CL. Sleepy punishers are harsh punishers: daylight saving time and legal sentences. *Psychol Sci.* 2017;28(2):242–247.
11. Kolla BP, Coombes BJ, Morgenthaler TI, Mansukhani MP. Increased patient safety-related incidents following the transition into daylight savings time. *J Gen Intern Med.* 2021;36(1):51–54.
12. British Broadcasting Corporation. European MPs Vote to End Summer Time Clock Changes. https://www.bbc.com/news/world-europe-47704345. Accessed March 15, 2024.
13. Reuters. U.S. Senate Approves Bill to Make Daylight Saving Time Permanent. https://www.reuters.com/world/us/us-senate-approves-bill-that-would-make-daylight-savings-time-permanent-2023-2022-03-15/. Accessed March 15, 2024.

14. The Guardian. Mexico Falls Back but Won't Spring Forward as Summer Time Abolished. https://www.theguardian.com/world/2022/oct/27/mexico-votes-abolish-summer-time-daylight-savings. Accessed March 15, 2024.
15. Cunningham CX, Nuñez TA, Hentati Y, et al. Permanent daylight saving time would reduce deer-vehicle collisions. *Curr Biol.* 2022;32(22):4982–4988.e4.
16. Roenneberg T, Winnebeck EC, Klerman EB. Daylight saving time and artificial time zones–a battle between biological and social times. *Front Physiol.* 2019; 10:944.
17. Chellappa SL, Morris CJ, Scheer FAJL. Daily circadian misalignment impairs human cognitive performance task-dependently. *Sci Rep.* 2018;8(1):3041.
18. US Department of Health and Human Services. National Practitioner Data Bank. https://www.npdb.hrsa.gov/index.jsp.
19. US Bureau of Labor Statistics. Consumer Price Index. https://www.bls.gov/cpi/tables/seasonal-adjustment/home.htm.
20. Lahti T, Nysten E, Haukka J, Sulander P, Partonen T. Daylight saving time transitions and road traffic accidents. *J Environ Public Health.* 2010;2010:657167.
21. Krause AJ, Simon EB, Mander BA, et al. The sleep-deprived human brain. *Nat Rev Neurosci.* 2017;18(7):404–418.
22. Chellappa SL, Morris CJ, Scheer FAJL. Circadian misalignment increases mood vulnerability in simulated shift work. *Sci Rep.* 2020;10(1):18614.
23. Landrigan CP, Rahman SA, Sullivan JP, et al; ROSTERS Study Group. Effect on patient safety of a resident physician schedule without 24-hour shifts. *N Engl J Med.* 2020;382(26):2514–2523.
24. Quan SF, Landrigan CP, Barger LK, et al. Impact of sleep deficiency on surgical performance: a prospective assessment [published online ahead of print, 2023 Apr 1]. *J Clin Sleep Med.*
25. Häusser JA, Halfmann E, Hüffmeier J. Negotiating through the night: how sleep deprivation can affect negotiation outcomes. *Negot Confl Manag Res.* 2022;16(2): 189–210.
26. Almond D, Du X. Later bedtimes predict President Trump's performance. *Econ Lett.* 2020;197:109590.
27. Barnes CM, Lucianetti L, Bhave DP, Christian MS. "You wouldn't like me when I'm sleepy": leaders' sleep, daily abusive supervision, and work unit engagement. *Acad Manage J.* 2015;58(5):1419–1437.
28. Frenda SJ, Berkowitz SR, Loftus EF, Fenn KM. Sleep deprivation and false confessions. *Proc Natl Acad Sci USA.* 2016;113(8):2047–2050.
29. Olsen OK, Pallesen S, Torsheim T, Espevik R. The effect of sleep deprivation on leadership behaviour in military officers: an experimental study. *J Sleep Res.* 2016;25(6):683–689.
30. Scullin MK, Hebl MR, Corrington A, Nguyen S. Experimental sleep loss, racial bias, and the decision criterion to shoot in the Police Officer's Dilemma task. *Sci Rep.* 2020;10(1):20581.
31. Santisteban JA, Brown TG, Ouimet MC, Gruber R. Cumulative mild partial sleep deprivation negatively impacts working memory capacity but not sustained attention, response inhibition, or decision making: a randomized controlled trial. *Sleep Health.* 2019;5(1):101–108.
32. Barimani B, Ahangar P, Nandra R, Porter K. The WHO surgical safety checklist: a review of outcomes and implementation strategies. *Perioper Care Oper Room Manag.* 2020;21:100117.
33. Ellis DA, Luther K, Jenkins R. Missed medical appointments during shifts to and from daylight saving time. *Chronobiol Int.* 2018;35(4):584–588.
34. Lockley SW, Cronin JW, Evans EE, et al; Harvard Work Hours, Health and Safety Group. Effect of reducing interns' weekly work hours on sleep and attentional failures. *N Engl J Med.* 2004;351(18):1829–1837.
35. Landrigan CP, Rothschild JM, Cronin JW, et al. Effect of reducing interns' work hours on serious medical errors in intensive care units. *N Engl J Med.* 2004; 351(18):1838–1848.
36. Malow BA. It is time to abolish the clock change and adopt permanent standard time in the United States: a Sleep Research Society position statement. *Sleep.* 2022;45(12):zsac236.
37. Rishi MA, Ahmed O, Barrantes Perez JH, et al. Daylight saving time: an American Academy of Sleep Medicine position statement. *J Clin Sleep Med.* 2020;16(10): 1781–1784.
38. American Medical Association. AMA Calls for Permanent Standard Time. https://www.ama-assn.org/press-center/press-releases/ama-calls-permanent-standard-time. Accessed March 15, 2024.
39. Goodman A, Page AS, Cooper AR; International Children's Accelerometry Database (ICAD) Collaborators. Daylight saving time as a potential public health intervention: an observational study of evening daylight and objectively-measured physical activity among 23,000 children from 9 countries. *Int J Behav Nutr Phys Act.* 2014;11(1):84.
40. Seabury SA, Helland E, Jena AB. Medical malpractice reform: noneconomic damages caps reduced payments 15 percent, with varied effects by specialty. *Health Aff (Millwood).* 2014;33(11):2048–2056.
41. Mello MM, Chandra A, Gawande AA, Studdert DM. National costs of the medical liability system. *Health Aff (Millwood).* 2010;29(9):1569–1577.
42. Suzuki M, Taniguchi T, Furihata R, et al. Seasonal changes in sleep duration and sleep problems: a prospective study in Japanese community residents. *PLoS One.* 2019;14(4):e0215345.
43. Barley BK, Gao C, Luster T, et al. Chronotype in college science students is associated with behavioral choices and can fluctuate across a semester. *Chronobiol Int.* 2023;40(6):710–724.
44. Greenberg AE. On the complementarity of prosocial norms: the case of restaurant tipping during the holidays. *J Econ Behav Organ.* 2014;97:103–112.
45. Shuhaiber JH, Goldsmith K, Nashef SA. The influence of seasonal variation on cardiac surgery: a time-related clinical outcome predictor. *J Thorac Cardiovasc Surg.* 2008;136(4):894–899.
46. Martinez ME. The calendar of epidemics: seasonal cycles of infectious diseases. *PLoS Pathog.* 2018;14(11):e1007327.

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