

engagement (ii) likert-rated school stress; and (iii) cognitive function (PROMIS t-scores). The model covaried for gender, race-ethnicity, and school-level

Results: Our model fit well (RMSEA=.041). Examining total effects (direct + indirect), online and hybrid instruction were associated with lower SLS (b 's: -.06 to -.26; p 's<.01). The three online groups had the strongest effects (synchronous: b = -.15; 95%CI: [-.20, -.11]; asynchronous: b = -.17; [-.23, -.11]; mixed: b = -.14; [-.19, -.098]; p 's<.001). Sleep disturbance was also negatively associated with SLS (b = -.02; [-.02, -.02], p <.001). Monte-carlo simulations confirmed sleep disturbance mediated online instruction's influence on SLS. The strongest effect was found for asynchronous instruction, with sleep disturbance mediating 24% of its effect (b = -.042; [-0.065, -.019]; p <.001). This sleep-mediated influence of asynchronous instruction propagated down to each SLS measure (p 's<.001), including a near 3-point difference on PROMIS cognitive scores (b = -2.86; [-3.73, -2.00]).

Conclusion: These analyses from the NESTED study indicate that sleep disruption may be one mechanism through which online instruction impacted learning during the pandemic. Sleep disturbances were unexpectedly influential for unscheduled instruction (i.e., asynchronous). Future analyses will examine specific sleep parameters (e.g., timing) and whether sleep's influence differs in teens who self-report learning/behavior problems (e.g., ADHD). These nationwide data further underscore the importance of considering sleep as educators and policy makers determine school schedules.

Support (if any):

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ADOLESCENT SLEEP VARIABILITY, SOCIAL JETLAG, AND MENTAL HEALTH DURING COVID-19: FINDINGS FROM A LARGE NATIONWIDE STUDY

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Introduction: Adolescents are vulnerable to short, insufficient sleep stemming from a combined preference for late bedtimes and early school start times, and also circadian disruptions from frequent shifts in sleep schedules (i.e., social jetlag). These sleep disruptions are associated with poor mental health. The COVID-19 pandemic has impacted education nationwide, including changes in instructional formats and school schedules. With data from the Nationwide Education and Sleep in TEens During COVID (NESTED) study, we examined whether sleep variability and social jetlag (SJL) during the pandemic associate with mental health.

Methods: Analyses included online survey data from 4767 students (grades 6-12, 46% female, 36% non-White, 87% high school). For each weekday, participants identified if they attended school in person (IP), online-scheduled synchronous classes (O/S), online-no scheduled classes (asynchronous, O/A), or no school. Students reported bedtimes (BT) and wake times (WT) for each instructional format and for week-ends/no school days. Sleep opportunity (SlpOpp) was calculated from BT and WT. Weekday night-to-night SlpOpp variability was calculated with mean square successive differences. SJL was calculated as the difference between the average sleep midpoint on free days (O/A, no school, weekends) versus scheduled days (IP, O/S). Participants also completed the PROMIS Pediatric Anxiety and Depressive Symptoms

Short Form. Data were analyzed with hierarchical linear regressions controlling for average SlpOpp, gender, and school-level (middle vs high school).

Results: Mean reported symptoms of anxiety (60.0 ± 9.1 ; 14% ≥ 70) and depression (63.4 ± 10.2 ; 22% ≥ 70) fell in the at-risk range. Shorter average SlpOpp (mean = 8.3 ± 1.2 hrs) was correlated with higher anxiety ($r = -.10$) and depression ($r = -.11$; p 's<.001) T-scores. Greater SlpOpp variability was associated with higher anxiety ($B = .71$ [95%CI = 41-1.01, p <.001) and depression ($B = .67$ [.33-1.00], p <.001) T-scores. Greater SJL (mean = 1.8 ± 1.2 hrs; 94% showed a delay in midpoint) was associated with higher anxiety ($B = .36$ [.12-.60], p <.001) and depression ($B = .77$ [.50-1.03], p <.001) T-scores.

Conclusion: In the context of system-wide education changes during COVID-19, students on average reported at-risk levels of anxiety and depression symptoms which were associated with greater variability in sleep opportunity across school days and greater social jetlag. Our findings suggest educators and policymakers should consider these sleep-mental health associations when developing instructional formats and school schedules during and post-pandemic.

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CHANGES IN CHILDREN'S SCHOOLYEAR AND SUMMER SLEEP DURING THE COVID-19 PANDEMIC

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Introduction: In spring 2020, elementary schools closed to minimize the spread of COVID-19. Questionnaire data suggest children's sleep was impacted during the pandemic, yet device-based data (i.e. accelerometry) on this topic is lacking. The purpose of this study was to examine children's sleep during the COVID-19 pandemic (i.e. spring and summer 2020) compared to previous data collected from the same children during each of the two previous years (spring and summer 2018 and 2019).

Methods: 68 children (age = 9.9 ± 1.2 years, 56% Black, 53% male) previously recruited for an observational cohort study wore a Fitbit Charge 2 on their wrist during the spring and summer from 2018-2020 (i.e. six 30-day measurement periods). We used multilevel mixed models to examine how children's sleep patterns changed during the pandemic accounting for previous trajectory (i.e. 2018 to 2019). Models included age, sex, and race as covariates.

Results: Children had an average of 84 nights of sleep data across all six 30-day measurement periods. In the spring of the pandemic, children slept 24.6 minutes more (95%CI = 11.6, 37.5) compared to previous springs. During the pandemic summer, they slept 40.0 minutes more (95%CI = 24.6, 58.5) compared to previous summers. Sleep midpoint was 117.1 minutes later (95%CI = 103.6, 130.6) in the spring during the pandemic and 46.0 minutes later (95% CI = 26.9, 65.2) in the summer during the pandemic compared to previous years. Sleep efficiency improved slightly by 1.3% (95% CI = 0.7, 1.9) and 3.6% (95% CI = 2.7, 4.5) in spring and summer, respectively, during the pandemic compared to previous years.

Conclusion: During the COVID-19 pandemic, children slept longer after accounting for previous developmental trends. Notably, the shift in sleep timing during the pandemic was nearly two hours later in the spring compared to previous years, potentially due to the lack of structure usually provided by school. Later sleep timing is independently associated with poor health behaviors (e.g., nutrition, physical activity, screen time). Future studies should examine if these changes in sleep