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## Brief Communication

## The impact of COVID-19 related school shutdown on sleep in adolescents: a natural experiment

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## ABSTRACT

**Objective:** During the outbreak of the COVID-19 pandemic in 2020, high schools closed or transitioned to remote teaching. The aim of this study was to describe how the COVID-19 related school shutdown impacted the sleep behaviors of typically developing adolescents.

**Methods:** A qualitative study was conducted between April 28 and June 3, 2020 with 45 adolescents using one-on-one semi-structured phone interviews.

**Results:** The “natural experiment” caused by the shutdown of schools due to the COVID-19 pandemic led to a 2-h shift in the sleep of typically developing adolescents, longer sleep duration, improved sleep quality, and less daytime sleepiness compared to those experienced under the regular school-time schedule.

**Discussion:** These findings are consistent with previous studies showing that delaying high school start times could be an effective way to extend sleep duration, improve sleep quality, reduce daytime sleepiness and lower adolescents' stress during the school year. As many countries look for ways to reduce the number of interactions between students in schools so that physical distancing is feasible, following teens' delayed sleep biology could offer an affordable solution. For example, staggering arrival times by delaying school start time for older adolescents compared with younger adolescents can reduce the total number of students attending school at the same time. This strategy offers a practical means to reduce school density and the number of interactions between students which are needed to reduce the potential transmission of COVID-19 in schools, while improving adolescents sleep health.

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## 1. Introduction

A large proportion of adolescents in different countries around the world [1,2] get less than the recommended amount of nightly sleep [3]. Sleep deprivation has a negative impact on youth mental and physical health [4,5]. Interventions to extend adolescents' sleep duration have had limited success [6]. Efforts to delay school start times have faced logistical barriers and doubts about whether the shift will translate to improved or extended sleep [7]. Following the outbreak of the COVID-19 pandemic in 2020, high schools closed or transitioned to remote teaching.

Following the school shutdown, schools' schedule changed as follows: the school day started at 10AM with 30 min subject specific sessions in which students were assigned tasks they had to complete online until noon. Next, in the afternoon, the students participated in arts or physical education classes and were able to seek academic support with their teachers in smaller online group settings. This schedule was different than the typical school day and aimed to balance online learning and independent work.

This “natural experiment” allowed adolescents' sleep patterns to be studied when they no longer have an imposed rise time. The aim of this study was to describe how the COVID-19 related school shutdown impacted the sleep behaviors of typically developing adolescents.

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## 2. Material and methods

A qualitative study was conducted with 45 adolescents (32 girls,  $M_{\text{age}} 13.5$  yrs; SD 1.9; 96% Caucasians; 2% Asian; 2% multiethnic). One-on-one semi-structured phone interviews (30–60 min) were conducted by trained research assistants between April 28 and June 3, 2020 to explore pre- and during-pandemic sleep schedules, duration and quality of their sleep, daytime sleepiness and their methods of waking up. The study was approved by the Institutional Ethics Review Board of the Douglas Research Centre, Montreal, Canada.

Interviews were transcribed anonymously and uploaded to MAXQDA, 2020 (Verbi Software). The transcriptions were independently coded by two researchers, who worked deductively with an a priori developed system of themes derived from the interview guide, and inductively from additional contents of the interviews. Their analyses were compared and the coded themes were modified when applicable. Data triangulation was ensured by seeking disconfirming evidence in the data. All findings were substantiated by the most representative quotes (Table 1).

## 3. Results

### 3.1. Changes in sleep quality and duration following in-person school shutdown

The majority of the participants reported that since school shutdown their sleep improved in quality and/or duration

[quotation 1–3 (Q1-3), Table 1] and that their sleep schedule had been delayed by about 2 h (they went to bed later and woke up later) (Q 4–5). They cited not having to wake up early and lower school-related stress as the main reasons for these changes (Q6-10).

### 3.2. Daytime sleepiness during the pandemic

55% of the participants described being sleepy during the school day before the pandemic (Q11) and attributed this to their need to wake up early to get to school and to getting less sleep (Q12-13). 78% reported that under the pandemic shutdown they were not sleepy and they attributed this primarily to getting more sleep (Q14-15).

### 3.3. Methods used to wake up during the pandemic

During the pandemic most participants reported waking up naturally; a few cited being awakened by a parent or alarm (Q16-20).

## 4. Discussion

The “natural experiment” caused by the abrupt shutdown of schools due to the COVID-19 pandemic led to a 2-h shift in the sleep of typically developing adolescents, longer sleep duration, improved sleep quality, and less daytime sleepiness compared to those experienced under the regular school-time schedule. In addition, participants reported decreased daytime sleepiness and

**Table 1**  
Quotations substantiating Adolescents' responses.

Quotation No.	Quotation
Question	Since you have been off school how has your sleep changed?
Quotation #1	<b>Better and Longer Sleep Following the pandemic</b> I'd say I'm probably getting better sleep. Because I'm, I go to bed later, a bit later, but I'm also sleeping in a lot more so I'm getting pretty good sleep
Quotation #2	It's been ok. I've been going to sleep. like I feel like I've been going to sleep way faster.
Quotation #3	I sleep longer and I'm less stressed, so it makes my sleep more enjoyable <b>Changes in sleep schedule following the pandemic</b>
Quotation #4	Can wake up a bit later than usual because I'd still do work, So I can sleep more in the morning
Quotation #5	I started going to bed at 10pm well I started having to bed around 10 and I wake up later like an hour later so my entire sleep schedule has kind of just moved an hour.
Question	Why has it changed?
Quotation #6	<b>Lower School-Related Stress</b> My sleep has been a bit better as in I haven't been as anxious so it's been easier to fall asleep and I've been going to bed later. But, it's been helping me fall asleep quicker. So, it's been getting better ever since we stopped going to school. <b>Easier To Fall Asleep when Going To Bed Later</b>
Quotation #7	Honestly, I think it's easier because since I go to bed later, I get more tired and it's easier to fall asleep. <b>Later School Start Time</b>
Quotation #8	Well I think it's because since I don't have to get up early in the morning and I can sleep in, so I don't have to go to bed as early.
Quotation #9	Can wake up a bit later than usual because I'd Still do work, but later. So I can sleep more in the morning
Quotation #10	Now it's like, I can wake up later in the morning, so I just go to bed later. I'm kind of night person <b>Day Time Sleepiness</b>
Question	How sleepy do you feel during the day? How sleepy did you feel during school?
Quotation #11	<b>Daytime sleepiness during School</b> I can be sleepy just like I'm just still paying attention just like laying my watching the teacher. Usually after school if I'm tired I try taking a little nap before supper <b>Daytime sleepiness during the pandemic</b>
Quotation #12	Not sleepy at all, fully awake
Question	<b>Way has it changed?</b>
Quotation #13	Cause since I get a good amount of sleep. So I don't really feel sleepy during the day
Quotation #14	Probably more than I do now, I probably felt more sleepy than I do now because I got less sleep than I do now <b>Methods used to wake up in the morning</b>
Quotation #15	Uh, during school, I put an alarm. And currently, by myself.
Quotation #16	I just wake up <b>House Noise</b>
Quotation #17	The shower, my brother yelling at his friend, or the dog running around to go outside.
Quotation #18	My parents make noise so I wake up <b>Set up an Alarm</b>
Quotation #19	I try to set one at 8.45 because I don't want to waste my whole day

increased daytime alertness consistent with extended and improved sleep. This suggests that the improved sleep could translate into improved daytime performance if later start times could be implemented through the school year.

Societal changes caused by the response to the COVID-19 pandemic, such as the potential staggering of school schedules to decrease the number of students in classes, flexible parental work schedules, and fewer extracurricular activities, afford a unique opportunity to overcome previous barriers that limited our ability to better align school start times with the delayed circadian biology of adolescents. Allowing adolescents to follow their naturally delayed sleep pattern by delaying school-start time could be a feasible, affordable and efficient way to improve their sleep health. This is expected to improve their resilience in the face of the challenges and stress caused by COVID-19.

Staggering arrival times by delaying school start time for older adolescents compared with younger adolescents can reduce the total number of students attending school at the same time. This strategy offers a practical means to reduce school density and the number of interactions between students which are needed to reduce the potential transmission of COVID-19 in schools, while improving the adolescents' sleep health.

Limitations of this study include a disproportionate number of girls, non-representative sample, and the lack of objective sleep measures.

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#### CRediT authorship contribution statement

**Reut Gruber:** Conceptualization, Methodology, Formal analysis, Writing - original draft, Funding acquisition. **Sujata Saha:** Conceptualization, Writing - original draft. **Gail Somerville:** Conceptualization, Writing - review & editing. **Johanne Boursier:** Conceptualization, Writing - review & editing. **Merrill S. Wise:** Formal analysis, Validation, Writing - review & editing.

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#### Conflict of interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: <https://doi.org/10.1016/j.sleep.2020.09.015>.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.sleep.2020.09.015>.

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