A later school start trial for adolescent night owls

Julia Harrington

Headmistress, Queen Anne's Secondary School, Berkshire, UK & CEO of BrainCanDo

Students at Queen Anne's Secondary School are fans of a later start time.

There is a growing amount of research on the power of sleep for the optimisation of health and performance in adolescents. An article published in 2016 in *Sleep Medicine Reviews* highlighted some of the impacts that instituting a later start time has had in other schools and we wanted to try it with our sixth-form pupils (Minges & Redeker, 2016). The greatest shift in biological rhythms (i.e. going to sleep later, waking up later, and having higher performance levels later in the day) are often found in older adolescents. Therefore, we chose to work with our year one sixth-form pupils. We understood that the change in the sleep/wake cycle often means that adolescents do not feel sleepy until much later in the evening. This later sleep time then has an impact on how much sleep they are getting in any one night. If we push back the school start time from 8:35 am until 10.00 am, this would provide an opportunity for our pupils to fall asleep at a time when they feel naturally tired and to wake more naturally once they have had enough sleep rather than rely on alarm clocks.

For one week in June 2018 we shifted the timetable for our year one sixth-form pupils. All of the same lessons still took place during that week but they were scheduled to happen at later times throughout the day, such as lunchtimes and others to slots after school. All teaching was finished by 6:15 pm. In effect, this meant that our pupils did not need to arrive in school until much later. For the boarding pupils, breakfast was served at the later time of 9:15 am. We compared this to the control group who started at 8:35 am. They completed the surveys and tasks a week before and a week after the late-start week.

Anecdotally, staff in the boarding house reported that the pupils generally seemed happier and more alert throughout late-start week. Teachers also reported that pupils seemed to be more attentive in their lessons. We also worked with Fran Knight, a sleep expert at the Institute of Education of University College London to help us to measure the impact of this later start time on our pupils. Analysis of the data collected by Knight revealed that during the late-start pupils gained an extra one hour of sleep per night on average (they slept an average of 8 hours per night) and more pupils reported that they were able to wake up without an alarm clock. We also found an improvement in their attention and ability to control impulses, such as interjecting thoughts during a lesson, compared with a typical start time.

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While conducting the trial, we also wanted to raise awareness among our pupils about the importance of good sleep hygiene. Sleep experts Nicola Barclay from the Sleep and Circadian Neuroscience Institute, University of Oxford University and Fran Knight, University College London delivered a lecture for all of our pupils and parents about sleep and the teenage brain. The talk included an explanation of the shifting biological rhythms in adolescence, the impact this has on the sleep/wake cycle and what teenagers could do to practice good sleep hygiene.

All of the staff within the school were extremely supportive of this initiative, from the senior leadership team, parents and pupils through to the teachers who willingly gave up lunchtimes or stayed until later in the evening. We would certainly recommend this practice to other schools, even for a one week trial to highlight the importance of sleep hygiene to pupils. The feedback was overwhelmingly positive. One of the advantages of doing the late-start week is that this provided a platform for us as a school to really raise awareness of the vital role that sleep plays in a range of functions including memory consolidation and learning. We were able to use evidence to really highlight issues around developing good sleep hygiene. The findings from the week have given us much food for thought.

References

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Chronobiology Q&A with our journals' Editors-in-Chief

Chronobiology is at the forefront of many researchers' minds. The Physiological Society's 2018 theme is "Physiology of our Body Clocks", there is a Society Meeting called "Sleep and Circadian Rhythms: From Mechanisms to Function", and the 2017 Nobel Prize for Physiology or Medicine was awarded for work elucidating the genetic makeup of the circadian clock.

Following suit with this themed issue, we asked our journals' Editors-in-Chief to weigh in on the impact of chronobiology on physiological research from the perspectives of experimental design and journal policy. We would like to thank Kim Barrett (*The Journal of Physiology*), Mike Tipton (*Experimental Physiology*), and Thomas Kleyman (*Physiological Reports*) for their time and informative answers.

Should journals make providing time-of-day information for all experimental interventions and measurements compulsory? Similarly, do you think light intensities and timing of exposure of animals (to handling for health checks, cage cleaning, adding food etc.) should be reported?

KB: There is increasing evidence that a wide range of physiological processes are influenced by factors such as time of day, as well as light exposure during normally dark periods or feeding periods. We have not yet attained sufficient understanding of the impact of chronobiology on all physiological mechanisms studied by our authors to mandate time-of-day reporting for all studies. However, it would not be unreasonable to encourage such reporting, where relevant.

MT: This is already standard practice in some areas (e.g. human physiology) where you will see statements like "the experiments were conducted at the same time of day to avoid circadian variation." I would leave this consideration to editors and reviewers at present. They should be considering this along with all other possible sources of pre-exposure variation (familiarisation, diet, fluid intake, exercise etc.).

TK: I agree with Mike's and Kim's responses. I would not require that authors address issues related to chronobiology. I think it is reasonable to suggest that authors provide a limited amount of information regarding chronobiology in the methods section, including the timing of the day/night cycle and the timing of studies (day vs. night), where applicable.

Do you think that policy concerning aligning the activity periods of nocturnal animals with times when they are more likely to be visited and handled by animal facility staff and researchers, should be implemented? (Staff and researchers would need night-vision goggles).

KB: This is a tricky one. Experimental outcomes in some studies may be influenced by artefacts introduced when normally nocturnal animals are disturbed during their rest periods. However, there are also health and safety issues to be considered for the staff and researchers, to say nothing of the fact that the animals might be subjected to greater stress and even the potential for injury when they are handled or maintained in the dark (even with the benefit of night vision goggles)! Based on my understanding of the latter, I don't think the technology is currently adequate to allow for appropriate and safe use, particularly when surgical manipulations are planned. The bottom line is that more research is definitely needed.

MT: More studies need to determine the criticality of this aspect. Unanswered questions concern not only laboratory housing but also the choice of animal models and isolation from other factors present in the natural environment e.g. moonlight (Kronfeld-Schor *et al.,* 2013). This question also applies to human studies. For example, should elite athletes preparing to perform in another country (e.g. Tokyo 2020) train at the time of their event in UK time or Japanese time? What about if they go to Japan early enough to adjust their circadian rhythm? There are also limited data to suggest that the timing of acclimatisation is important (Shido *et al.,* 1999) - threshold reductions for the onset of sweating were mostly observed if thermal loading was applied at the same time of day as the original adaptation impulse ("adaptation memory"). Finally, all of our data on humans tend to be collected between 9 am and 5 pm on Monday to Friday. How valuable are these data (e.g. survival time estimations) when a ferry sinks outside of this period?

TK: My impression is that carefully addressing questions related to chronobiology in mammalian systems requires that staff (investigators, postdocs, predocs, techs) be flexible regarding work hours, and be willing to work nights. This is a lot to ask of trainees and technicians, including animal care technicians. Reminds me of when I was training in medicine, and frequently on night call.

References

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Shido O, Sugimoto N, Tanabe M, Sakurada S (1999). Core temperature and sweating onset in humans acclimated to heat given at a fixed daily time. *American Journal of Physiology* **276**, R1095-101.

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