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Research Paper Draft: Changes in Circadian Rhythms of Adolescents

The circadian rhythm is a natural clock that determines when people are able to sleep. A lack of an appropriate amount of sleep daily can be negative for their health and ability to function throughout the day. For adolescents, sleep is particularly important since it contributes to their ability to grow and sets the tone for their adult lives. There are both internal and external factors that may impact one's ability to keep to their circadian rhythm, but external factors are, in general, easier to identify and resolve.

The range of external factors affecting circadian rhythms are wide, but many of them fit the typical student's life. These factors include parental influence, school start times, and employment and extracurricular activities (Millman et al., 1774). Not keeping to a circadian rhythm can have a range of dire impacts as well, including daytime sleepiness, problems with school performance, attention deficiency and hyperactivity, mood disturbances, and drowsiness while driving (Millman et al., 1774). The external factor that has perhaps had the largest effect on adolescent circadian rhythms is early school times, which need to be changed as they are negatively impacting students' brain function and overall wellbeing. Through investigation of published works on how early school times impact adolescent students' sleeping patterns, I conclude that there is a real need to adjust school schedules to be a better match for adolescent natural circadian rhythms.

Most adolescents are students, and school around the world usually begins in the morning. Some students have to wake up even earlier if they commute to school. The difference between a person's social and biological clocks has been termed "social jet lag," and teenagers are likely to experience it due to early school times.

It is because of social jet lag that many students are likely to sleep in on weekends, when they do not have school. The issue with "catching up" on sleep over the weekends is that sleep that is lost cannot be made up. Arcady Putilov and Evgeniy Verevkin conducted a study on the concept of sleeping in, and chose to study adolescents because they are susceptible to social jet lag since their sleep times are later than younger people, their sleep duration is longer than older people, and the time they wake up on weekdays is the same as the time of younger people. Their findings were that being able to catch up sleep on weekends or vacation is indeed a myth, and that "what people think is their weekend extra sleep is exactly what would be expected to be just a normal sleep" (Putilov & Verevkin, 10). To put it another way, adolescents sleeping in on days off are not catching up on sleep, but rather are sleeping according to their circadian rhythms. School schedules prevent them from sleeping that far into the day on a normal basis.

Being in tune with circadian rhythm on a daily basis rather than only on weekends is important specifically for adolescents for two reasons: peoples' executive functions perform the best during their most optimal times as determined by the circadian rhythm, and adolescents rapidly change as they transition from childhood to adulthood. Constanze Hahn and six associates investigated both of these concerns. Regarding executive function, they found that "participants tested at their optimal time performed better on a composite measure of [executive function], as well as on individual measures of affective decision-making (the Iowa Gambling Task) and working memory (the SOP task, concrete version)" (Hahn et al., 412). In other words,

the subjects were able to complete their tasks to their best ability when it was at their preferred times. The idea of “preferred” times, or in accordance with circadian rhythm, should be applied to adolescents in school since, most of the time, students have to begin work when it is not their best time.

The other issue Hahn et al. addresses is the growth of adolescents, as school times start earlier but optimal functioning times become later. They note that children growing into adolescence experience greater autonomy in their lives, which means that they are more able to engage in risky behaviors. The impacts of a lack of sleep on executive function means that adolescents are likely to lead to “impulsive acts and errors in judgment” (Hahn et al. 414). So, not only does a lack of sleep impact the success of students in school, it can prove a danger to adolescents.

Social jet lag, loss of sleep, reduced executive function, and increased risk behavior are among the issues caused by the early school day for adolescents. The solution, then, would be to have a later school day in order to better cater to adolescents’ natural schedules. Not only would students then be able to better in school, keeping to a proper schedule could also be better for adolescent health in the long term. Greater choice in scheduling is also an option for improving adolescent wellbeing, and has been employed in college studies successfully.

One can argue, however, that it is rather the adolescent lifestyle that is preventing them from adjusting to a given school schedule. However, that claim can be disproved through additional studies conducted on how school times affect adolescent day-to-day sleeping. One such study, by S.J. Crowley, compared adolescents’ and adults’ abilities to sleep at certain times of day. They found that, while both age groups tended to lose sleep due to other obligations, adolescents “had more difficulty sleeping during the forbidden zone despite lying in bed in the

dark with no knowledge of time nor access to phones, computers, televisions and so on” (Crowley, A96). The “forbidden zone” is a result of the circadian rhythm, where although someone may have been awake for a prolonged period of time, there are still periods of time where they do not feel tired. Reading into Crowley’s results, the fact that teenagers were unable to sleep during the time they were “supposed” to sleep in order to get the appropriate amount of rest before school is an indication that school schedules go against the natural circadian rhythms of adolescents, which minimizes the amount of sleep students are able to get.

In addition, B.P. Hasler, W. Ngari, and D.B. Clark sought to explore how weekend alcohol use impacted the circadian rhythms of adolescents. Their findings were that the data “did not support hypothesized associations between circadian misalignment and weekend alcohol use” (Hasler et al., 371). While alcohol is only one of the many substances adolescents may find their selves involved with, the study still shows that circadian rhythm is a complex topic and no one factor defines what it is for every person.

In sum, then, an early school day greatly impacts adolescent’s sleeping patterns. Through analysis of published works, I found that early wake up times negatively impact students including through social jet lag, loss of sleep, and reduced executive function, though there can be external factors that play into sleep schedules. The best way to address these issues would be to move the school day to later in the day in order to better fit adolescent circadian rhythms. The problem, however, remains that different students may have different circadian rhythms, begging for greater research in the field and possible student inputs. With a school day better suited for every age group, education can only improve for the future.

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