

Erratic sleep patterns linked to elevated blood pressure in teens with extra belly weight

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Staying awake later into the night and sleeping in on the weekends are hallmarks of adolescent behavior, however, erratic sleep patterns may

have consequences for future heart health by increasing blood pressure among teens who have more abdominal fat, according to new research published today in *Hypertension*, an American Heart Association journal.

"Pediatricians should pay close attention to youth who are experiencing [weight gain](#) or have already become overweight and examine their [sleep patterns](#), since a more regular sleep schedule may help them with weight loss and improve their long-term heart health," said Julio Fernandez-Mendoza, Ph.D., senior author of the study, an associate professor at the Penn State College of Medicine and sleep psychologist at the Sleep Research & Treatment Center of Penn State College of Medicine in Hershey, Pennsylvania.

Healthy sleep is a key factor in total cardiovascular health, as defined by the American Heart Association's [Life's Essential 8](#), which also includes [physical activity](#), not smoking, healthy weight and healthy levels of cholesterol, [blood sugar](#) and [blood](#) pressure. According to the Association's cardiovascular health metrics, teens ages 13-18 should get 8 to 10 [hours of sleep](#) each night.

The researchers evaluated sleep, [visceral fat](#) and blood pressure in 303 adolescents from central Pennsylvania (average age 16.2 years; 47.5% female; 21.5% Black or Hispanic) who returned for a repeat evaluation after participating as children in the Penn State Child Cohort study. Sleep was measured during one night in the sleep lab, and at home over 7 days by wearing a wristwatch-like sleep monitoring device. With this device researchers tracked sleep duration and its variability (to capture how much and how little adolescents slept night-to-night), and sleep midpoint (the midpoint between sleep and wake-up time) and its regularity (to capture their sleep patterns over time). A sleep midpoint at 2 a.m. or later is considered delayed for a typical adolescent during the school week, and night-to-night differences of 45 minutes or more in the sleep midpoint was considered highly irregular.

Visceral abdominal fat, which is the deep belly fat that surrounds the stomach, liver and intestines, was measured with a dual-energy, X-ray absorptiometry (DEXA) scan during the sleep lab visit. Visceral fat is more dangerous to heart health than fat stored just under the skin. Seated blood pressure was measured also during the sleep lab visit 3 times at 5-minute intervals, with the last 2 readings averaged.

Among the findings:

- Overall, the participants had sleep habits typical of adolescents—going to bed later than they did during grade school, and sleeping later on weekends and school breaks than on school days.
- Among the adolescents studied during the [school year](#) and whose sleep varied by 45 minutes or more during the school week, each unit increase in visceral abdominal fat was linked to a 7 mm Hg higher systolic (top number) blood pressure and a 3 mm Hg higher diastolic (bottom number) blood pressure.
- In contrast, among teens whose sleep varied less than 45 minutes during the school week, there was no link between visceral abdominal fat and elevated blood pressure.
- For those who fell asleep later on weekdays (with a sleep midpoint of 2 a.m. or later), each unit increase in visceral abdominal fat was linked to a 5 mm Hg increase in systolic blood pressure and a 2 mm Hg increase in diastolic blood pressure. For those who went to sleep earlier, there was no link between visceral abdominal fat and elevated blood pressure.
- Among the teens who participated in the study during a school break, neither a delayed sleep midpoint nor sleep regularity significantly altered the link between visceral abdominal fat and blood pressure.
- In teens who described themselves as "evening people," each unit increase in visceral abdominal fat was linked to about a 3 mm Hg

higher diastolic blood pressure, however, among self-described "morning people," there was no impact of visceral [abdominal fat](#) on blood pressure.

"These results suggest that keeping a regular sleep pattern may protect adolescents from the cardiovascular consequences of obesity," said Natasha Morales-Ghinaglia, B.S., first author of the study and an American Heart Association predoctoral fellow at the Penn State College of Medicine Sleep Research & Treatment Center in Hummelstown, Pennsylvania.

Morales-Ghinaglia added, "Teens are not wrong in following their normal inclinations to sleep later than in their childhood years. Rather, it's a normal developmental pattern that previous studies have shown to be at odds with certain aspects of teen lifestyle — primarily school and extracurricular activity schedules."

Sleep experts have stressed that early middle and high school start times often make it difficult for teens to get regular, sufficient sleep. Morales-Ghinaglia encourages parents and teens to understand their body's needs. "It's important to educate teens on how important it is to have regular sleep. They don't need an early bedtime like [younger children](#), but it's important to get more regular sleep for the benefit of their heart and mental health."

Fernandez-Mendoza adds that changing middle and high school start times, among other potential interventions, such as educating administrators, teachers, school clinicians, parents and youth on sleep and circadian rhythms, may improve school attendance, academic performance and emotional functioning. "It is time to raise awareness that having a misalignment between sleep patterns and [school](#) schedules may mean more obesity, more depression, worse performance and more heart disease among adolescents."

The study has several limitations. Because it was not a controlled trial, where researchers could compare groups based on factors like sleep conditions or patterns, and the participants were studied at a single time, the results cannot demonstrate a cause-and-effect link between sleep habits and blood pressure. Sleep was evaluated by one night in the sleep lab and 7 nights at home, which may not be as reliable as measurements from more than one night in a sleep lab and 14 nights or more of home monitoring so that more weekend nights are captured. Blood [pressure](#) was measured only in the lab, which may be a less accurate reflection of usual [blood pressure](#) levels such as those taken during 24-hour monitoring with multiple readings.

Fernandez-Mendoza is currently inviting the teen Penn State Child Cohort participants to return for another evaluation as young adults ages 20 and older.

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More information: Circadian misalignment impacts the association of visceral adiposity with elevated blood pressure in adolescents, *Hypertension* (2023). [DOI: 10.1161/HYPERTENSIONAHA.122.20398](https://doi.org/10.1161/HYPERTENSIONAHA.122.20398)

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