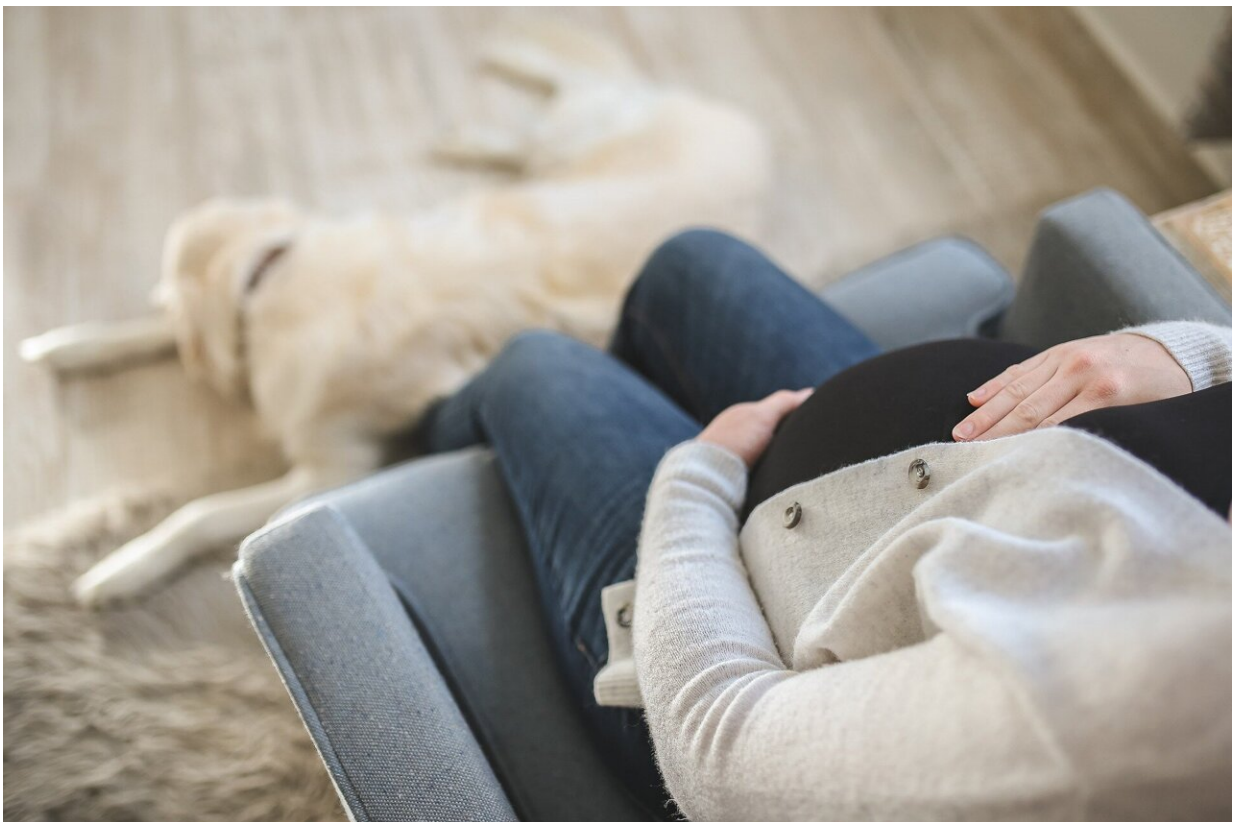


Wearable device data reveals that reduced sleep and activity in pregnancy is linked to premature birth risk

September 28 2023



Credit: Pixabay/CC0 Public Domain

A lack of sleep and reduced physical activity during pregnancy are linked to risk of preterm birth, according to new research led by the

Stanford School of Medicine.

In the study, which will be published online in *npj Digital Medicine*, the researchers collected data from devices worn by more than 1,000 women throughout [pregnancy](#). With a machine learning algorithm, the scientists sifted through participants' activity information to detect fine-grained changes in sleep and [physical activity](#) patterns.

"We showed that an artificial intelligence algorithm can build a 'clock' of physical activity and sleep during pregnancy, and can tell how far along a patient's pregnancy is," said senior study author Nima Aghaeepour, Ph.D., an associate professor of anesthesiology, perioperative and pain medicine and of pediatrics at Stanford Medicine.

Normal pregnancy is characterized by progressive changes in sleep and physical activity as the pregnancy advances, he said. "But some patients don't follow that clock." When patients' sleep and activity levels don't change on a typical trajectory, the study showed it's a warning sign for premature [birth](#), he added.

The study's lead author is Neal Ravindra, Ph.D., a former postdoctoral scholar at Stanford Medicine.

As the pregnancies progressed, sleep typically became more disrupted, and women became less physically active, the study showed. However, some women's sleep and activity patterns changed on an accelerated timeline relative to how far along they were in their pregnancies. These individuals were more likely to deliver early, the study found.

"The people who look 'very pregnant' to the AI algorithm—but are not—end up being at significantly increased risk of [preterm birth](#)," Aghaeepour said.

A struggle to prevent early deliveries

Premature birth, when a baby is born three or more weeks early, affects [10.5% of births](#) in the United States; these rates are [higher](#) in some other parts of the world.

Premature newborns can suffer many medical complications, including diseases of the eyes, lungs, brain and digestive system. Prematurity is the [leading cause of death](#) for children under age five around the world.

Research has identified a variety of risk factors for premature delivery, including greater levels of inflammation in the pregnant person, specific immune-system changes, African American race, higher levels of stress, history of having a preterm birth and certain types of bacteria in the mother's microbiome.

But doctors still can't reliably determine which pregnancies are at risk for premature delivery. Even when they know a mom is at risk—because she's previously had a premature delivery, for example—they still don't have great treatments to extend the pregnancy closer to the due date. Developing medications that could do this would be complex, in part because of ethical concerns regarding testing drugs that might harm the fetus.

If researchers can identify sleep and activity patterns that lower prematurity risk, they can design interventions to help expectant mothers adopt better sleep and exercise habits, a potentially low-risk way of reducing preterm births, Aghaepour said.

Focusing on at-risk moms

The Stanford Medicine team collaborated with scientists at Washington

University in St. Louis, who collected the sleep and physical activity data from 1,083 [pregnant women](#) treated there. More than half of the cohort (706 participants) were Black. In the United States, the rate of premature birth is about 50% higher in Black women than in white women.

"Our patient population experiences a lot of adversity, and our preterm birth rates are much higher than at Stanford," said study co-author Sarah England, Ph.D., professor of obstetrics and gynecology at Washington University School of Medicine in St. Louis.

The study participants included women experiencing a variety of stressors linked with higher rates of preterm birth, such as racism, low socioeconomic status and living in areas with higher crime rates, England said, adding that it is important for studies of preterm birth to include populations with the greatest need. "Typically, Black women and women of color have not been included in many large cohort studies," she said.

The participants wore actigraphy devices similar to smartwatches to collect once-a-minute measurements of physical activity and light exposure starting in the first trimester of pregnancy and continuing until their babies were born.

The researchers also had data from participants' electronic medical records on gestational age, or how far along each pregnancy was; maternal medical conditions such as high blood pressure, diabetes, heart disease and depression; pregnancy complications such as preeclampsia and infections; and information about the birth, including duration of the pregnancy, the baby's birth weight and newborn medical complications.

With the movement and [light exposure](#) data, the research team developed a machine learning model of activity and sleep during pregnancy. The model shows that patterns of sleep and physical activity

change over the course of pregnancy, which generally is associated with more sleep disruption and less physical activity as pregnancy progresses.

"Anecdotally, lots of women will say, 'Of course!'" said study co-author Erik Herzog, Ph.D., professor of biology at Washington University in St. Louis, adding that, for example, women experience more sleep disruptions as the baby gets larger and more active. "But, surprisingly, the literature has not had a real consensus about what exactly happens to sleep in pregnancy," he said. Using imprecise methods to measure sleep habits, such as questionnaires, has not provided adequate answers.

The researchers were surprised at how strongly deviations from the normal pattern of sleep and physical activity could predict preterm birth. If the machine-learning model classified a woman as sleeping better and being more physically active than usual for her stage of pregnancy, this was linked with a 48% reduction in risk for preterm delivery.

Conversely, if the model classified a woman as sleeping worse and being less physically active than usual for her stage of pregnancy, her risk for preterm delivery was 44% higher than for pregnant women with typical sleep and activity patterns.

Strong clues for preventing prematurity

"This is exciting preliminary data," Aghaeepour said. The results suggest that scientists should run studies to test whether tracking and modifying pregnant women's sleep or physical activity could their lower prematurity risk, he said, adding, "It's telling us where to go for future interventions."

The circadian clock regulates several other biological pathways implicated in [premature birth](#), such as those regulating inflammation and the immune response, the scientists said. They plan to test whether

improving sleep and physical activity in pregnancy could modify other key pathways, such as those controlling inflammation.

"Our feeling is that if we look at this overarching regulator, we may be able to control individual systems that lead to preterm birth," England said.

Although the findings are at an early stage, and more work is needed to understand their implications for preventing prematurity, there's little risk in advising pregnant women to maintain good sleep habits now, she added. For instance, [women](#) should try to maintain consistent bedtimes and wake-up times, get enough sleep, and get some natural light during the day to help regulate their body clock.

"If we can use sleep and physical activity to modulate biology in the right direction, it could be a great intervention for reducing the rate of preterm birth," Aghaeepour said.

More information: Neal G. Ravindra et al, Deep representation learning identifies associations between physical activity and sleep patterns during pregnancy and prematurity, *npj Digital Medicine* (2023). [DOI: 10.1038/s41746-023-00911-x](https://doi.org/10.1038/s41746-023-00911-x)

Provided by Stanford University Medical Center

Citation: Wearable device data reveals that reduced sleep and activity in pregnancy is linked to premature birth risk (2023, September 28) retrieved 6 May 2024 from <https://medicalxpress.com/news/2023-09-wearable-device-reveals-pregnancy-linked.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.