



PRESS RELEASE

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Earlier menopause linked to faster biological ageing, NUS Medicine study finds

NUS Medicine-led review of more than 550,000 women finds earlier menopause and a higher number of births were associated with modestly greater biological age acceleration, offering new insights into women's health and healthy longevity

Singapore, 12 October 2026 — The age at which a woman experiences menopause and her reproductive history may be associated with how quickly she ages biologically, according to a study led by researchers from the Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine).

The study, published in [*Mechanisms of Ageing and Development*](#), brought together evidence from 29 previously published studies involving 550,550 women to examine whether reproductive milestones, pregnancies, and birth outcomes were associated with biological ageing measured using DNA methylation (DNAm) clocks.

DNAm clocks estimate biological ageing by analysing chemical changes to the human DNA that accumulate over time, providing an indication of how old the body appears biologically compared with a person's actual age. Researchers can use these measurements to calculate epigenetic age acceleration (EAA), which reflects whether biological ageing appears faster or slower than expected. This does not mean that every organ or system has literally aged by the same amount. The study found that earlier menopause showed one of the clearest associations with greater EAA.

In the meta-analysis, each one-year earlier age at menopause was associated with approximately 0.08 years, or about one month, of greater EAA when measured using GrimAge, one of the newer generation of DNAm clocks. This analysis included 5,920 women. Similar associations were also found using the Horvath1Age and PhenoAge clocks.

Professor Andrea Maier, Oon Chiew Seng Professor in Medicine, Healthy Ageing and Dementia Research, corresponding author of the study and Director of the NUS Academy for Healthy Longevity at NUS Medicine, said, "Women's reproductive history forms an important part of their health across the life course. Our findings suggest that events such as menopause may also provide information about underlying biological ageing. This does not mean that menopause itself simply makes a woman age faster, but it highlights the close relationship between reproductive health and the wider ageing process."

They also examined pregnancy and birth history. Using PhenoAge, each additional pregnancy or delivery was associated with about 0.13 years, or 1.6 months, of higher EAA, with a slightly stronger association when only deliveries were analysed. However, findings varied across studies and DNAm clocks.

Dr Matthew Simonson, first author of the study and a researcher with the NUS Academy for Healthy Longevity, said, “The differences we observed are modest, and our findings should not be interpreted to mean that having children directly causes accelerated ageing. Rather, they suggest that reproductive experiences may be one of several factors associated with the biological changes that accumulate throughout a woman’s life.”

In contrast, no consistent association was found between age at first menstruation and biological age acceleration. The review also found an emerging link between biological age acceleration during pregnancy and preterm birth. In one study, each additional year of GrimAge acceleration during pregnancy was associated with 11% higher odds of birth before 37 weeks, 13% before 34 weeks, and 18% before 28 weeks. Other studies also linked biological age acceleration during pregnancy with spontaneous preterm birth. While DNAm clocks may eventually help identify women at higher risk, the evidence remains preliminary. The main study involved only 163 women, and it is unclear whether these measures improve on existing clinical tools.

Prof Maier added, “Biological-age measures could eventually complement existing approaches to understanding women’s health, from reproductive ageing to pregnancy outcomes. Before that can happen, however, we need larger longitudinal studies that follow women over time and establish what these biological-age differences mean for their future health.”

The researchers stressed that the findings show associations, not cause and effect. Most studies in the meta-analyses were cross-sectional, and factors such as socioeconomic circumstances, smoking, body mass index, and existing health conditions may also influence the results. Larger longitudinal studies are needed to clarify how reproductive health and biological ageing change over time, and whether DNAm clocks could eventually support more personalised approaches to women’s healthy longevity.

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Our multidisciplinary and real-world approach to education, research, and entrepreneurship enables us to work closely with industry, governments, and academia to address crucial and complex issues relevant to Asia and the world. Researchers in our faculties, 30 university-level research institutes, research centres of excellence and corporate labs focus on themes that include energy; environmental and urban sustainability; treatment and prevention of diseases; active ageing; advanced materials; risk management and resilience of financial systems; Asian studies; and Smart Nation capabilities such as artificial intelligence, data science, operations research, and cybersecurity.

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Through a dynamic and future-oriented five-year curriculum that is inter-disciplinary and inter-professional in nature, our students undergo a holistic learning experience that exposes them to multiple facets of healthcare and prepares them to become visionary leaders and compassionate doctors and nurses of tomorrow. Since the School's founding in 1905, more than 12,000 graduates have passed through our doors.

In our pursuit of health for all, our strategic research programmes focus in innovative, cutting-edge biomedical research with collaborators around the world to deliver high impact solutions to benefit human lives.

The School is the oldest institution of higher learning in the National University Health System. It is one of the leading medical schools in Asia and ranks among the best in the world (Times Higher Education World University Rankings 2026 by subject and the Quacquarelli Symonds (QS) World University Rankings by Subject 2026).

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