PRESS RELEASE

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Studies reveal Asian and Singaporean women with PCOS may experience longer reproductive lifespans and more favourable reproductive outcomes than peers without PCOS

An international study involving researchers from Singapore, China, USA, Europe and Brazil has identified four subtypes of polycystic ovary syndrome (PCOS). Among them, the subtype with the best reproductive and health outcomes is observed in majority of the Singapore cohort. In another related Singapore study, findings show that women with PCOS could attain successful pregnancy outcomes through fertility assistance, even at older maternal ages.

Singapore, 17 December 2025 – Globally, around 11 to 13 percent of women live with polycystic ovary syndrome (PCOS), a hormonal disorder that affects the function of the ovaries, which may cause irregular menstrual periods, excess hair growth, acne, fertility issues, and higher risk for certain health conditions, like diabetes and high blood pressure. However, Singaporean women with PCOS are likely to have more favourable outcomes compared to women in Western populations, according to an international study involving researchers from the Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine), and National University Hospital (NUH).

Published in *Nature Medicine*, the study identified four distinct subtypes of PCOS from a discovery cohort of over 11,900 women in China who were diagnosed with PCOS between December 2013 and June 2020. The researchers then confirmed these same subtypes in five separate validation cohorts from China, Singapore, the United States, Europe and Brazil. All women in the discovery and validation cohorts were between 20 and 45 years old. The subtypes are namely the following:

- **Hyper-androgenic phenotype (HA-PCOS)**: Characterised by elevated levels of male sex hormones, which can result in increased abnormal hair growth, or hirsutism.
- **Overweight-obesity phenotype (OB-PCOS):** Characterised by higher Body Mass Index (BMI) and insulin resistance, with the highest prevalence of Type 2 Diabetes Mellitus (T2DM), dyslipidemia and hypertension.

- **High level of sex hormone-binding globulin (SHBG-PCOS):** Characterised by the highest SHBG levels and lowest BMI, with lower luteinizing hormone (LH) and testosterone levels. SHBG refers to a protein made mostly in the liver that binds to sex hormones like testosterone and estrogen, while LH is a chemical that regulates reproductive functions.
- **Elevated LH and anti-Müllerian hormone (LH-PCOS):** Characterised by elevated levels of LH, as well as follicle-stimulating hormone (FSH) and anti-Müllerian hormone (AMH), both of which assess a woman's ovarian reserve, estimating the number of eggs in the ovaries.

Among Singapore's validation cohort of 127 women who were diagnosed with PCOS from 2011 to 2019, over half (53%) were observed to be of the SHBG-PCOS subtype, followed by the OB-PCOS subtype (27%), HA-PCOS subtype (15%) and LH-PCOS subtype (5%).

Based on the discovery cohort from China, the research team followed up with 4,542 women from March 2021 to August 2024 to examine the association between reproductive and metabolic variables, as well as 5,418 women who were receiving in-vitro fertilisation (IVF) treatment to investigate reproductive outcomes and pregnancy complications. The results showed clear differences in pregnancy rates, live births, and complications among the subtypes:

- **HA-PCOS subtype**: This group had the highest risk of miscarriage in the second trimester and is linked to metabolic diseases including obesity, T2DM, hypertension, dyslipidemia, and metabolic dysfunction-associated steatotic liver disease (MASLD).
- **OB-PCOS subtype:** This group exhibited the most pronounced association with metabolic diseases, the lowest proportion of live births, but also the highest proportion who recovered from PCOS over time. Women in this group were also more prone to pregnancy complications, including hypertensive disorders, gestational diabetes, preterm birth and cesarean delivery
- **SHBG-PCOS subtype:** This group represents the mildest form of PCOS and has the best IVF outcomes, although it often presents with irregular menstrual cycles. Women in this group also exhibited the lowest risk of diabetes and hypertension, relatively mild androgenic features, with primary abnormalities related to ovulatory dysfunction.
- **LH-PCOS subtype:** This group had the highest risk of ovarian hyperstimulation syndrome (OHSS) during IVF and the lowest rate of recovery from PCOS over time.

Given that Singapore has the highest proportion of the SHBG-PCOS subtype compared to the other validation cohorts (27% in China, 24% in USA, 34% in Europe, and 26% in Brazil), the findings shed light on why some of them may have better reproductive outcomes compared to women in other countries, especially the Western populations.

Prof Yong Eu Leong from the Department of Obstetrics and Gynaecology at NUS Medicine and NUH, who is one of the study's corresponding authors, said, "Much of what we know about PCOS comes from studies in Western populations, which do not fully explain why Asian women with PCOS often experience different outcomes. Our new study plugs this gap by demonstrating that

PCOS is not a single condition, but comprises diverse subtypes — each with clear, distinct clinical features as well as differing reproductive and health outcomes. Importantly, the study debunks the long-held belief that PCOS is inherently a worrying diagnosis. In fact, we now know that majority of Singaporean women with PCOS are of the subtype associated with the most favourable outcomes."

With the identification of the four PCOS subtypes, the study provides important insights into the heterogeneity of PCOS and highlights the potential for more personalised treatment approaches in clinical practice. In fact, women with PCOS may experience an extended reproductive lifespan and achieve successful pregnancy outcomes through assisted reproductive technologies, even at an older age, as demonstrated in another study led by Adjunct Assistant Professor Huang Zhongwei from the Department of Obstetrics and Gynaecology at NUS Medicine and NUH.

Published in *Human Reproduction Open*, the study involved 1,249 Asian women aged 22 to 42 years, who underwent IVF at NUH between 2016 and 2022. Of these participants, 212 had PCOS and 1,037 did not. The research team found that women with PCOS demonstrated better reproductive outcomes overall, including higher pregnancy rates and a greater number of oocytes retrieved per IVF cycle. Cumulative pregnancy rates were significantly higher among women with PCOS compared to those without PCOS (52.8% versus 38.7%). On average, women with PCOS had nearly twice as many oocytes retrieved per cycle compared to women without PCOS. Notably, even at advanced maternal ages of 36 years and above, women with PCOS exhibited higher pregnancy rates (70% versus 27.6%).

The findings also suggest that women with PCOS tend to maintain a higher ovarian reserve as they age. Significantly higher levels of AMH were observed in women with PCOS compared to women without PCOS of the same age. Higher AMH is typically associated with a greater number of ovarian follicles and a larger pool of eggs, which can translate to more robust responses to fertility treatment.

Adj Asst Prof Huang, who is also the Deputy Director of the Bia-Echo Asia Centre for Reproductive Longevity and Equality (ACRLE) at NUS Medicine., said, "Our study shows that women with PCOS may retain a higher ovarian reserve for longer and can achieve positive reproductive outcomes, even at an older age. This underscores the importance of personalised fertility counselling and timely access to fertility treatments, especially for women with PCOS. While individual outcomes may still vary, our findings support a more optimistic outlook for women with PCOS who are considering pregnancy at older maternal ages."

Professor Mahesh Choolani, Head of the Department of Obstetrics and Gynaecology at NUS Medicine and NUH, and one of the authors of the study with Adj Asst Prof Huang, added, "Recognising that PCOS comprises distinct subtypes allows us to care for women in a more personalised way. In Singapore, many women have a milder subtype of PCOS, which helps explain why their outcomes are often better. Combined with new evidence that women with PCOS can still do well with fertility treatment even at an older age, these findings should offer real

reassurance. Our focus is to translate these insights into clear guidance and tailored care, so women can plan their families with confidence while safeguarding their long-term health."

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About National University of Singapore (NUS)

The National University of Singapore (NUS) is Singapore's flagship university, which offers a global approach to education, research, and entrepreneurship, with a focus on Asian perspectives and expertise. We have 15 colleges, faculties, and schools across three campuses in Singapore, with more than 40,000 students from 100 countries enriching our vibrant and diverse campus community. We have also established more than 20 NUS Overseas Colleges entrepreneurial hubs around the world.

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, research centres of excellence, corporate labs and more than 30 university-level research institutes 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.

For more information on NUS, please visit http://www.nus.edu.sg/

About the NUS Yong Loo Lin School of Medicine (NUS Medicine)

The NUS Yong Loo Lin School of Medicine is Singapore's first and largest medical school. Our enduring mission centres on nurturing highly competent, values-driven, and inspired healthcare professionals to transform the practice of medicine and improve health around the world.

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 on 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 of Singapore and a founding institutional member of 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 2025 by subject and the Quacquarelli Symonds (QS) World University Rankings by subject 2025).

For more information about NUS Medicine, please visit https://medicine.nus.edu.sg/

About the National University Hospital (NUH)

The National University Hospital (NUH) is Singapore's leading university hospital. While the hospital at Kent Ridge first received its patients on 24 June 1985, our legacy started from 1905, the date of the founding of what is today the NUS Yong Loo Lin School of Medicine. NUH is the principal teaching hospital of the medical school.

Our unique identity as a university hospital is a key attraction for healthcare professionals who aspire to do more than practise tertiary medical care. We offer an environment where research and teaching are an integral part of medicine, and continue to shape medicine and transform care for the community we care for.

We are an academic medical centre with over 1,200 beds, serving more than one million patients a year with over 50 medical, surgical and dental specialties. NUH is the only public and not-for-profit hospital in Singapore to provide trusted care for adults, women and children under one roof, including the only paediatric kidney and liver transplant programme in the country.

The NUH is a key member of the National University Health System (NUHS), one of three public healthcare clusters in Singapore. For more information, visit www.nuh.com.sg.

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