

Is It Possible to Predict Miscarriages?

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Threatened miscarriage is a common early pregnancy complication, but clinicians have lacked structured, locally validated tools to accurately predict outcomes. While management typically involves monitoring and progesterone therapy, uncertainty remains high. New research from the University of Malta has developed a high-accuracy predictive model that integrates ultrasound and blood markers to support more informed, personalised care.

According to the European Research Council-funded project SOC-MISC, 25% of women have experienced a miscarriage before 24 weeks of gestation. Losing a pregnancy is, in itself, a desolating experience. It becomes much worse when one adds endless waiting, uncertainty, and a lack of answers from doctors.

This is the common scenario for pregnant people suffering from a condition called 'threatened miscarriage'. This condition is characterised by bleeding during the first weeks of pregnancy, while the cervix remains closed. Despite the bleeding, the embryo (the technical name given during the first nine weeks of gestation) or foetus (the technical name given to the developing body until birth) is alive.

Currently, progesterone supplementation is given to support early pregnancy, particularly where there is an increased risk of miscarriage. Medical professionals rely on ultrasound findings and clinical

experience to guide discussions. However, until now, there has been no locally validated prediction tool to support risk assessment in threatened miscarriage. This means that patients go home not knowing whether they will experience a miscarriage. Moreover, psychological support during this period can be inconsistent, as services are not always structured specifically around early pregnancy complications.

Adding to an already complex condition, threatened miscarriage has not been previously investigated in Malta. The Directorate of Health Information and Research does not collect data prior to 22 weeks' gestation, meaning that threatened miscarriage cases are unrecorded. In most cases, this condition affects the first trimester (the first 12 weeks and 6 days) of pregnancy. However, any vaginal bleeding that occurs before 20 weeks' gestation in a viable pregnancy with a closed cervix is referred to as threatened miscarriage.

Dr Lara Sammut is a radiographer at Mater Dei Hospital with a Master's in foetal anomaly ultrasound screening.

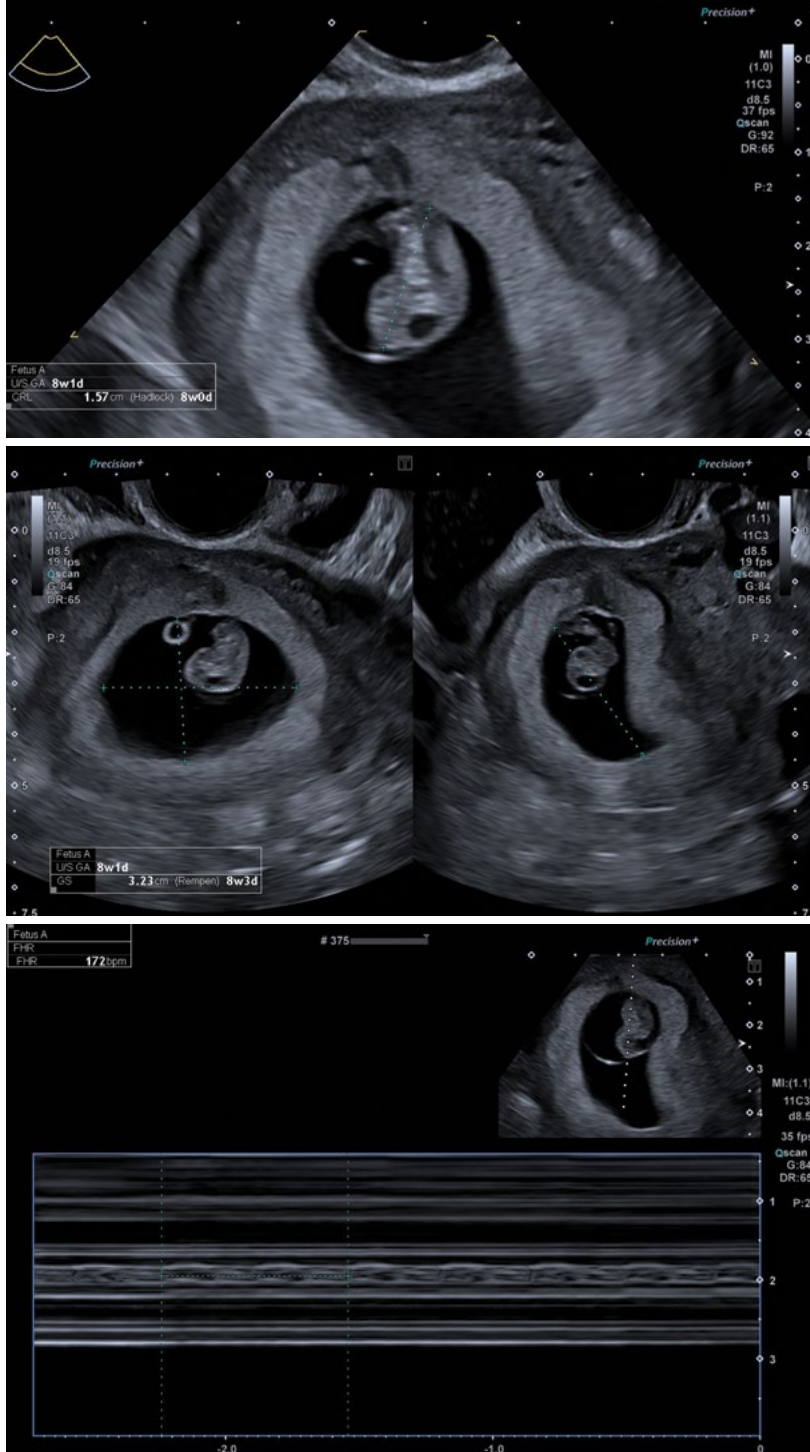
After 13 years of witnessing the impact of threatened miscarriage at the Obstetrics and Gynaecology (Ob/Gyn) Department, the researcher, radiographer, and lecturer decided to start her Ph.D. research to address this knowledge gap.

FROM LOCAL DATA TO NATIONAL DIALOGUE

Sammut's research provides the first locally derived data on pregnancy outcomes following threatened miscarriage in Malta, establishing a



Dr Lara Sammut



Transvaginal ultrasound images showing an eight-week embryo
Images courtesy of Dr Lara Sammut

23% loss rate within a prospectively studied cohort. Sammut developed and validated a predictive model that integrates ultrasound findings, biochemical markers, and maternal characteristics to improve early pregnancy risk assessment.

She divided her Ph.D. research into three phases. First, she studied the prevalence of threatened miscarriage in Malta through a retrospective study. Then, she conducted a scoping

review of the literature to identify markers that have already been investigated to predict the outcome of a pregnancy after a threatened miscarriage. The findings from the first and second phases of the study informed the third phase – a prospective case-control study that used data collected from patients at Mater Dei Hospital over two years.

Data from ultrasound, blood tests, and maternal characteristics

were collected from 177 women and analysed using both multivariate logistic regression (MLR) and a random forest (RF) model. The RF model achieved 93% overall accuracy in predicting pregnancy outcome.

In June 2025, Sammut was invited by the Parliamentary Secretary, Hon. Dr Andy Ellul, to deliver a keynote address at the Miscarriage Leave Public Consultation in Gozo, thereby further strengthening the national conversation on miscarriage recognition, evidence-based care, and the need for structured support services in early pregnancy. She explained in her speech that the predictive model she developed 'could provide patients with clearer information, personalised care, and appropriate counselling based on their individual risk.' Following this, Malta enacted a new law in 2026, granting miscarriage leave.

BUILDING A RIGOROUS FRAMEWORK FOR PREDICTION

During the first phase, a retrospective cohort study drew on data from Mater Dei Hospital collected in 2019. This year was specifically chosen to avoid COVID-era distortions in care. The result was a highly representative sample of the national population, since Mater Dei is the only local, state hospital, and national data included both public and private births.

In the second phase, the study progressed to a scoping review, designed to map the global evidence on first-trimester ultrasound and biochemical markers used to predict pregnancy outcomes. Instead of limiting the review to one marker, it explored how multiple markers could work together. ➔

During this stage, Sammut also explored the ratio of two molecules linked to blood vessel formation – placental growth factor (PIGF), and soluble fms-like tyrosine kinase-1 (sFlt-1) – to determine whether they could add value to predicting early pregnancy outcomes. Although sFlt-1 and PIGF did not emerge directly from the scoping review, as previous studies only examined them in isolation, several papers referenced them in relation to placental dysfunction.

Together, these findings highlighted the need for a prospective case-control design that could ensure consistency in how variables are defined and measured.

ESTABLISHING MALTA'S FIRST PREDICTIVE MODEL FOR THREATENED MISCARRIAGE

In the third phase of the study, Sammut collected data from the Ob/Gyn Department at Mater Dei Hospital for the development of the predictive model. The researcher collected data from 177 women with a viable gestation in their first trimester of pregnancy. The study included an ultrasound assessment, blood tests, and the collection of clinical and sociodemographic data, as well as birth outcomes. One of the most significant contributions of this research was establishing Malta's first recorded pregnancy loss rate following confirmed threatened miscarriage. The prospective study identified a 23% loss rate within the study group, thereby providing, for the first time, locally generated data to inform counselling, policy, and service planning.

All collected data was analysed using MLR and an RF machine-learning model. The MLR estimates the probability of pregnancy loss from multiple predictors and provides clinically interpretable outputs in the form of odds ratios. To explore whether predictive accuracy could be improved,

Sammut also applied an RF model – a machine-learning approach that falls within the broader field of artificial intelligence. This method builds multiple decision trees and aggregates their predictions, enabling the detection of complex nonlinear interactions among ultrasound findings, biochemical markers, and maternal characteristics.

The use of an RF model that combines first-trimester ultrasound and biochemical markers represents one of the first AI-driven applications worldwide, specifically targeting threatened miscarriage prediction. Rather than replacing clinical judgement, the model is designed to support clinicians by providing structured, data-informed risk assessment. As Sammut explains, 'the RF model consistently outperformed the MLR model with 93% overall accuracy in predicting pregnancies that continued and those that resulted in loss.'

REDEFINING EARLY PREGNANCY CARE IN MALTA

For her next steps, Sammut hopes to secure additional funding to analyse the prevalence of threatened miscarriage in Malta using more recent, post-COVID-19 numbers and to further develop the RF model and enable its use in everyday clinical practice.

Her findings were presented during national policy discussions on miscarriage leave, bringing scientific data into legislative dialogue at a pivotal moment. The subsequent opening of the Early Pregnancy Assessment Unit at Mater Dei Hospital reflects a system increasingly informed by evidence, where research, policy, and clinical service development are integrated. Previously, pregnant people facing complications were seen in emergency departments or outpatient clinics. This means they often witnessed families leaving postnatal wards or late-stage pregnancies, all of which can cause deep distress.

Sammut's work illustrates how evidence-based research can redefine women's health priorities. By quantifying risk, introducing AI-driven prediction, and contributing to national policy dialogue, her research has helped move early pregnancy from the margins of healthcare to the centre of public health attention. It is a reminder that when science listens to women's lived experiences, systems can change. **T**

Further Reading

Sammut, L., Bezzina, P., Gibbs, V., Muscat-Baron, Y., Agius-Camenzuli, A., & Calleja-Agius, J. (2025). Predicting first-trimester pregnancy outcome in threatened miscarriage: A comparison of a multivariate logistic regression and machine learning models. *Radiography*, 31(6), 103159. <https://doi.org/10.1016/j.radi.2025.103159>

Sammut, L., Bezzina, P., Gibbs, V., Baron, B., & Calleja-Agius, J. (2025). First-trimester bleeding: Can ultrasound and biochemical developmental markers deepen our understanding of threatened miscarriage? *Radiography*, 31(5), 103024. <https://doi.org/10.1016/j.radi.2025.103024>

Sammut, L., Bezzina, P., Gibbs, V., Muscat-Baron, Y., & Calleja-Agius, J. (2024). The prevalence of threatened miscarriage in Malta. *European Journal of Obstetrics & Gynecology and Reproductive Biology*: X, 24, 100353. <https://doi.org/10.1016/j.eurox.2024.100353>

Sammut, L., Bezzina, P., Gibbs, V., & Calleja-Agius, J. (2024). Assessing the predictive value of first-trimester ultrasound and biochemical markers in miscarriage: A scoping review. *Radiography*, 30(5), 1368–1375. <https://doi.org/10.1016/j.radi.2024.07.022>