Derleme
(Review)

Yasemin ÖZHÜNER

Orcid: 0000-0001-8968-6819

Eskişehir Vadişehir Aile Sağlığı Merkezi, Eskişehir, Türkiye.

Corresponding Author (Sorumlu Yazar):

Yasemin ÖZHÜNER

yaseminozhuner2018@gmail.com

Keywords: Artificial intelligence; pregnancy; complication.

Anahtar Sözcükler: Yapay zeka; gebelik; komplikasyon.

EGEHFD, 2025, 41 (3): 621-631

Doi: 10.53490/egehemsire.1634798

The Importance of Artificial Intelligence Applications for Healthcare Professionals in Identifying Pregnancy Complications: A Traditional Review

Gebelik Komplikasyonlarının Belirlenmesinde Yapay Zeka Uygulamalarının Sağlık Profesyonelleri İçin Önemi: Geleneksel Derleme

Gönderilme Tarihi: 06 Şubat 2025 **Kabul Tarihi:** 04 Temmuz 2025

Abstract

Artificial intelligence applications are widely used in the healthcare field. Healthcare also integrates prediction, diagnosis, and prioritization methods into its operations. With the emergence of these applications, digital technologies are becoming practical auxiliary tools in various healthcare sectors. Especially, applications play an important role in predicting pregnancy complications. Pregnancy-related issues escalate the rate of maternal death. Therefore, early and accurate detection of pregnancy-related complications plays a critical role in reducing maternal mortality rates. Reduced maternal and newborn fatalities depend on early screening and diagnosis. Artificial intelligence applications have a wide range of applications and techniques in this field, including monitoring the health of the mother and embryo, identifying pregnancy risk factors, and predicting preterm birth. These applications facilitate earlier detection and intervention, allowing healthcare professionals to proactively manage pregnancy complications, thereby improving outcomes for both mother and baby. Additionally, with these predictive models, healthcare professionals can assess the risk of complications in the early stages of pregnancy and adapt interventions accordingly. This study aims to examine how artificial intelligence applications can improve maternal health care through early detection of pregnancy complications and increase access to quality care for women globally

Öz

Yapay zeka uygulamaları sağlık alanında yaygın bir şekilde kullanılmaktadır. Sağlık bakımı, tahmin, teşhis ve öncelik belirleme yöntemi olarakta sağlığa entegre edilmektedir. Bu uygulamaların ortaya çıkmasıyla, dijital teknolojiler farklı sağlık sektörlerinde pratik yardımcı araçlar olarak yer almaktadır. Özellikle, gebelik komplikasyonların tahmininde uygulamaların önemli bir yeri vardır. Gebelikle ilgili yaşanan bu sorunlar anne ölüm oranını arttırmaktadır. Bundan dolayı, gebelikle ilgili komplikasyonların erken zamanda ve doğru tespit edilmesi anne ölüm oranını azaltmada çok önemlidir. Anne ve yenidoğan ölümlerinin azaltılması erken tarama ve tanıya bağlıdır. Yapay zeka uygulamaları, anne ve embriyonun sağlığını izleme, gebelik risk faktörlerini belirleme ve erken doğumu tahmin etme dahil olmak üzere bu alanda çok çeşitli uygulamalara ve tekniklere sahiptir. Bu uygulamalar, daha erken tespit ve müdahaleyi kolaylaştırarak, sağlık profesyonellerinin gebelik komplikasyonlarını proaktif bir şekilde yönetmesini sağlar, hem anne hem de bebek sonuçlarını iyileştirir. Ayrıca, bu öngörücü modeller ile, sağlık profesyonelleri gebeliğin erken döneminde komplikasyon risk değerlendirmesi yaparak, müdahaleleri ona göre uyarlamasını sağlar. Bu çalışma, gebelik komplikasyonlarında yapay zeka uygulamalarının erken tespiti ile anne sağlığı hizmetlerini nasıl iyileştirebileceğini ve küresel çapta kadınlar için kaliteli bakıma erişimi nasıl artırabileceğini incelemeyi amaçlamaktadır.

How to cite: Özhüner, Y. (2025). The Importance of Artificial Intelligence Applications for Healthcare Professionals in Identifying Pregnancy Complications: A Traditional Review. *JEUNF, 41*(3), 621-631 DOI: 10.53490/egehemsire.1634798.
Kaynak gösterimi: Özhüner, Y. (2025). Gebelik Komplikasyonlarının Belirlenmesinde Yapay Zeka Uygulamalarının Sağlık Profesyonelleri İçin Önemi: Geleneksel Derleme. *EGEHFD, 41*(3), 621-631 DOI: 10.53490/egehemsire.1634798.

INTRODUCTION

Even though most pregnancies and births unfold smoothly, every pregnancy inherently carries a degree of risk throughout the entire process. Roughly 15% of pregnant women experience a potentially fatal complication, and some of them need a significant obstetric intervention. The World Health Organization (WHO) estimates that each day, some 800 pregnant women globally pass away from avoidable causes. About 295.000 women lost their lives during pregnancy and delivery in 2017. These deaths were due to complications such as heart disease, anemia, high blood pressure, infections and severe bleeding. However, most of these deaths (94%) were from largely preventable causes and occurred in resource-limited settings (Jones et al., 2021; Organization, 2023b).

Identifying pregnancies with elevated risk factors represents a crucial step in safeguarding both maternal and fetal health. This identification process serves as a preventive measure against potential complications. However, healthcare providers face significant challenges in this assessment due to the intricate nature and considerable variability of risk factors that may influence pregnancy outcomes. Pregnancy-related risk to maternal health is the possibility that a woman will have unfavorable health outcomes during her pregnancy or delivery. Pregnancies are categorized as low, medium, or high risk based on the presence of specific risk factors that may lead to complications (as noted in recent medical literature) (Al-Hindi et al., 2020). When a pregnancy is designated as high-risk, it presents potential perinatal challenges for both mother and child. Maternal complications may include conditions such as preeclampsia, gestational diabetes, and the necessity for cesarean delivery. For the developing fetus, risks extend to premature birth, oxygen deprivation during delivery (perinatal asphyxia), birth defects, and even long-term cardiovascular issues that may manifest in adulthood (Correa-de-Araujo & Yoon, 2021; Togunwa, Babatunde, & Abdullah, 2023). These adverse outcomes associated with high-risk pregnancies may pose significant threats to both maternal health and fetal development (Togunwa et al., 2023).

Once they occur, most pregnancy complications are not directly treatable. Therefore, perinatal medicine implements interventions to predict high-risk groups and minimize adverse perinatal outcomes. These interventions include progesterone for preterm delivery, nutrition and insulin for diabetes, aspirin for preeclampsia, and growth evaluation for stillbirth. By incorporating artificial intelligence (Al) applications into risk assessment and the prediction of adverse pregnancy outcomes, an opportunity arises for contemporary perinatal medicine. Predictive models and efficient screening techniques for unfavorable pregnancy outcomes can enhance diagnosis and treatment conclusions and have a major influence on women's and children's health. Regular use of artificial intelligence can enhance healthcare even further (Feduniw et al., 2022; Ginsberg & Levine, 2021; Jones et al., 2021; Maassen et al., 2021).

In recent years, artificial intelligence applications have led to significant advancements in healthcare due to their impact on the delivery and quality of diagnostic and treatment services. In fact, they have garnered significant attention in recent years due to their ability to address problems that traditional approaches have either failed to solve or proven ineffective in solving. Communication between medical devices and digital transformations, such as using artificial intelligence applications to suggest diagnoses and tests for patients to healthcare personnel, are among the innovative approaches in the healthcare system (Limon, 2019; Şendir, Şimşekoğlu, Kaya, & Sümer, 2019). These innovative approaches enable the production of cost-effective and easily accessible solutions in healthcare services, particularly in areas with limited resources like labor, equipment, and money, through the use of advanced technologies (Joseph, Huber, Bair, Moorhead, & Hanrahan, 2019). Artificial intelligence applications have greatly improved in parallel with global technological advancements, with the introduction of new learning algorithms, theories, and advanced computing power facilitating the transition from theoretical models to practical use (Barbounaki & Vivilaki, 2021). Healthcare professionals may utilize its Al support to enhance decision-making, minimize medical errors, improve the accuracy of diagnostic interpretations, and ultimately alleviate their overall workload (Frizzell et al., 2017; Makary & Daniel, 2016). Additionally, by reducing the complex structure of medical knowledge, supporting diagnosis, and predicting clinical outcomes as quickly as possible, it has become a promising method for medicine (Figure1.) (Frizzell et al., 2017; Makary & Daniel, 2016; Yaseen & and Rather, 2024).

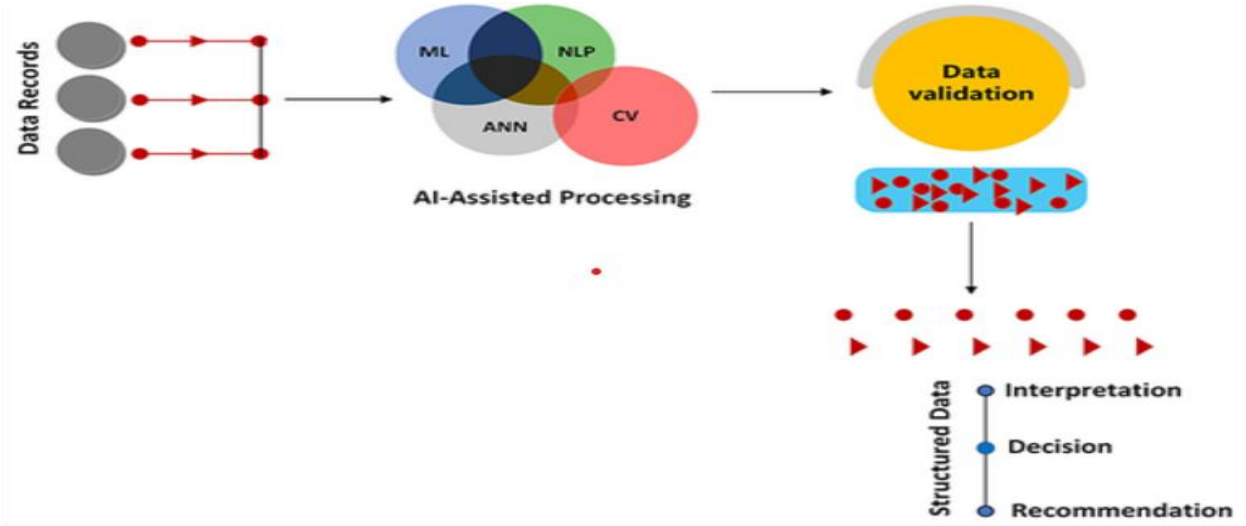


Figure1: Systematic processing and interpretation of data records of the AI model

This study aims to examine how AI can improve maternal health services through early detection of pregnancy complications and increase access to quality care for women globally, while also examining the ethical aspects of these applications. In this context, the most commonly observed pregnancy complications, such as hypertension, gestational diabetes, anemia, preterm birth, abortion and stillbirth, preeclampsia, placenta accreta, infections, and ectopic pregnancy, will be discussed in relation to artificial intelligence applications.

Hypertension (HT)

During pregnancy, blood vessels commonly narrow, restricting blood flow to different body areas. This narrowing raises arterial pressure, resulting in hypertension. When hypertension occurs, blood struggles to flow through the placenta, limiting nutrient delivery to the developing fetus. Consequently, this can result in fetal growth restriction while increasing the mother's risk of delivering prematurely or developing preeclampsia (M. Khan et al., 2022). Therefore, it is extremely important to detect hypertension in pregnancy at an early stage. HT can be detected early with artificial intelligence applications. The artificial intelligence model, which classifies each risk factor such as headache, epigastric pain, nausea-vomiting and blurred vision in determining HT, has been shown to effectively predict the probability of developing hypertensive diseases in high-risk pregnancies (Moreira, Rodrigues, Oliveira, Saleem, & Neto, 2016). Hoffman et all. AI to predict hypertension-related readmissions within 42 days after childbirth. Their study analyzed discharge data from electronic medical records across two cohorts: 20,032 women (1.2% readmission rate) and a validation group of 5,823 women (1.4% readmission rate). The model successfully identified 31 clinical features that consistently predicted readmission risk across both populations. This work highlights how computational approaches can leverage existing clinical data to identify patients at elevated risk for hypertensive complications, potentially reducing maternal morbidity through more personalized postpartum care planning (Hoffman, Ma, & Roberts, 2021). Park and colleagues developed an AI system for first-trimester prediction of pregnancy-associated hypertensive disorders. In their study of 3,066 women, the model successfully identified 91.7% of cases who later developed early-onset preeclampsia. This impressive detection rate during the first trimester, long before clinical symptoms appear, represents a significant advance in prenatal risk assessment. Such early detection could enable timely preventive interventions and more targeted monitoring, potentially reducing the serious maternal and fetal complications associated with these hypertensive conditions (Park et al., 2013).

Gestational Diabetes Mellitus (GDM)

Diabetes affects people across all age groups and genders. While not contagious, it develops in those with insufficient insulin production or utilization. Studies show pregnant women with diabetes face increased risks of pregnancy loss, kidney dysfunction, heart problems, vision loss, and other serious chronic conditions. Early detection of diabetes during pregnancy is therefore essential for proper management and reducing these potential complications (McIntyre et al., 2019).Gestational diabetes, defined by the American Diabetes Association as diabetes diagnosed in the second or third trimester without pre-pregnancy evidence, significantly impacts maternal and fetal health. Short-term complications include increased risks of preeclampsia, premature delivery, fetal macrosomia, and neonatal hypoglycemia. Long-term consequences extend beyond pregnancy, with mothers facing higher rates of prediabetes and diabetes, while their children show increased susceptibility to obesity and impaired fasting glucose.

This metabolic disorder's intergenerational health impact underscores the importance of effective screening, management, and follow-up care(McIntyre et al., 2019).

Therefore, people frequently use artificial intelligence applications to quickly and effectively diagnose diabetes. AI systems analyze key factors to identify early gestational diabetes indicators, including maternal age, diabetes in close family members, multiple gestation pregnancies, previous gestational diabetes history, fasting blood glucose measurements, and triglyceride levels. Studies have demonstrated that artificial intelligence applications can accurately detect diabetes early in the first trimester of pregnancy, with a high accuracy rate (Araya et al., 2021; Debata & Mohapatra, 2021). Gallardo Rincon et al. worked with 1.709 pregnant women in a cohort study where they developed an AI-based prediction model for gestational diabetes. We evaluated age, type 2 diabetes, family history, previous diagnosis of hypertension, pre-pregnancy body mass index, gestational week, parity, birth weight of the last child, and glucose level as the best predictive variables for the risk of gestational diabetes. The study revealed a high (70.3%) accuracy rate of the artificial intelligence application in identifying women at high risk of developing gestational diabetes (Gallardo-Rincón et al., 2023). Balani and colleagues used AI techniques to predict gestational diabetes in obese pregnant women at 14-17 weeks gestation, achieving 77.53% accuracy. Their most significant finding was identifying visceral fat mass as the strongest predictor of GDM development—a previously unrecognized risk factor. This research demonstrates AI's dual value in improving early risk assessment while uncovering new insights into disease mechanisms. The discovery of visceral adiposity's importance suggests potential new approaches for both screening and prevention in high-risk pregnancies (Balani, Hyer, Shehata, & Mohareb, 2018). Bigdeli et al. The artificial intelligence used to predict GDM in the first trimester achieved the best performance compared to other models with 89% accuracy and 86% precision in predicting GDM with demographic variables, medical history and clinical findings. It has been shown that this application has an acceptable accuracy in early prediction of GDM in the first trimester of pregnancy (Bigdeli, Ghazisaedi, Ayyoubzadeh, Hantoushzadeh, & Ahmadi, 2025). In the study by Kang et al., in which they predicted large-for-gestational-age babies in mothers with GDM using artificial intelligence, glycemic fluctuations of 371 women were evaluated during 20 to 34 weeks of pregnancy. As a result of the study, it was seen that the AI application predicted large-for-gestational-age babies better and had an accuracy rate of 84.4% (Kang et al., 2025).

Anemia

Anemia impairs cognitive and motor function in adults, affecting not just individual health but also national economic development. WHO data suggests over 30% of people worldwide have anemia, with pregnancy rates averaging 38.2% (ranging from 36-80%). The prevalence varies significantly between developed nations (18%) and developing regions (35-75%). This widespread condition, defined by insufficient healthy red blood cells, poses substantial risks to pregnant women and their developing fetuses (Organization, 2015; Suryanarayana, Chandrappa, Santhuram, Prathima, & Sheela, 2017). In pregnancy, it can lead to premature birth and low birth weight babies. Insufficient iron stores in newborns due to anemia cause adverse reproductive and developmental outcomes. When left untreated, anemia can significantly diminish the health and quality of life for millions of women while simultaneously compromising the physical development and cognitive capabilities of their children.Therefore, further technological advances are needed for the rapid detection and monitoring of anemia in pregnancy (Anggraeni & Fatoni, 2017). Research conducted in Indonesia by Anggraeni and Fatoni developed a non-invasive method for detecting anemia in pregnant women using smartphone camera technology. Their approach involved analyzing palpebral conjunctiva color through digital imaging to identify potential anemia cases early, potentially reducing postpartum hemorrhage incidents. The system captured images using a smartphone camera without flash and applied color correction techniques. Analysis of red, green, and blue color intensities revealed that red intensity demonstrated the strongest correlation with hemoglobin levels, achieving a coefficient of determination ($R^2 = 0.814$) and a correlation coefficient of 0.92 (Anggraeni & Fatoni, 2017).

More recently, Kitaw et al. (2024) evaluated artificial intelligence applications for predicting anemia severity among pregnant women in Ethiopia. Their research, as published in BMC Public Health, utilized data from the Ethiopian Demographic Health Survey and various hospitals to develop predictive models. The study demonstrated impressive results, with the Random Forest classifier achieving 97% accuracy and 93% precision, recall, and F1-score in identifying anemia severity levels. This AI-based approach contributes significantly to understanding anemia risk factors and supports the development of targeted early intervention strategies for maternal health (Figure 2.) (Kitaw, Asefa, & Legese, 2024).

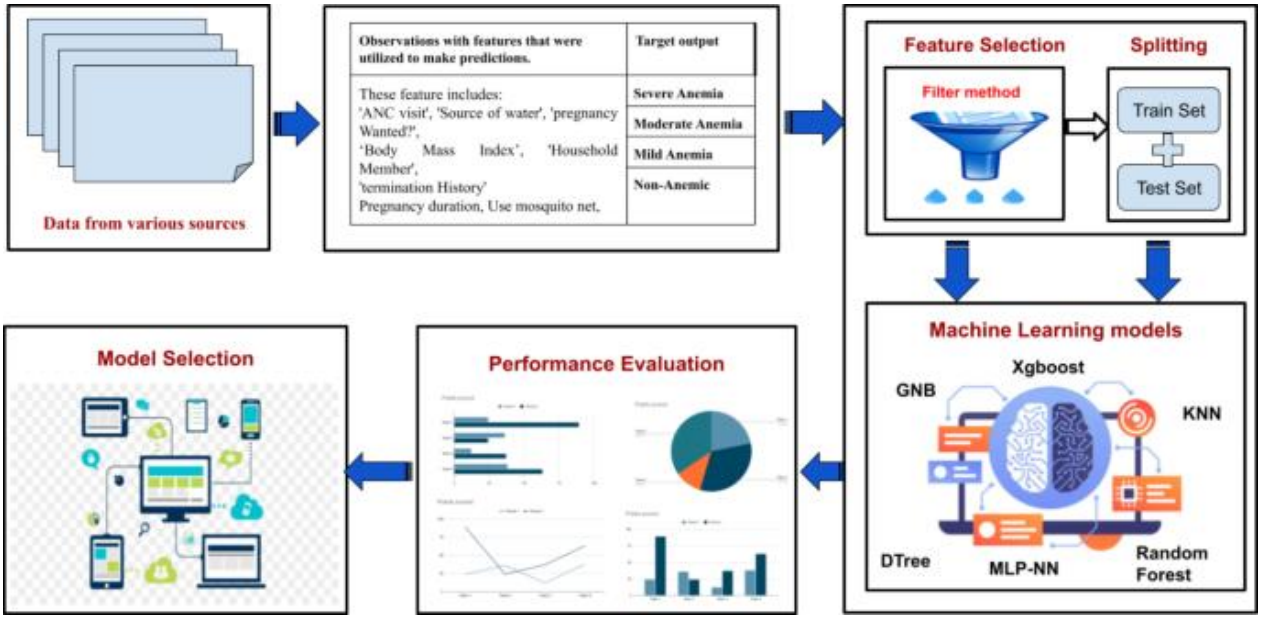


Figure 2: AI applications for determination of anemia severity

Preterm Birth

According to established international medical standards of the World Health Organization, babies born alive before completing 37 weeks of gestation are classified as preterm birth (Organization, 2023a). Estimates from 2014 indicated that unknown reasons accounted for 10.6% of preterm births worldwide. Preterm births can result in numerous health issues for the baby, as the brain and immune system develop during the later stages of pregnancy (Howson, Kinney, McDougall, Lawn, & the Born Too Soon Preterm Birth Action Group, 2013).
Globally, preterm delivery is the top cause of mortality among kids younger five. Additionally, it has both immediate and long-term effects on neonates' health. For parents and healthcare institutions, this condition poses a serious financial and psychological strain. Therefore, the development of predictive tests for premature birth, the provision of prophylactic interventions by healthcare personnel, and the application of artificial intelligence in making prenatal management decisions can be helpful (Mennickent et al., 2023).

Recent technological advancements using artificial intelligence have made it possible to characterize the wide range of biological changes during pregnancy. The focus of a systematic review using artificial intelligence methods to improve preterm birth outcomes was on cervix-related risks, preterm birth risk prediction, maternal education, and improving neonatal mortality and morbidity (Davidson & Boland, 2021). Malocova et al. carried out a cohort study to investigate the use of artificial intelligence in predicting preterm and stillbirth. They observed that the father's nationality and the mother's age significantly influenced the prediction of preterm birth (Malacova vd., 2020). Jehan et al. conducted a cohort study in which they evaluated the diagnosis/prognosis of preterm delivery using an artificial intelligence model and found that the AI model effectively predicted early delivery based on blood and urine samples collected from 81 pregnant women (Jehan et al., 2020). A study observed that an artificial intelligence application, examining over 1.400,000 births and inputting 112 personal characteristics, created a model that accurately predicted premature births at a rate of 81% (Mennickent et al., 2023) . Lee et al. In their study examining the application of artificial intelligence in predicting spontaneous preterm birth, the main determinants were determined to be body mass index, hypertension, diabetes mellitus, cone biopsy, previous placenta previa, parity, cervical length, age, previous preterm birth, myomas and adenomyosis. As a result of the study, in addition to preventive measures for hypertension and diabetes mellitus, cervix length screening should be widespread with different guidelines according to the extent/type of previous conization in order to prevent premature birth (Lee & Ahn, 2019).

Abortıon and Stillbirth

An abortion happens extremely early in pregnancy and is defined as the loss of a pregnancy for natural reasons. Miscarriages occur in over 20% of pregnancies. Abortion is the natural death of a fetus before the 20th week of pregnancy. It is a common and serious pregnancy complication that has significant psychological effects on the mother and family. Only by taking specific measures can we address and prevent abortion (Mennickent et al., 2023). Recent technological advancements, especially in the realm of artificial intelligence, have facilitated the utilization of the growing volume of data from biomedical studies to enhance patient outcomes.

Consequently, with precision medicine, it has become easier to improve and predict medical outcomes. In this context, advanced AI systems now analyze time-lapse embryo images to identify subtle developmental patterns linked to miscarriage risk. This technology helps fertility specialists select embryos with better implantation potential, improving success rates in assisted reproduction and reducing the likelihood of pregnancy loss. Amitai et al. found that the artificial intelligence model they used for early prediction of miscarriages in the first trimester accurately predicted the risk of miscarriage in a study of 391 women (Amitai et al., 2023).

Stillbirth, defined as fetal death beyond 20 weeks gestation, persists as a significant obstetric challenge despite advances in prenatal care. Many cases remain unexplained, hampering prevention efforts. Artificial intelligence has created new opportunities for early detection. Research by Malacova et al. (2020) demonstrated that AI systems can identify approximately 50% of stillbirths prenatally by analyzing multiple factors including pregnancy complications, congenital anomalies, and maternal health characteristics (Malacova et al., 2020). A study developed an AI model that achieved 87% accuracy in predicting both stillbirth and early neonatal death using peripartum clinical data. These computational approaches allow healthcare providers to identify high-risk pregnancies that may benefit from increased monitoring and intervention (Mennickent et al., 2023).

Preeclampsia

Preeclampsia is a pregnancy complication marked by hypertension after 20 weeks gestation. It presents in two forms. Moderate preeclampsia typically emerges after 34 weeks gestation, presenting with blood pressure readings of ≥140/90 mmHg. It can cause liver and kidney dysfunction, thrombocytopenia, significant proteinuria (≥3g/24h), and may affect fetal growth patterns. Severe preeclampsia appears earlier, before 34 weeks gestation, with more pronounced hypertension (≥160/110 mmHg). This form involves multisystem organ damage, heavier proteinuria (≥5g/24h), and frequently causes intrauterine growth restriction, posing greater risks to both maternal and fetal health. Early diagnosis and appropriate management of both are essential to prevent serious complications such as eclampsia, placental abruption, and adverse neonatal outcomes (August & Sibai, 2017).

Preeclampsia likely stems from abnormal placental formation, though its exact cause remains undetermined. The primary theory involves inadequate remodeling of maternal spiral arteries, restricting blood flow to the placenta and failing to meet fetal metabolic demands. This pathological process initiates in the first trimester, though clinical manifestations typically appear later. The placental dysfunction triggers systemic maternal effects while simultaneously compromising fetal development in the second and third trimesters through reduced nutrient and oxygen delivery (Gyselaers, Mullens, Tomsin, Mesens, & Peeters, 2011).

Preeclampsia affects 5-8% of global pregnancies and represents a major cause of maternal-fetal morbidity and mortality. It can lead to impaired fetal growth, neonatal respiratory distress, and stillbirth. Early detection is essential, as the condition often develops silently before maternal symptoms appear. Identifying preeclampsia before clinical manifestations emerge allows for timely intervention and potentially improved outcomes for both mother and baby. Effective screening protocols that incorporate risk assessment, biomarkers, and imaging are critical to this preventive approach (Nelson, Ziadie, McIntire, Rogers, & Leveno, 2014; Saleem et al., 2014).
There is presently no effective preventative intervention for preeclampsia, despite its serious clinical effects. Preeclampsia serves as the primary clinical management strategy, requiring close monitoring and early diagnosis to ensure prompt management. Thus, research has concentrated on creating practical preeclampsia prediction techniques (Figure 3.) (Espinosa et al., 2021; Payne et al., 2014).

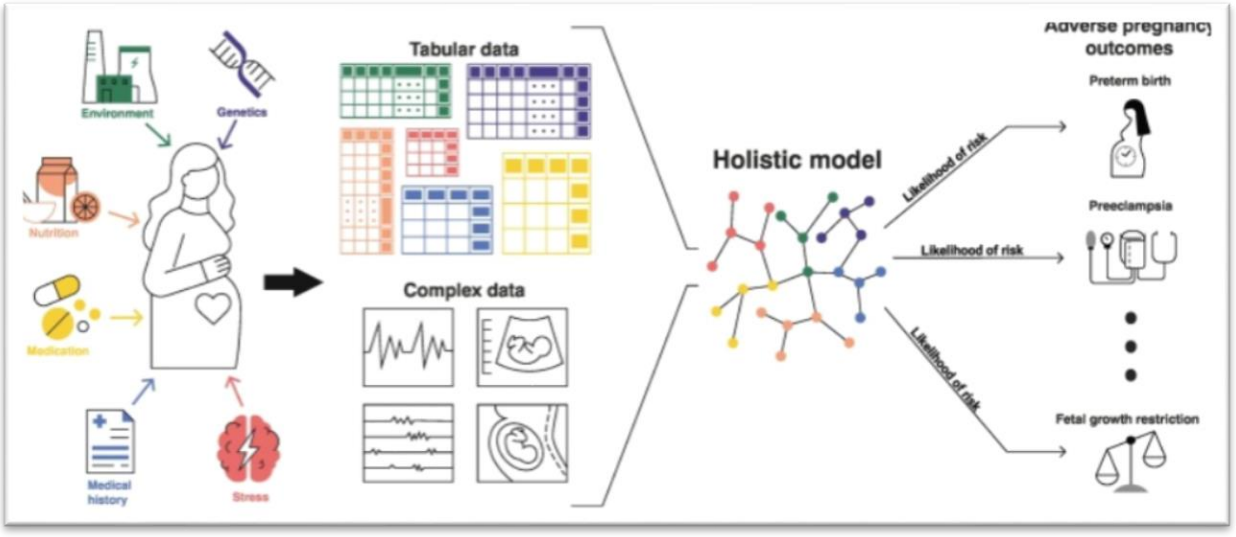


Figure 3: Application of AL in determining preeclampsia

Researchers use artificial intelligence models to detect preeclampsia early. A practical predictive AI model could enable healthcare professionals to monitor at-risk patients more closely, reducing the need to monitor patients who are less likely to develop preeclampsia (Zeisler et al., 2016). Jhee et al. developed an artificial intelligence model to predict late-onset preeclampsia up to the 34th week in 11.006 pregnant women, demonstrating a prediction accuracy of 0.973 and showing that it is an important tool for early detection of preeclampsia (Jhee et al., 2019). Marić et al. applied gradient boosting and elastic net algorithms to develop an early preeclampsia prediction model with promising results. Their system achieved 45.2% sensitivity with only 8.1% false positives. A key strength was the model's autonomous identification of significant preeclampsia risk factors from routine pregnancy data, eliminating human selection bias. This computational approach demonstrates how machine learning can enhance prenatal risk assessment using standard clinical information, potentially improving early detection without requiring additional testing (Marić et al., 2020).

AI predictive models for preeclampsia confirm the importance of established clinical indicators while revealing potential new relationships. The models identify systemic blood pressure, platelet count, and urinary protein levels as highly predictive variables, aligning with current medical understanding. Interestingly, the algorithms assign minimal predictive value to several other parameters including glucose levels, leukocyte counts, and serum calcium and potassium measurements. These computational findings both validate existing clinical knowledge and suggest new avenues for focused research, potentially refining how clinicians prioritize biomarkers when assessing preeclampsia risk (Bertini, Salas, Chabert, Sobrevia, & Pardo, 2022; Jhee et al., 2019).

Placenta Accreta

Placenta accreta means that the placenta doesn't develop normally and the trophoblasts don't invade the myometrial layer properly, and they do so at different depths (Cali et al., 2022).
Placenta accreta is a life-threatening complication during pregnancy. The existence of uterine scars from prior cesarean sections or other uterine procedures, as well as placenta previa (the underlying placenta covering the internal cervical region entirely or partially) are the two most significant risk factors. Only a histological examination can make the definitive diagnosis. However, there have been numerous efforts to enhance prenatal detection using transabdominal and transvaginal ultrasound examinations (Carbone, Saccone, Conforti, Maruotti, & Berghella, 2021). In this field, artificial intelligence applications can help improve prenatal diagnosis. Clinical decision-making in the early diagnosis of placenta accreta is facilitated by AI technologies, according to studies (Romeo et al., 2019; Sun et al., 2019). Romeo et al. in their artificial intelligence application to predict placenta accreta in placenta previa patients, preoperative MRI examinations of 64 patients with placenta previa were performed. As a result of the study, it was determined that the AI application had 98.1% accuracy, 98.7% precision, 97.5% sensitivity and 98.7% specificity in evaluating the placenta accreta status in placenta previa patients. The model can be used as a feasible tool in the identification of placental tissue abnormalities (Figure 4.) (Romeo et al., 2019).

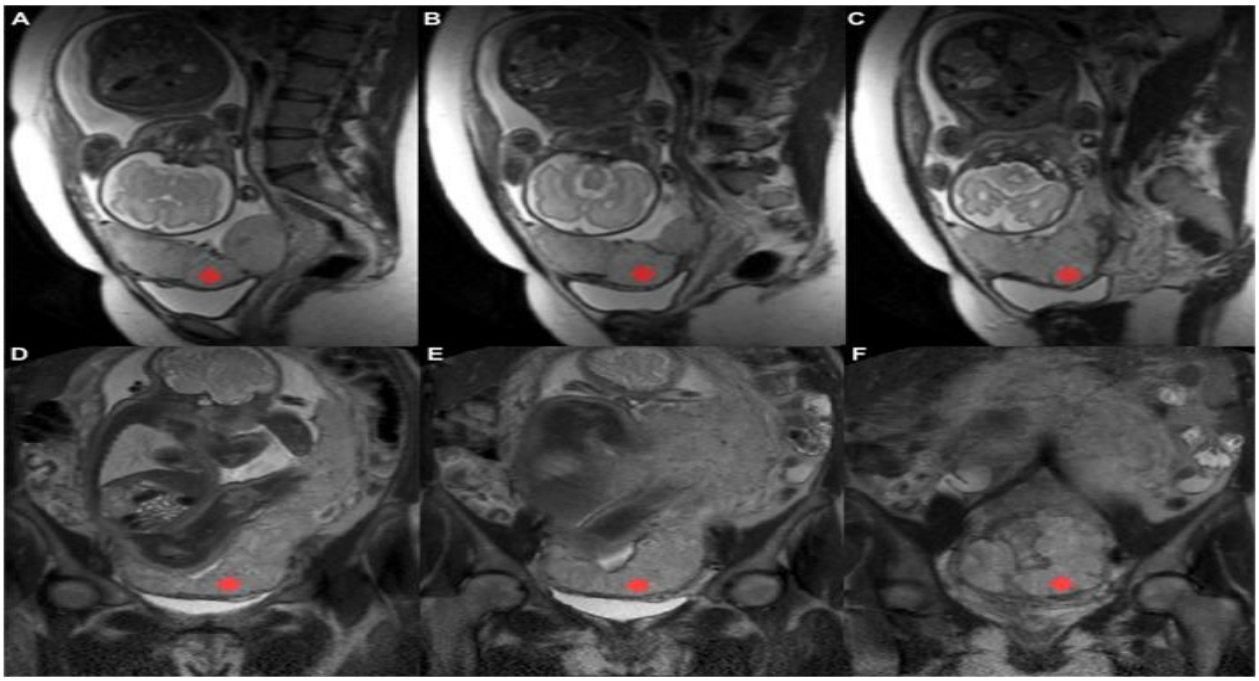


Fıgure 4: MRI tissue features and AI application analysis in predicting placenta accreta

Sun et al. developed an AI system that analyzes MRI textural features to identify invasive placentation. Their study examined 155 pregnant women (99 with confirmed placental invasion, 56 with simple placenta previa). The algorithm achieved remarkable diagnostic performance: 100% specificity, 88.5% sensitivity, and 95.2% accuracy. These results demonstrate AI's potential to enhance clinical decision-making for suspected placental invasion cases by providing reliable, objective assessment that could improve surgical planning and patient management for this high-risk obstetric condition (Sun et al., 2019). Shazly et al. performed an AI application to predict clinical outcomes in women with placenta accreta spectrum. In the study, major blood loss, prolonged hospital stay and intensive care unit admission, parity, placental location and hemoglobin values were taken from 727 women. The AI application showed 0.86 accuracy, 0.90 precision and 0.86 sensitivity in predicting placenta accreta. As a result of the study, it was seen that the AI application can be used to calculate individualized morbidity risk in women with placenta accreta (Shazly et al., 2022).

Infections

Pregnancy naturally suppresses maternal immunity to accommodate the fetus, increasing vulnerability to infections that may cross the placental barrier. These infections can cause serious complications including preterm birth, congenital anomalies, and pregnancy loss. However, a comprehensive approach including pre-conception screening, regular prenatal monitoring, and postnatal vigilance significantly reduces these risks. Early detection through appropriate testing enables timely intervention with pregnancy-compatible treatments, protecting both maternal and fetal health throughout this vulnerable period (Caly et al., 2021).
The mother's antibodies, which are transferred to her baby during pregnancy, can also protect the newborn, and infections can occur before, during and after birth. Nevertheless, sepsis describes a severe reaction to an infection, which may cause death or severe injury, because in newborns, the risk of developing sepsis is particularly high. The immune system is still weak, therefore early detection of sepsis is crucial, and AI technology can detect the disease earlier than previously possible (M. S. Khan, Bates, & Kovacheva, 2021). According to research findings, studies have found that AI applications perform better than current sepsis assessment systems, including those for pediatric organ failure and inflammatory response (Le et al., 2019).

It is important to detect infections that occur in women during pregnancy at an early stage. AI applications are extremely effective in quickly identifying the infection. Whelan et al. used the AI application to map gonorrhea infection and examined the conditions associated with gonorrhea (clinical conditions, complications, co-infections, and health problems). As a result of the study, they detected rare and serious health problems associated with gonorrhea infection in the AI application. Whelan et al. used the AI application to map gonorrhea infection and examined the conditions (clinical conditions, complications, co-infections and health problems) associated with gonorrhea. As a result of the study, they identified rare and serious health problems associated with gonorrhea infection in the AI application (Fıgure 4.) (Whelan, Ghoniem, Médoc, Apicella, & Beck, 2021).

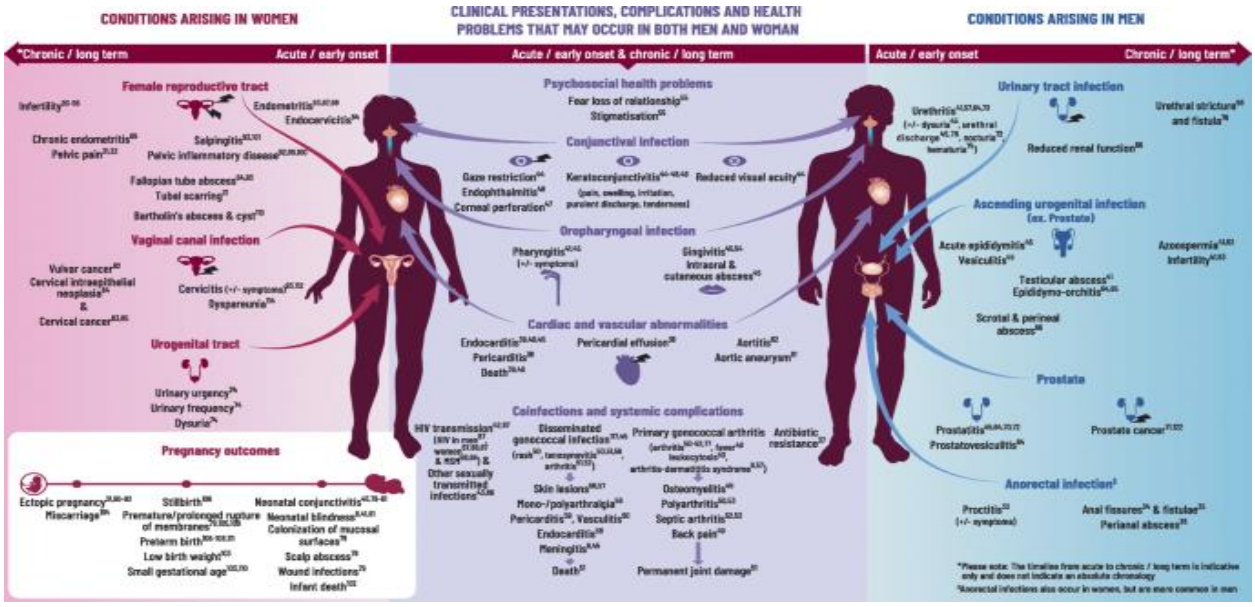


Fıgure 4: AI app and Gonorrhea health map

Ectopic Pregnancy

The term "ectopic pregnancy" refers to pregnancy that occurs outside of the uterus. The majority of ectopic pregnancies (84%) implant in the fallopian tube, but other locations are also possible (cervical, cornual, hysterotomy scar, intramural, ovarian, and abdominal). Ectopic pregnancy is a significant cause of morbidity and mortality worldwide. This medical condition has the potential to be life-threatening, therefore early detection and treatment are crucial. We can determine the location of the pregnancy and diagnose ectopic pregnancy earlier with the routine use of transvaginal ultrasonography. The diagnosis and monitoring of these individuals benefit from the quantitative measurement of the human chorionic gonadotropin beta subunit. Different factors dictate whether to treat ectopic pregnancy with surgery, pharmacological treatment, or conservative therapy (Bouyer, Coste, Fernandez, Pouly, & Job-Spira, 2002; Silva Rocha et al., 2022).

Testing with clinical diagnostic technology, including laparoscopy and ultrasound, makes it easier and more convenient to identify ectopic pregnancy early. However, recently, applications offering information and communication technologies have been used alongside traditional diagnostic techniques. Artificial intelligence has a significant impact in any research field today, and its use in the clinical domain is showing substantial growth. Computational models known as artificial intelligence algorithms aim to solve problems beyond the scope of statistical methods. Therefore, the development of algorithms that help predict or classify diseases from a knowledge base and act like clinical decision support systems has shown significant progress in various application areas (Davidson & Boland, 2021). In a three-stage artificial intelligence application, De Ramon Fernandez et al. achieved 98% accuracy, sensitivity, and specificity in identifying ectopic pregnancies. In this context, they have demonstrated that the application can aid gynecologists in making decisions about the initial treatment for ectopic pregnancy (De Ramón Fernández, Ruiz Fernández, & Prieto Sánchez, 2019). Suresh et al. developed an artificial intelligence application using ultrasound images to improve ectopic pregnancy detection, and showed that the AI application had a 98% accuracy rate in predicting ectopic pregnancy. The AI model reduces the risk of complications and increases the likelihood that the patient will receive the most appropriate treatment (Suresh & Lakshmanan, 2025). The artificial intelligence application developed by Verma et al. with predictive modeling for ectopic pregnancy detection was performed by considering a dataset consisting of clinical risk factors, signs and symptoms, and serum human chorionic gonadotropin findings of 298 women. It was observed that the AI application achieved the highest accuracy in predicting ectopic pregnancy and was better than other models with an accuracy of 81% (Verma & Agarwal, 2025).

Ethical Issues

- Data Privacy and Security: Robust security measures, such as strong encryption and strict access controls, are critical to protecting sensitive patient health information and maintaining patient trust. Clear communication about data use and obtaining informed consent is essential. However, clinical data collected by Robots can be hacked and used for malicious purposes that minimize privacy and security (Farhud & Zokaei, 2021).
- Empathy and Sympathy: Healthcare professionals are expected to provide treatment in an empathic and compassionate environment that will significantly affect the healing process of patients. However, this will

not be achieved with robotic healthcare professionals. Patients will lose empathy, kindness, and appropriate behavior when dealing with robotic doctors and nurses because these robots do not have human characteristics such as compassion. This is one of the most important negative aspects of artificial intelligence in medical science (Sunder, 2020).

- Transparency and Explainability: The "black box" nature of some AI systems can hinder trust. Healthcare professionals need to understand how AI algorithms reach their conclusions and integrate them into clinical decision-making with confidence. Developing explainable AI models is crucial. If AI practices are not explainable, healthcare practitioners may be unfairly held responsible for AI failures. To prevent this, standardized policies and government measures must be implemented (Mennella, Maniscalco, De Pietro, & Esposito, 2024).
- Algorithmic Bias: Measures must be taken to prevent and reduce bias that can arise from unrepresentative training data in AI algorithms. This requires careful consideration during data collection, model development, and ongoing monitoring. It can occur due to a variety of factors, including missing data, skewed sampling methods, or errors in data recording. When AI models are trained on biased data, they can inherit and perpetuate these inaccuracies, leading to biased conclusions and medical decisions (Hanna et al., 2025).
- Accountability: Clear guidelines and legal frameworks are needed to determine responsibility for errors or adverse outcomes that may arise from AI-driven decisions (CiRban Ekrem & Daşikan, 2021).

CONCLUSION

Identifying maternal health risks (hypertension, gestational diabetes, anemia, preterm birth, miscarriage and stillbirth, preeclampsia, placenta accreta, infections, and ectopic pregnancy) is particularly critical in reducing the number of maternal deaths. AI models can help healthcare professionals assess pregnancy risks and provide counseling and care in their daily practices. They can also eliminate errors in decision-making. Public health in nations, in particular, can be improved by applying AI techniques to healthcare services and facilitating individual pregnancy management. Integrating AI applications into healthcare services can help improve personalized interventions for high-risk pregnancies and reduce global maternal mortality rates. In addition, these applications can provide early diagnosis and detection of pregnancy complications. In this case, the health of both the mother and the baby can be significantly improved. However, on the other hand, AI application can create some flaws in the clinic when moving from theory to practice. These flaws can cause legal and ethical problems such as medical errors and lead to doubts in clinical care. Therefore, studies on AI need to increase the number of studies that require large, high-quality training datasets to work properly. It is recommended that future research focus on less studied areas (hypertension, gestational diabetes, anemia, preterm birth, miscarriage and stillbirth, preeclampsia, placenta accreta, infections, and ectopic pregnancy) and further integrate AI applications in the clinic.

Author Contributions

Concept and design: Y.Ö., Supervision and consultancy: Y.Ö., Writing manuscript : Y.Ö., Critical review: Y.Ö.

Conflict of Interest: The authors have no conflicts of interest to declare.

Funding: The authors declared that this study has received no financial support.

KAYNAKLAR

Abu-Baker, N. N., AbuAlrub, S., Obeidat, R. F., Assmairan, K. (2021). Evidence-based practice beliefs and implementations: A cross-sectional study among undergraduate nursing students. *BMC Nursing*, *20*(1), 1-8. doi:10.1186/s12912-020-00522-x

American Society for Reproductive Medicine (ESHRE) (2020). Definitions of infertility and recurrent pregnancy loss: A committee opinion. *Fertility and Sterility*, *113*(3), 533-535. doi:10.1016/j.fertnstert.2019.11.025

Bender Atik, R., Christiansen, O. B., Elson, J., Kolte, A. M., Lewis, S., Goddijn, M. (2023). ESHRE guideline: Recurrent pregnancy loss: an update in 2022. *Human Reproduction Open, 2023*(1), hoad002. doi: 10.1093/hropen/hoad002

Chester, M. R., Tirlapur, A., Jayaprakasan, K. (2022). Current management of recurrent pregnancy loss. *The Obstetrician & Gynaecologist, 24*(4), 260-271. doi:10.1111/tog.12832

Emparanza, J. I., Cabello, J. B., Burls, A. J. (2015). Does evidence-based practice improve patient outcomes? An analysis of a natural experiment in a Spanish hospital. *Journal of Evaluation in Clinical Practice, 21*(6), 1059-1065. doi:org/10.1111/jep.12460

ESHRE Recurrent Pregnancy Loss Guideline Development Group (2022). Guideline of European Society of Human Reproduction and Embryology. Erişim adresi: https://www.eshre.eu/Guidelines-and-Legal/Guidelines/Recurrent-pregnancy-loss Erişim tarihi: 05.11.2023

Fernández-Basanta, S., Movilla-Fernández, M. J., Coronado, C., Llorente-García, H., Bondas, T. (2020). Involuntary pregnancy loss and nursing care: A meta-ethnography. *International Journal of Environmental Research and Public Health, 17*(5), 1486. doi:10.3390/ijerph17051486

Griffin, G., Ngulube, M., Farrell, V., Hauck, Y. L. (2021). Caring for women through early pregnancy loss: Exploring nurses' experiences of care. *Collegian*, *28*(3), 268-274. doi:10.1016/j.colegn.2020.08.011

Kahveci, M., Kavlak, O. (2022). Tekrarlayan ektopik gebelik olgusunda yaşanan depresyon ve anksiyeteye yönelik verilen hemşirelik bakımının Stetler Modeli'ne uyarlanması. SBÜ Hemşirelik Dergisi, 4(2), 103-110. doi: 10.48071/sbuhemsirelik.1079553

Moghbeli, M. (2019). Genetics of recurrent pregnancy loss among Iranian population. *Molecular Genetics & Genomic Medicine*, *7*(9), e891. doi:10.1002/mgg3.891

Musters, A. M., Koot, Y. E., van den Boogaard, N. M., Kaaijk, E., Macklon, N. S., van der Veen, F.... Goddijn, M. (2013). Supportive care for women with recurrent miscarriage: a survey to quantify women's preferences. *Human Reproduction*, *28*(2), 398-405. doi:10.1093/humrep/des374

Pillarisetty, L. S., Mahdy, H. (2022). Recurrent pregnancy loss. Treasure Island (FL): StatPearls Publishing

Radford, E. J., Hughes, M. (2015). Women's experiences of early miscarriage: Implications for nursing care. *Journal of Clinical Nursing*, *24*(11-12), 1457-1465. doi: 10.1111/jocn.12781

Stevens, K. R. (2013). The impact of evidence-based practice in nursing and the next big ideas. *Online Journal of Issues in Nursing*, *18*(2). doi:10.3912/OJIN.Vol18No02Man04

Tomkiewicz, J., Darmochwał-Kolarz, D. (2023). The diagnostics and treatment of recurrent pregnancy loss. *Journal of Clinical Medicine*, *12*(14), 4768. doi: 10.3390/jcm12144768

Turesheva, A., Aimagambetova, G., Ukybassova, T., Marat, A., Kanabekova, P., Kaldygulova, L.... Atageldiyeva, K. (2023). Recurrent pregnancy loss etiology, risk factors, diagnosis, and management. Fresh look into a full box. *Journal of Clinical Medicine*, *12*(12), 4074. doi:10.3390/jcm12124074

Türkiye Nüfus ve Sağlık Araştırması (TNSA) (2018). Hacettepe Üniversitesi Nüfus Etütleri Enstitüsü. Erişim adresi: http://www.hips.hacettepe.edu.tr/tnsa2018/rapor/TNSA2018_ana_Rapor.pdf Erişim tarihi: 05.11.2023

Van Dijk, M. M., Kolte, A. M., Limpens, J., Kirk, E., Quenby, S., van Wely, M., Goddijn, M. (2020). Recurrent pregnancy loss: diagnostic workup after two or three pregnancy losses? A systematic review of the literature and meta-analysis. *Human Reproduction Update*, *26*(3), 356-367. doi:10.1093/humupd/dmz048