

Original Research

Previous Preeclamptic Pregnancy and Chronic Hypertension Affects Current Preeclampsia at a Public Health Center in Bojonegoro, Indonesia

Indrayanti Indrayanti*, Abdul Latip, Masfuah Ernawati and Mariya Ulfah

Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Surabaya, East Java, Indonesia

Article history

Received: 21 December 2025

Revised: 31 March 2026

Accepted: 1 April 2026

Published Online: 30 April 2026

*Correspondence:

Indrayanti Indrayanti

Address: HOS Cokroaminoto Street, Ngraseh Village, Dander District, Bojonegoro, Indonesia.

Email: indrayanti@poltekkes-surabaya-ac.id

How to cite this article: Indrayanti I, Latip A, Ernawati M, Ulfah M. Previous Preeclamptic Pregnancy and Chronic Hypertension Affects Current Preeclampsia at a Public Health Center in Bojonegoro, Indonesia. *Health Dynamics*, 2026, 3(4), 143-149. <https://doi.org/10.33846/hd30403>



Copyrights: © 2026 by the authors. This is an open access article under the terms and conditions of the Creative Commons Attribution – NoDerivatives 4.0 International (CC BY-ND 4.0) license (<https://creativecommons.org/licenses/by-nd/4.0/>).

ABSTRACT

Background: Preeclampsia is one of the leading causes of maternal mortality and occurs frequently in Indonesia. The high maternal mortality rate (MMR) reflects the low quality of health services during pregnancy, childbirth, and the postpartum period. This study aimed to analyze the risk factors associated with the incidence of preeclampsia among pregnant women at the Public Health Center in Sukosewu, Bojonegoro, Indonesia. **Methods:** This study used a cross-sectional design. The samples consisted of 120 pregnant women at the Public Health Center in Sukosewu, Bojonegoro District, Indonesia. Odds ratio and logistic regression tests were applied in this study. **Results:** Gravida ($p = 0.046$) and a history of chronic hypertension ($p = 0.015$) had a significant positive effect ($p < 0.05$) on the incidence of preeclampsia. Meanwhile, family history ($p = 0.079$), twin pregnancy ($p = 0.999$), gestational interval ($p = 0.261$), age ($p = 0.132$), BMI ($p = 0.336$), MAP ($p = 0.997$), history of hypertension during pregnancy ($p = 0.260$), and history of DM ($p = 1.000$) showed no significant effect on the incidence of preeclampsia. **Conclusion:** The incidence of preeclampsia among pregnant women at the Public Health Center in Sukosewu, Bojonegoro, Indonesia, was associated with the risk factors of previous preeclampsia and a history of chronic hypertension during pregnancy.

Keywords: Risk factor; preeclampsia; gravida; chronic hypertension

1. INTRODUCTION

Preeclampsia is one of the leading causes of maternal mortality and occurs frequently in Indonesia. The high maternal mortality rate (MMR) reflects the low quality of health services during pregnancy, childbirth, and the postpartum period.⁽¹⁾ Preeclampsia is a serious health problem because of its high level of complexity.⁽²⁾ The management of preeclampsia in Indonesia still varies among health workers, practitioners, and hospitals.⁽³⁾ The World Health Organization (WHO) estimates that cases of preeclampsia are seven times higher in developing countries than in developed countries.⁽⁴⁾ The incidence of preeclampsia in Indonesia is 128,273 cases per year, or approximately 5.3%.⁽¹⁾ In 2023, the maternal mortality rate in Indonesia due to hypertension during pregnancy, including preeclampsia, was 10.31%.⁽⁵⁾ In East Java, the rate was 24.52%, while in Bojonegoro Regency it was 18.19%. The early course of preeclampsia often does not show clear signs and symptoms; however, at some point, the condition may worsen rapidly.⁽⁶⁾ Disorders may occur in the vascular system, kidneys, liver, and hematological system, resulting in hemolysis and decreased platelet levels. Severe hemolysis accompanied by thrombocytopenia may lead to HELLP syndrome (Hemolysis, Elevated Liver Enzymes, and Low Platelets). In addition, the placenta becomes more susceptible to placental abruption.^(7,8)

The heart may also experience left ventricular diastolic dysfunction and failure. This disorder can also cause severe headaches, intracranial edema, and even bleeding that may result in endothelial damage.⁽⁹⁾ The diagnosis of preeclampsia is based on the presence of pregnancy-induced hypertension accompanied by disorders in other organ systems after 20 weeks of gestation and the presence of proteinuria.⁽¹⁰⁾

Prevention of preeclampsia is considered the best course of action; however, it can only be effectively achieved if the exact causes are clearly identified so that these factors can be avoided or controlled.⁽¹¹⁾ Nevertheless, the exact cause of preeclampsia remains unknown. Identified risk factors can assist in pregnancy risk assessment during the initial antenatal visit. The risk factors most commonly associated with preeclampsia and eclampsia include maternal age, primigravida status, history of chronic hypertension, history of preeclampsia in previous pregnancies, obesity, diabetes mellitus or gestational diabetes, and short interpregnancy intervals.⁽¹²⁾

The objective of this study was to analyze the risk factors associated with the incidence of preeclampsia among pregnant women at the Public Health Center in Sukosewu, Bojonegoro District, Indonesia. This research is important for the early detection of preeclampsia and may serve as a basis for clinical decision-making to help reduce maternal mortality.

2. METHODS

This study used a cross-sectional design, emphasizing the measurement or observation of the independent and dependent variables at a single point in time. The dependent variable in this study was the incidence of preeclampsia, while the independent variables included family history of preeclampsia, gravida, twin pregnancy, pregnancy interval, maternal age > 35 years, Body Mass Index (BMI), Mean Arterial Pressure (MAP), history of hypertension during pregnancy, history of chronic hypertension, and history of diabetes mellitus.

The population in this study consisted of all pregnant women at the Public Health Center in Sukosewu, Bojonegoro District, Indonesia, totaling 588 individuals. The samples consisted of 120 pregnant women at the Sukosewu Public Health Center, Bojonegoro District, Indonesia. The inclusion criteria for this study were pregnant women who resided within the

working area of the Sukosewu Community Health Center (Puskesmas) in Bojonegoro Regency at the time of the study. The exclusion criteria were pregnant women who lived within the Sukosewu Community Health Center area but changed their address during the study period.

The tests employed in this study were the Odds Ratio test, used to measure the likelihood of risk factors contributing to the incidence of preeclampsia, and logistic regression analysis, used to analyze the relationship between several risk factors and the incidence of preeclampsia. Ethical principles applied in this research included informed consent, beneficence, non-maleficence, confidentiality, and privacy.

3. RESULTS

It was found that the number of preeclampsia cases at the Sukosewu Public Health Center was 48 (40%) (Table 1). The results of this study revealed that 106 (88%) pregnant women had no family history of preeclampsia, 93 (77.5%) were multigravida, 118 (98%) did not have twin pregnancies, 91 (76%) had pregnancy intervals of less than 10 years, 93 (77.5%) were aged 20–35 years, 100 (83%) had a BMI of less than 30, 81 (67.5%) had a Mean Arterial Pressure (MAP) of more than 90 mmHg, 94 (78%) had no history of hypertension during pregnancy, 93 (77.5%) had no history of chronic hypertension, and 119 (99%) had no history of diabetes mellitus (Table 2).

Table 1. Distribution of preeclampsia frequency

Preeclampsia	Frequency	Percentage
Yes	48	40%
No	72	60%
Total	120	100%

The results of the multiple logistic regression analysis showed that gravida had a p -value of 0.046, while a history of chronic hypertension had a p -value of 0.015, indicating a significant positive effect ($p < 0.05$) on the incidence of preeclampsia (Table 3). This means that respondents who were primigravida and had a history of chronic hypertension tended to experience preeclampsia.

Meanwhile, the variables of family history of preeclampsia ($p = 0.079$), multiple pregnancy ($p = 0.999$), gestational interval ($p = 0.261$), age ($p = 0.132$), BMI ($p = 0.336$), MAP ($p = 0.997$), history of hypertension during pregnancy ($p = 0.260$), and history of diabetes mellitus ($p = 1.000$) showed no significant effect on the incidence of preeclampsia.

Table 2. Frequency distribution of preeclampsia risk factors among pregnant women at the Sukosewu Community Health Center

Preeclampsia risk factor	Category	Frequency	Percentage
Family history of preeclampsia	Yes	14	12%
	No	106	88%
	Total	120	100 %
Gravida	Primigravida	27	22.5%
	Multigravida	93	77.5%
	Total	120	100 %
Twin pregnancy	Yes	2	2%
	No	118	98 %
	Total	120	100 %
Pregnancy interval	>10 years	29	24%
	< 10 years	91	76%
	Total	120	100%
Body mass index (BMI)	>30	20	17%
	<30	100	83%
	Total	120	100%
Mean arterial pressure (MAP)	>90	81	67.5%
	<90	39	32.5%
	Total	120	100%
History of hypertension in pregnancy	Yes	26	22%
	No	94	78%
	Total	120	100%
History of chronic hypertension	Yes	27	22.5%
	No	93	77.5%
	Total	120	100%
History of diabetes mellitus	Yes	1	1%
	No	119	99%
	Total	120	100%

4. DISCUSSION

The results of the logistic regression analysis showed that a family history of preeclampsia had no significant effect ($p = 0.093$) on the incidence of preeclampsia at the Sukosewu Public Health Center, Bojonegoro. The Odds Ratio (OR) value was 0.121, indicating that mothers with a family history of preeclampsia had 0.121 times the odds of experiencing preeclampsia compared to mothers without a family history of preeclampsia.

Preeclampsia is considered an inherited disease and is commonly found in women whose mothers had preeclampsia or who had a family history of preeclampsia.⁽¹²⁾ In this study, 14 respondents (12%) had a family history of preeclampsia, and no significant effect on the incidence of preeclampsia was observed. Genetic factors affecting endothelial function or angiogenesis may contribute to the development of preeclampsia.⁽¹³⁾

Primigravida mothers are considered a high-risk group because they are experiencing pregnancy for the first time and have no previous pregnancy experience.⁽¹⁴⁾ Primigravida mothers need counseling regarding pregnancy, maternal needs during pregnancy, discomforts, and emergency conditions during pregnancy. By understanding these conditions, mothers can make prompt decisions to seek medical help during emergencies.⁽¹⁵⁾ Gravida (primigravida) had a significant effect ($p = 0.046$) on the incidence of preeclampsia among pregnant women at the Sukosewu Public Health Center. The Odds Ratio (OR) value of 0.198 indicated that primigravida mothers had 0.2 times the odds of experiencing preeclampsia compared to multigravida mothers.

The incidence of preeclampsia is generally higher in primigravida women than in multigravida women because, during the first pregnancy, the formation of blocking antibodies against antigens is not yet optimal. In the first pregnancy, Human Leukocyte Antigen-G (HLA-

Table 3. Results of the risk factor variable tests for preeclampsia among pregnant women at the Sukosewu Health Center, Bojonegoro, Indonesia

Variables	Regression						Notes
	Regression coefficient (B)	S.E	Wald	dF	Sig	Exp (B)	
Family history with PE	-2.116	1.204	3.089	1	0.079	0.121	Non-significant
Gravida	-1.617	0.809	3.996	1	0.046	0.198	Significant
Twin pregnancy	-20.517	26956.434	0.000	1	0.999	0.000	Non-significant
Pregnancy distance	-0.834	0.742	1.265	1	0.261	0.434	Non-significant
Age	-1.026	0.682	2.264	1	0.132	0.358	Non-significant
Body Mass Index (BMI)	-0.667	0.693	0.927	1	0.336	0.513	Non-significant
MAP	-21.028	5965.349	0.000	1	0.997	0.000	Non-significant
History of hypertension in pregnancy	-0.840	0.746	1.268	1	0.260	0.432	Non-significant
History of chronic hypertension	-1.961	0.804	5.945	1	0.015	0.141	Significant
History of diabetes mellitus	-20.035	40193.001	0.000	1	1.000	0.000	Non-significant

G) proteins are formed and play an important role in modulating the immune response. As a result, maternal intolerance to placental tissue may occur, leading to preeclampsia. The results of this study supported Angsar's findings that primigravida women had a greater risk of developing hypertension during pregnancy (preeclampsia) compared to multigravida women.⁽¹⁶⁾

Some normal maternal physiological responses to pregnancy are exacerbated by the presence of multiple fetuses. The increased uterine weight may cause compression of the major blood vessels, resulting in reduced uterine blood flow due to aortic compression, supine hypotension, or both. Under these circumstances, edema and proteinuria are commonly observed.⁽¹⁷⁾ Twin pregnancy had no significant effect ($p = 0.999$) on the incidence of preeclampsia among pregnant women at the Sukosewu Public Health Center, Bojonegoro. Clinical studies have shown that the incidence of preeclampsia is two to three times higher in twin pregnancies than in singleton pregnancies. However, recent studies on preeclampsia risk prediction have mostly been limited to singleton pregnancies.

The risk of preeclampsia increases when the interval between the current and previous deliveries reaches 10 years.⁽¹⁹⁾ The risk of preeclampsia during the second pregnancy has been found to increase progressively with longer intervals since the first pregnancy. Ten years after the first pregnancy, the risk of preeclampsia may increase more than threefold, approaching the level observed in nulliparous women.⁽²⁰⁾ An increased interval between the second and third

deliveries is also associated with an increased risk of preeclampsia.

The results of this study showed that a gestational interval of >10 years had no significant effect ($p = 0.261$) on the incidence of preeclampsia among pregnant women at the Sukosewu Public Health Center, Bojonegoro. The Odds Ratio (OR) value was 0.434, indicating that pregnant women with gestational intervals of >10 years had 0.4 times the odds of experiencing preeclampsia compared to pregnant women with gestational intervals of <10 years.

Women older than 35 years have a higher incidence of chronic hypertension and are at greater risk of developing superimposed preeclampsia during pregnancy. Age is an important component of reproductive status because it is associated with changes in body functions that may affect health status. According to existing theories, preeclampsia is more commonly found during early and late reproductive ages, particularly in adolescents and women older than 35 years.⁽²¹⁾ Pregnant women younger than 20 years are more susceptible to increased blood pressure and seizures, while women older than 35 years are more prone to hypertension due to age-related physiological changes.⁽²²⁾

The results of the logistic regression analysis showed that maternal age <20 years and >35 years had no significant effect ($p = 0.132$) on the incidence of preeclampsia among pregnant women at the Sukosewu Public Health Center. The Odds Ratio (OR) value of 0.358 indicated that pregnant women aged <20 years and >35 years had 0.4 times the odds of experiencing

preeclampsia. On the other hand, women older than 45 years are more likely to experience acute heart failure and acute kidney injury. These findings suggest that both extremely young and older mothers are exposed to greater risks during pregnancy, although through different mechanisms.⁽²³⁾

The World Health Organization (WHO) defines obesity as excessive fat accumulation that may impair health and contribute to various diseases such as diabetes mellitus, hypertension, and cardiovascular disease.⁽²⁴⁾ Hypertriglyceridemia is associated with the pathogenesis of hypertension during pregnancy. Excessive fat accumulation also contributes to endothelial dysfunction in preeclampsia. Elevated triglyceride levels increase the risk of placental vascular abnormalities, which may stimulate endothelial dysfunction, atherosclerosis, and thrombosis.⁽²⁵⁾ In preeclamptic women, atherosclerosis commonly occurs in the spiral arteries of the placenta. Obesity is also associated with insulin resistance. Obesity increases the risk of preeclampsia by 2.47 times, while women with a pre-pregnancy BMI >35 have a fourfold increased risk of developing preeclampsia.⁽²⁶⁾

The results of this study showed that a Body Mass Index (BMI) >30 had no significant effect ($p = 0.336$) on the incidence of preeclampsia among pregnant women at the Sukosewu Public Health Center. The Odds Ratio (OR) value of 0.513 indicated that pregnant women with a BMI >30 had 0.5 times the odds of experiencing preeclampsia compared to mothers with a BMI <30.

The most predictive period for measuring Mean Arterial Pressure (MAP) is during the second trimester of pregnancy. This is because systolic and diastolic blood pressure levels increase during the first trimester, reducing their predictive accuracy for preeclampsia.⁽²⁷⁾ The results of the logistic regression analysis in this study showed that MAP >90 mmHg had no significant effect ($p = 0.997$) on the incidence of preeclampsia among pregnant women at the Sukosewu Public Health Center, Bojonegoro District. MAP-2 is considered a simple method for identifying pregnant women who should undergo further predictive testing. Alternatively, weekly blood pressure monitoring is recommended for the early detection of hypertensive disorders in late pregnancy among women with MAP-2 values ≥ 90 mmHg.⁽²⁸⁾

Pregnant women with a history of preeclampsia are at risk of developing preeclampsia again in subsequent pregnancies. Among multigravida women, approximately 20% had experienced preeclampsia in a previous pregnancy.⁽²⁹⁾ The results of the logistic

regression analysis showed that a history of hypertension during pregnancy had no significant effect ($p = 0.260$) on the incidence of preeclampsia among pregnant women at the Sukosewu Public Health Center, Bojonegoro. The Odds Ratio (OR) value of 0.432 indicated that pregnant women with a history of hypertension during pregnancy had 0.4 times the odds of experiencing preeclampsia compared to women without such a history.

Approximately 20% of mothers with chronic hypertension experience an increased risk accompanied by symptoms of preeclampsia.⁽³⁰⁾ The prevalence of chronic hypertension is higher among women with preeclampsia than among those without preeclampsia.⁽²⁹⁾ The results of this study were consistent with Saraswati's study, which demonstrated a significant relationship between a history of hypertension and the incidence of preeclampsia ($p = 0.001$), with an Odds Ratio (OR) value of 6.026. Normally, during pregnancy, the spiral arteries in the uterus dilate from thick-walled muscular vessels into thin-walled vessels with much larger diameters. This physiological change increases vascular capacity to accommodate the increased blood volume during pregnancy.⁽³¹⁾

In this study, the logistic regression analysis showed that a history of chronic hypertension had a significant effect ($p = 0.014$) on the incidence of preeclampsia among pregnant women at the Sukosewu Public Health Center. The Odds Ratio (OR) value was 0.141, indicating that pregnant women with a history of chronic hypertension had 0.1 times the odds of experiencing preeclampsia compared to pregnant women without a history of chronic hypertension.

Women with insulin-dependent diabetes mellitus are four times more likely to develop preeclampsia if diabetes existed before pregnancy.⁽³²⁾ In this study, a history of diabetes mellitus had no significant effect ($p = 1.000$) on the incidence of preeclampsia among pregnant women. These findings were supported by Saraswati's study, which also found no significant relationship between a history of diabetes mellitus and the incidence of preeclampsia among pregnant women.⁽¹³⁾

5. CONCLUSION

The incidence of preeclampsia among pregnant women at the Sukosewu Public Health Center, Bojonegoro, Indonesia, was associated with the risk factors of gravida status and a history of chronic hypertension. This study had a limited sample size;

therefore, future research is recommended to include a larger sample size, use a longitudinal design, and utilize technology-based screening methods for preeclampsia.

Ethical Approval

Ethics approval of this study had been obtained from the research ethics committee of Politeknik Kesehatan Kementerian Kesehatan Surabaya with the reference number EA/337/KEPK-Poltekkes_Sby/V/2020.

Acknowledgement

We would like to express our gratitude to the Surabaya Health Polytechnic of the Ministry of Health for providing the researchers with the opportunity and funding to conduct this study. We also thank the Sugihwaras Community Health Center for their assistance with data collection.

Competing Interests

All the authors declare that there are no conflicts of interest."

Funding Information

Funding was obtained from DIPA funds from the Surabaya Ministry of Health Polytechnic (funding reference no. HK. 02.03/F.XVI/2101/2025).

Underlying Data

Derived data supporting the findings of this study are available from the corresponding author on request.

REFERENCES

1. Facca TA, Famá EAB, Mastroianni-Kirsztajn G, Sass N. Why Is Preeclampsia still an Important Cause of Maternal Mortality Worldwide? *Revista Brasileira de Ginecologia e Obstetrícia / RBGO Gynecology and Obstetrics*. 2020;42(9):586-587. <http://dx.doi.org/10.1055/s-0040-1714132>
2. Chang KJ, Seow KM, Chen KH. Preeclampsia: Recent Advances in Predicting, Preventing, and Managing the Maternal and Fetal Life-Threatening Condition. *International Journal of Environmental Research and Public Health*. 2023;20(4):2994. <http://dx.doi.org/10.3390/ijerph20042994>
3. Akbar MIA, et al. 2018. The Massive Problem of Preeclampsia in Indonesia : In need of a designed national health care system. *Pregnancy Hypertension*. 2018;13(supplement 1):516. <https://doi.org/10.1016/j.preghy.2018.08.051>
4. Meazaw MW, Chojenta C, Muluneh MD, Loxton D.

Systematic and meta-analysis of factors associated with preeclampsia and eclampsia in sub-Saharan Africa. *PLoS One*. 2020;15(8):e0237600.

5. Ministry of Health of the Republic of Indonesia. Profil Kesehatan Indonesia Tahun 2023. Jakarta: Ministry of Health of the Republic of Indonesia; 2024.
6. Karrar SA, Martingano DJ, Hong PL. Preeclampsia. Treasure Island (FL): StatPearls Publishing; 2025. Available from: <https://www.ncbi.nlm.nih.gov/sites/books/NBK570611/> (Accessed on 20 Dec 2025)
7. Turgut F, Awad AS, Abdel-Rahman EM. Acute Kidney Injury: Medical Causes and Pathogenesis. *Journal of Clinical Medicine*. 2023;12(1):375. <http://dx.doi.org/10.3390/jcm12010375>
8. Krishnan S, Suarez-Martinez AD, Bagher P, Gonzalez A, Liu R, Murfee WL, Mohandas R. Microvascular dysfunction and kidney disease: Challenges and opportunities? *Microcirculation*. 2021;28(3):e12661. <http://dx.doi.org/10.1111/micc.12661>
9. Vlasopoulou K, Synetos A, Ktenopoulos N, Katsaros O, Koliastasis L, Apostolos A, Drakopoulou M, Toutouzas K, Tsioufis C. Unmasking Left Ventricular Diastolic Dysfunction: Pathophysiology, Diagnosis, and Treatment Strategies. *Medical Sciences*. 2025;13(3):204. <http://dx.doi.org/10.3390/medsci13030204>
10. Fox R, Kitt J, Leeson P, Aye CYL, Lewandowski AJ. Preeclampsia: Risk Factors, Diagnosis, Management, and the Cardiovascular Impact on the Offspring. *Journal of Clinical Medicine*. 2019;8(10):1625. <http://dx.doi.org/10.3390/jcm8101625>
11. Alipova G, Ablakimova N, Tussupkaliyeva K, Bermagambetova S, Kosmuratova S, Karimsakova B, Gaiday A, Gaiday A, Dinets A, Tussupkaliyev A. Prevention of Pre-Eclampsia: Modern Strategies and the Role of Early Screening. *Journal of Clinical Medicine*. 2025;14(9):2970. <http://dx.doi.org/10.3390/jcm14092970>
12. Mustary M, Ansariadi, Syam A, Riskiyani S, Erika KA, Moedjiono AI, Lubis M. Preeclampsia: Etiology, Pathophysiology, Risk Factors, Impact and Prevention: A Narrative Review. *Iranian Journal of Public Health*. 2024;53(11):2392-2403. <http://dx.doi.org/10.18502/ijph.v53i11.16941>
13. Wu CT, Kuo CF, Lin CP, Huang YT, Chen SW, Wu HM, Chu PH. Association of family history with incidence and gestational hypertension outcomes of preeclampsia. *International Journal of Cardiology Hypertension*. 2021;9:100084. <http://dx.doi.org/10.1016/j.ijchy.2021.100084>
14. Khalil H, Gul S, Gul S, Habib M, Rashid U. Maternal Risk Factors and Outcome in Primigravida Patient with Preeclampsia and Eclampsia. *Insight Journal of Health and Rehabilitation*. 2025;3:472-477. <http://dx.doi.org/10.71000/p5x9tr08>
15. Aziz M, Kokiwar PR. Effectiveness of Counseling in Reducing Pregnancy-related Anxiety among Primigravida Women – A Quasi-experimental Study. *Journal of Medical Sciences*. 2025;45(5):183-188.

- http://dx.doi.org/10.4103/jmedsci.jmedsci_32_25
16. Angsar MD. Hipertensi dalam Kehamilan. Ilmu Kebidanan Sarwono Prawirohardjo. Jakarta: PT Bina Pustaka Sarwono Prawirohardjo; 2020.
 17. Repley JM, Bates K, Mohiuddin SS. Physiology, Maternal Changes. [Updated 2023 Mar 12]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK539766/> (Accessed on 20 Dec 2025)
 18. Wang Y, Wu N, Shen H. A Review of Research Progress of Pregnancy with Twins with Preeclampsia. Risk Management and Healthcare Policy. 2021;14:1999-2010. <http://dx.doi.org/10.2147/RMHP.S304040>
 19. Njoroge S, Kuriloff M, Mueller A, Lopes Perdigao J, Dhir R, Rana S. The Interval between births and the risk of recurrent preeclampsia among predominantly high risk women in urban tertiary care center. *Pregnancy Hypertension*. 2021;25:7-11. <http://dx.doi.org/10.1016/j.preghy.2021.05.009>
 20. Shimizu H, Murakoshi T, Wakisaka S, Hamada Y, Shimizu Y, Iga K, Konno H, Sei K. Evaluating the risk factors for preeclampsia in subsequent pregnancies in patients with a history of preeclampsia: a single-institution retrospective study. *Hypertension Research*. 2025;48(4):1315-1320. <https://doi.org/10.1038/s41440-025-02098-y>
 21. Flint B, Tadi P. Physiology, Aging. [Updated 2023 Jan 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK556106/> (Accessed on 20 Dec 2025)
 22. Cífková R. Hypertension in Pregnancy: A Diagnostic and Therapeutic Overview. *High Blood Pressure & Cardiovascular Prevention*. 2023;30(4):289-303. <http://dx.doi.org/10.1007/s40292-023-00582-5>
 23. Chang KJ, Seow KM, Chen KH. Preeclampsia: Recent Advances in Predicting, Preventing, and Managing the Maternal and Fetal Life-Threatening Condition. *International Journal of Environmental Research and Public Health*. 2023;20(4):2994. <http://dx.doi.org/10.3390/ijerph20042994>
 24. Lin X, Li H. Obesity: Epidemiology, Pathophysiology, and Therapeutics. *Frontiers in Endocrinology*. 2021;12:706978. <http://dx.doi.org/10.3389/fendo.2021.706978>
 25. Henning RJ. Obesity and obesity-induced inflammatory disease contribute to atherosclerosis: a review of the pathophysiology and treatment of obesity. *American Journal of Cardiovascular Disease*. 2021;11(4):504-529.
 26. Stubert J, Reister F, Hartmann S, Janni W. The Risks Associated With Obesity in Pregnancy. *Deutsches Ärzteblatt international*. 2018;115(16):276-283. <http://dx.doi.org/10.3238/arztebl.2018.0276>
 27. Zhu J, Zhang J, Syaza Razali N, Chern B, Tan KH. Mean arterial pressure for predicting preeclampsia in Asian women: a longitudinal cohort study. *BMJ Open*. 2021;11(8):e046161. <http://dx.doi.org/10.1136/bmjopen-2020-046161>
 28. Oney T, Kaulhausen H. The value of the mean arterial blood pressure in the second trimester (MAP-2 value) as a predictor of pregnancy-induced hypertension and preeclampsia. A preliminary report. *Clinical and Experimental Hypertension. Part B: Hypertension in Pregnancy*. 1983;2(2):211-216. <http://dx.doi.org/10.3109/10641958309006081>
 29. Nie X, Xu Z, Ren H. Analysis of risk factors of preeclampsia in pregnancy women with chronic hypertension and its impact pregnancy outcomes. *BMC Pregnancy and Childbirth*. 2024;24:307. <https://doi.org/10.1186/s12884-024-06476-1>
 30. Khedagi AM, Bello NA. Hypertensive Disorders of Pregnancy. *Cardiology Clinics*. 2021;39(1):77-90. <https://doi.org/10.1016/j.ccl.2020.09.005>
 31. Ramanlal R, Gupta V. Physiology, Vasodilation. [Updated 2023 Jan 23]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025. Available from: <https://www.ncbi.nlm.nih.gov/sites/books/NBK557562/> (Accessed on 20 Dec 2025)
 32. Do NC, Vestgaard M, Nørgaard SK, Damm P, Mathiesen ER, Ringholm L. Prediction and prevention of preeclampsia in women with preexisting diabetes: the role of home blood pressure, physical activity, and aspirin. *Frontiers in Endocrinology*. 2023;14:1166884. <http://dx.doi.org/10.3389/fendo.2023.1166884>