



# The Relationship Between Obesity and Family Support with The Occurrence Of Preeclampsia At Puskesmas Bulak Banteng, Surabaya City

Dhiana Setyorini, Tika Widyaningsih, Hilmi Yumni, Endah Suprihatin

Department of Nursing, Poltekkes Kemenkes Surabaya  
tikawidyaningsih78@gmail.com

**Abstract.** One of the issues during and after pregnancy as well as childbirth that causes 75% of maternal mortality is preeclampsia. Low family support and obesity during pregnancy be one of the causes of preeclampsia. The aim of this study is to find out the relationship between obesity and family support with the occurrence of preeclampsia in pregnant women. This research method is inferential statistics with the type of quantitative data used to analyze the relationship between obesity and family support with the incidence of preeclampsia. The subjects in the study were 28 pregnant women in the Puskesmas Bulak Banteng region. The data were analyzed using the Fisher's Exact and Spearman Rank tests. The results of this study showed that pregnant women with preeclampsia were 89% obesity and 56% had moderate family support. From the data showed that there was a relationship between obesity (value Sig.=0,000) with the occurrence of preeclampsia and there was no relationship between family support (value Sig.=0,352) with the appearance of preeclampsia in the region of Puskesmas Bulak Banteng. The conclusion of this study is expected of pregnant women to find information about the relationship of obesity and family support with the occurrence of preeclampsia. Thus, it can monitor weight gain during pregnancy and provide maximum support that can minimize the occurrence of complications during pregnant-ness such as preeclampsia.

**Keywords:** Obesity, Family Support, Preeclampsia

## 1 Introduction.

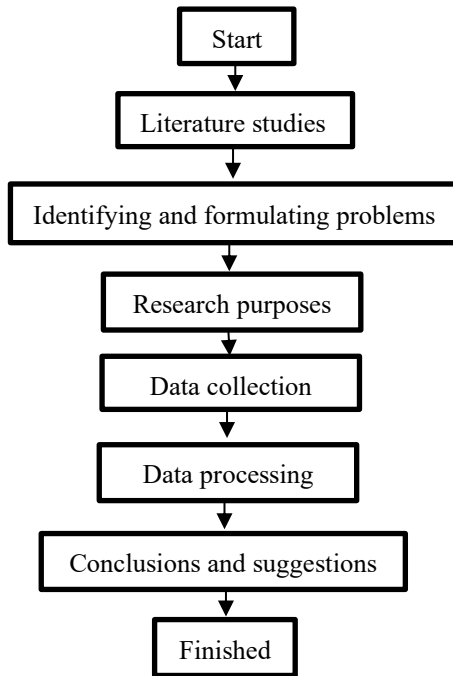
The maternal mortality rate is one of the indicators for seeing the success of maternal health efforts [2]. 75% of maternal deaths are caused by complications during and after pregnancy and childbirth, one of which is preeclampsia [24]. Preeclampsia has several causes, one of which is obesity that occurs as a result of an energy imbalance over a long period of time [5]. Pregnant women with obesity are twice as likely to have preeclampsia [13]. The lack of attention, guidance and support given to the family during pregnancy can also reduce the mother's health, leading to complications such as preeclampsia [26].

The proportion of pregnant mothers with preeclampsia and eclampsia in 2018 in East Java Province has increased by 2.4% from 2017 to 31.32% [3]. According to a study conducted by Husaidah, Putri, & Harlina in 2022, most pregnant women with pre-eclampsia are due to obesity, while the results of a study carried out by Yani, Hermawati, & Darmawati in 2021, the majority of pregnant mothers receive family support of fewer than 42 respondents or 53.2% of their husbands. Lack of support from husband and family can increase stress and lead to weight gain (obesity) due to lack of care inning health [26]. Obesity in pregnancy is the weight gain in pregnant women that exceeds 12-16 kg of normal weight and can lead to hypertension, hyper cholesterol and hyperglycemia [22]. The longer the pregnant woman's body is, the more heart pumping power and blood circulation will increase, resulting in increased blood pressure in pregnant women, thus increasing the risk of preeclampsia [16].

Efforts to reduce the incidence of preeclampsia, one of which is caused by obesity and the minimal support of the family, namely by improving the behavior of Antenatal Care (ANC) in early detection of Preeclampsia prevention in pregnant mothers [27]. In early detecting the risk of preeclampsia in pregnancy mothers can use KSDS (Kartu Skor Dhiana Setyorini) which can be used by mothers who are not pregnant or pregnant, health cadres and health workers [17]. In general, this study aims to explain the relationship between obesity and family support with the occurrence of preeclampsia in pregnant mothers in Puskesmas Bulak Banteng Surabaya city. The benefits of this research are new knowledge about the relationship between obesity and family support with preeclampsia. Contribution during the research is that the researchers participated in the pregnancy screening activities of pregnant mothers in the Puskesmas Bulak Banteng. The contribution that can be made in future to the development of science is by contributing to the promotion of health. The presence of such recommendations can raise the client's awareness of routine medical examinations during pregnancy to reduce and minimize the risk of preeclampsia.

## 2 Research methods

This study uses inferential statistics to analyze sample data using cross-sectional time approach methods. The research was carried out in the Puskesmas Bulak Banteng Surabaya city. Subjects in this study consisted of 28 pregnant women obtained through incidental sampling techniques, according to the specified criteria. The criteria in this study are that pregnant mothers with pregnancy ages of trimester 2 and trimester 3, family and pregnant mother agree informed consent, pregnant women who do not have cognitive impairment and the pregnant woman in a state of consciousness. The exclusion criterion in this study is that pregnant mothers refuse when given informed consent (Fig. 1).



**Fig. 1.** Research procedures

The instrument used in this research is a questionnaire. The questionnaire contains the personal data of the mother, the mother's health data and the scale of family support to the pregnant mother with scores ranging from one to four. The data category favorable for score 1 is very disagreeable and score 4 is very unfavorable. The questionnaire, which is a pregnant mother's statement regarding family support, is a questionnaire that has been tested for validity and reality by previous researchers [12].

The procedure for obtaining research data on this study is to start with the handling of the license letter through the website SSW (Surabaya Singel Window). Then to handle the authorization letter to Dinas Kesehatan Surabaya and finally to take care of the permit letter to Puskesmas Bulak Banteng Surabaya. Once the administrative file (a letter of approval) is completed, the initial step in data collection is to take candidate research subjects according to the criteria and quantities that have been specified. In the selection of the candidate subjects, the researchers explained the purpose and purpose of the research to be carried out with the aim of seeking the consent of the pregnant mother. The next step is to give the researchers the questionnaire and explain the method of filling it and there will be a question-and-answer session to the pregnant mother about the data needed for the research. The researchers then tabulated the data they obtained.

The data are analyzed using descriptive analysis and inferential analysis. Descriptive analyses are used to describe and analyze data characteristics of respondents such as general data, pregnant mother's body mass index, the frequency of family support in pregnant mothers and the occurrence of preeclampsia. The statistical test used is the Fisher's exact test for obesity variables and family support variables using the Spearman Rank test as well as to connect the two variables with the logistical regression test in statistical calculations, which is computer software. The research was carried out after obtaining the approval of KEPK Poltekkes Kemenkes Surabaya with certificate number No.EA/1437/KEPK-Poltekkes\_Sby/V/2023. The research is also conducted with a view to the ethics of research that includes the principles of benefit, respect for human rights, and the principle of justice.

### 3 Results

#### 3.1. Test

Characteristics of the 28 pregnant women in the study included age, employment, frequency of pregnancy, gestation age, history of illness, prevalence of obesity, family support received by the pregnant mother, and incidence of preeclampsia. Pregnant mothers in this study were almost entirely (82%) aged 20-35 and in terms of employment, pregnant mothers were mostly (89%) housewives. The pregnancy age of the pregnant women in this study was half (50%) in the category of the second trimester and half (50%) in the Category of the third trimester. The frequency of pregnancies in mothers was half (50%) at risk parity and half (50%) at non-risk parity. Nearly half (36%) of pregnant mothers have a history of hypertension. Almost half (32%) of pregnant women are obese and the majority (68%) are non-obese. The family support that mothers have from their families is that a small proportion (11%) have low family support and the majority (57%) have moderate family support. The incidence of preeclampsia in pregnant mothers in this study almost half (36%) had preeclampsia and the majority (64%) did not have (Table 1).

**Table 1.** Characteristics of pregnant mothers in Puskesmas Bulak Banteng 5 April – 12 April 2023

Characteristics	Frequency	Percentage (%)
Age		
<20 years	0	0
20-35 years	23	82%
>35 years	5	18%
Job		
Housewife	25	89%
Private officer	1	4%
Others	2	7%

Characteristics	Frequency	Percentage (%)
Pregnancy frequency		
Risk Parity (Parity 1&>3)	14	50%
Risk-free parity (Parity 2-3)	14	50%
Pregnancy age		
Trimester 2	14	50%
Trimester 3	14	50%
Disease history		
Hypertension	10	36%
No history of illness	18	64%
Obesity incidents		
Obesity	9	32%
No obesity	19	68%
Family support		
Height	9	32%
I'm in.	16	57%
Low	3	11%
Preeclampsia		
Preeclampsia	10	36%
No preeclampsia	18	64%
Total	28	100%

**Table 2.** Relationship between obesity and preeclampsia in Puskesmas Bulak Banteng 5 April-12 April 2023

Category IMT	Preeclampsia				Total	
	Yes		No		F	%
	F	%	F	%		
Obesity	8	89%	1	11%	9	100%
No Obesity	2	11%	17	89%	19	100%
Total	10	36%	18	64%	28	100%

Value Sig. Fisher's Exact Test = 0,000 (Value  $\alpha = 0,05$ )

From the data on the Table 2 obtained the results of Fisher's Exact test that there is a relationship between obesity and preeclampsia occurrence in Puskesmas Bulak Banteng Surabaya City supported with Sig. value 0,000 which means Sig value  $< \alpha$  ( $\alpha=0,05$ ).

**Table 3.** Relationship of family support with preeclampsia incidents in Puskesmas Bulak Banteng 5 April-12 April 2023

Family Support	Preeclampsia				Total	
	Yes		No		F	%
	F	%	F	%		
Height	1	11%	8	89%	9	100%
I'm in.	9	56%	7	44%	16	100%
Low	0	0%	3	100%	3	100%
Total	10	36%	18	64%	28	100%

Value Sig. Spearman test = 0,352 (Nilai Sig.> $\alpha$  ( $\alpha = 0,05$ ))  
 Value Correlation Coefficient = (-) 0,183

From the data on Table 3 obtained Spearman test results that showed a Sig. value of 0.352 > $\alpha$  which means there is no relationship of family support with the occurrence of preeclampsia in Puskesmas Bulak Banteng Surabaya City.

**Table 4.** Relationship of obesity and family support with preeclampsia in Puskesmas Bulak Banteng

Variable	Logistic regression test			
	Value Sig.	Odds Ratio (OR)		
		Exp (B)	Lower	Upper
Obesity	0,001	66,538	5,196	852,0032
Family Support	0,680	0,671	0,101	4,468

From the data on Table 4, the OR value from the logistical regression test on the obesity variable showed that pregnant women with obesities were 66,538 times more likely to experience preeclampsia than non-obese pregnant mothers. The OR value on the family support variable indicates that pregnant mothers with low family support have a 0.671 times greater tendency to develop preeclampsia compared to pregnant women with high family support.

## **4 Discussion**

### **4.1. Identification of cases of obesity in pregnant mothers in Puskesmas Bulak Banteng Surabaya City**

According to the results of research obtained in the Puskesmas Bulak Banteng of Surabaya City, of 28 pregnant women, almost half (32%) are obese. While a study conducted by Wahyuni, Azhari, & Syukur in 2019 resulted that the majority (64%) had obesity as many as 25 respondents. Preeclampsia occurs due to obesity due to increased heart pump power and blood circulation volume so blood pressure also increases. An increase in blood pressure until hypertension is one of the symptoms of preeclampsia [20–22]. In pregnancy, hypertension is defined using the traditional cutoff of 140/90 mmHg measured on consecutive occasions at least 4 hours apart. Thus, chronic hypertension in pregnancy refers to hypertension either predating pregnancy or occurring in the first 20 gestational weeks [10]. Intensive blood pressure monitoring is essential for mothers at high risk of preeclampsia [25]. Based on the results of research, theory and related research, researchers argue that pregnant mothers with obesity influence the occurrence of preeclampsia in the region of Puskesmas Bulak Bulak.

### **4.2. Identification of family support for pregnant mothers in Puskesmas Bulak Banteng Surabaya City.**

According to the results of research obtained in the Puskesmas Bulak Banteng Surabaya City, 28 pregnant mothers mostly (57%) receive moderate family support. While Sunaringtyas & Rachmania research in 2023 found that 45.2% of pregnant women had less family support. Family support is a real attitude or behavior given by a family to each of its members [26]. Forms of support can be given such as advising to actively follow the ANC program, showing compassion and providing funds to prepare for childbirth [27]. Family support is still needed after childbirth because the increased incidence of preeclampsia also occur postpartum [14]. Based on the results of research, theory and related research the researchers argue that pregnant mothers in the region of Puskesmas Bulak Banteng get adequate family support so that during pregnancy can reduce unwanted incidents due to lack of family support.

### **4.3. Identification of preeclampsia cases in pregnant mothers Puskesmas Bulak Banteng Surabaya City**

According to the results of research obtained in the Puskesmas Bulak Banteng Surabaya City, of 28 pregnant women almost half (36%) have preeclampsia. A study conducted by Sunaringtyas & Rachmania in 2023 found that 45.2% of pregnant women had mild preeclampsia and 19% had severe. Preeclampsia is a set of symptoms that occur in pregnant, laboratory, and respiratory women consisting of hypertension, edema, and proteinuria that occur during 20 weeks of pregnancy until the end of the first week after

delivery [15, 19]. The classification of the preeclampsia is largely based on the gestational age at the time of diagnosis (early-onset vs late-onset preeclampsia). Early-onset preeclampsia is associated with defective placentation, whereas late-onset preeclampsia seems to be related to the mismatch between maternal perfusion and fetoplacental demands, along with a maternal predisposition to cardiovascular disease [9]. The 2019 National Institute for Health and Care Excellence (NICE) guidelines classify a woman at high risk of preeclampsia if there is a history of hypertensive disease during a previous pregnancy or a maternal disease including chronic kidney disease, autoimmune diseases, diabetes, or chronic hypertension [4]. Based on the results of research, theory and related research, researchers argue that preeclampsia occurrence can occur in the region of Puskesmas Bulak Banteng so it is necessary to increase caution in the entire case of preeclampsia.

#### **4.4. Analysis of obesity with preeclampsia in Puskesmas Bulak Banteng Surabaya City**

According to the results of the study, of the nine pregnant women who suffer from obesity in Puskesmas Bulak Banteng Surabaya City almost entirely (89%) have preeclampsia. From the data, a statistical test of Fisher's Exact test with computer software resulted in a Sig.0,000 value. The results concluded that there was a significant relationship (sig.< $\alpha$  ( $\alpha=0,05$ )) between obesity and the occurrence of preeclampsia in Puskesmas Bulak Banteng Kota Surabaya. The results of this study are in line with some other researchers, namely a study conducted by Husaidah, Putri, & Harlina in 2022 entitled Obesity and stress levels causing preeclampsia in pregnant mothers. Obesity is defined as a medical condition in which excess body fat has accumulated in an individual to an extent that it may have a negative effect on the individual's health [1]. The occurrence of preeclampsia is also supported by other factors such as the age factor of over 35 years because of the association with essential hypertension [5, 17]. The theory is in line with the results of this study, which suggests that a small percentage (18%) of pregnant women are over the age of 35. The other factor is parity, because repeated births will have a higher risk of pregnancy than preeclampsia [17, 18]. Pregnant mothers in this study half (50%) were a risk-parity group (primigravida dan grandemultigravida). In this case, the researchers argued that mothers with preeclampsia were not only caused by obesity but in this study, pregnant women who were not obese also had preeclampsia.

#### **4.5. Analysis of family support with preeclampsia in Puskesmas Bulak Banteng Surabaya City.**

Based on a statistical test of Spearman Rank with computer software that produced Sig values. 0.352. The results concluded that there was no significant relationship (Sig.> $\alpha$  ( $\alpha=0,05$ )) between family support and preeclampsia in Puskesmas Bulak Banteng Surabaya City. The results of this study are inconsistent with a study conducted by



Sunaringtyas & Rachmania in 2023 entitled Family Support with Preeclampsia Incidence that  $p$  value = 0,000 ( $p < \alpha$ ) ( $\alpha = 0,05$ ). This may be due to the family support that pregnant mothers gain in the region of Puskesmas Bulak Banteng majority is satisfied which is supported by data that the majority (57%) pregnant women get moderate family support and almost half (32%) get high family support. Family support plays an important role in the level of anxiety of pregnant mothers where the better family support is given, the lower the level is felt [6, 19]. Stress or anxiety experienced by a pregnant woman is one of the trigger indicators of preeclampsia [7]. Besides, pregnant mother with their first pregnancy can also be at risk of developing preeclampsia so family support is very helpful to the pregnant mother through her pregnancies [23]. The support that the family can provide is the need for information about pregnant women suffering from high blood pressure, providing comfort, meeting economic and spiritual needs [8]. In this regard, the researchers argue that family support that is a factor in preeclampsia is not only family support with a lower category as other researchers did but medium family support and high family support can also lead to preeclampsia.

#### **4.6. Analysis of obesity and family support with preeclampsia incidents in Puskesmas Bulak Banteng Surabaya City**

Based on the results of the logistical regression test, it can be understood that pregnant women with obesity are 66,538 times more likely to have preeclampsia than non-obese pregnant mothers. While the family support variable yields an OR of 0.671 (lower = 0.101 upper = 4.468) it can be understood that pregnant mothers with low family support have a tendency to develop preeclampsia of 0.626 times greater than pregnant women with high family support. Adequate family support due to the involvement of the husband as the head of the family in providing support in every action or behavior during pregnancy such as advocating a balanced diet to avoid excessive weight gain or obesity [26]. Obesity can occur due to excessive accumulation of fat that plays a role in endothelial damage resulting in an increase in triglycerides. Women with elevated triglycerides have a double risk of developing preeclampsia [22]. Pregnant women that suffer preeclampsia will have an increased risk of future cardiovascular disease and related mortality in their later life [11]. In this case, the researchers argue that the obesity factor in pregnant mothers in the region of Bulak Banteng has a greater risk of preeclampsia than the pregnant mother of non-obesity while family support does not affect the occurrence of preeclampsia.

### **3 Conclusions**

The conclusions that can be drawn are : almost half of the pregnant mothers in Puskesmas Bulak Banteng have obesity, most of the pregnant mothers in Puskesmas Bulak Banteng have the support of the family, almost half of pregnant mothers in Puskesmas Bulak Banteng have preeclampsia, there's a relationship between obesity and preeclampsia in pregnant mothers in Puskesmas Bulak Banteng, there's no relationship

between family support and preeclampsia in pregnant mothers in Puskesmas Bulak Banteng and obesity has a 66,538 times greater risk of preeclampsia than non-obesity pregnant mothers. Advice that can be given based on the conclusion that has been outlined above, that is to always update knowledge related to preeclampsia so that the health care personnel can provide optimal services. It is hoped that future researchers will be able to investigate further on other factors that can lead to preeclampsia, thereby reducing maternal mortality. For every mother is expected to maintain and monitor weight gain during pregnancy and the family is expecting to provide maximum support.

## References

1. Abraham, T., Romani, A.M.P.: The relationship between obesity and pre-eclampsia : incidental risks and identification of potential biomarkers for pre-eclampsia. *Cells*. 11, 1548, 1–24 (2022). <https://doi.org/https://doi.org/10.3390/cells11091548>.
2. Bardja, S.: Faktor Risiko Kejadian Preeklampsia Berat/Eklampsia pada Ibu Hamil. *EMBRIO J. Kebidanan*. 12, 1, 18–30 (2020). <https://doi.org/10.36456/embrio.v12i1.2351>.
3. Dinkes Jawa Timur: Profil kesehatan provinsi Jawa Timur, <https://dinkes.jatimprov.go.id/>, last accessed 2022/09/06.
4. Fox, R. et al.: Preeclampsia: risk factors , diagnosis, management, and the cardiovascular impact on the off spring. *J. Clin. Med*. 8, 1625, 1–22 (2019).
5. Husaidah, S. et al.: Obesitas dan tingkat stress menyebabkan kejadian preeklampsia pada ibu hamil. *Midwifery Care J*. 3, 2, 31–29 (2022).
6. Ike et al.: Hubungan dukungan keluarga dengan tingkat kecemasan ibu hamil dalam melakukan kunjungan Antenatal Care (ANC) pada masa pandemi covid-19 di Kelurahan Sangatani. *J. ProNers*. 6, 1, 1–11 (2021).
7. Insani, U., Supriatun, E.: Determinan kejadian preeklampsia pada ibu hamil di wilayah kerja UPTD Puskesmas Dukuwaru Slawi. *J. Ilm. Kesehat. Keperawatan*. 16, 2, 81–90 (2020). <https://doi.org/10.26753/jikk.v16i2.471>.
8. Insani, U., Supriatun, E.: Family support related to information, comfort, economy and spiritual in preeclamptic pregnancy care : qualitative exploration. *J. Keperawatan*. 12, 1, 42–52 (2021). <https://doi.org/10.22219/JK.V12I1.13638>.
9. Jung, E. et al.: The etiology preeclampsia. *Am. J. Obstet. Gynecol*. 226, 2, S844–S866 (2022). <https://doi.org/10.1016/j.ajog.2021.11.1356>.
10. Kametas, N.A. et al.: Chronic hypertension and superimposed preeclampsia : screening and diagnosis. *Am. J. Obstet. Gynecol*. 226, 2, S1182–S1195 (2022). <https://doi.org/10.1016/j.ajog.2020.11.029>.
11. Lopez-jaramillo, P. et al.: Obesity and preeclampsia: Common pathophysiological mechanisms. *Front. Physiol*. 9, December, 1–10 (2018). <https://doi.org/10.3389/fphys.2018.01838>.
12. Mahmudah, D.: Hubungan dukungan keluarga dan religiusitas dengan kecemasan melahirkan pada ibu hamil anak pertama (primigravida). Universitas Islam Negeri Syarif Hidayatullah, Jakarta (2010).

13. Nirupama, R. et al.: Preeclampsia: Pathophysiology and management. *J. Gynecol. Obstet. Hum. Reprod.* 50, 2, 101975 (2021). <https://doi.org/10.1016/j.jogoh.2020.101975>.
14. Rana, S. et al.: Compendium on the pathophysiology and treatment of hypertension. *Circ. Res.* 124, 1094–1112 (2019). <https://doi.org/10.1161/CIRCRESAHA.118.313276>.
15. Ratnawati, A.: *Asuhan keperawatan maternitas*. Pusaka Baru Press, Yogyakarta (2018).
16. Rohkuswara, T.D., Syarif, S.: Hubungan obesitas dengan kejadian hipertensi derajat 1 di pos pembinaan terpadu penyakit tidak menular (posbindu PTM) kantor kesehatan pelabuhan bandung tahun 2016. *J. Epidemiol. Kesehat. Indones.* 1, 2, 13–18 (2017). <https://doi.org/10.7454/epidkes.v1i2.1805>.
17. Setyorini, D., Cahyono, I.: Modul deteksi dini risiko preeklampsia. *Forum Ilmiah Kesehatan (FORIKES)*, Ponorogo (2017).
18. Setyorini, D., Cahyono, I.: The Characteristics Of Mother WHO Ever Suffered Either Preeclampsia Or Eclampsia in Surabaya. *Int. J. Adv. Res.* 5, 5, 643–646 (2017). <https://doi.org/10.21474/IJAR01/4158>.
19. Sunaringtyas, W., Rachmania, D.: Dukungan keluarga dengan kejadian preeklampsia pada ibu hamil. *J. Ilm. Kesehat. Sekol. Tinggi Ilmu Kesehat. Majapahit.* 15, 1, 31–38 (2023).
20. Turbeville, H.R., Sasser, J.M.: Preeclampsia beyond pregnancy: long-term consequences for mother and child. *Am. J. Physiol. Physiol.* 318, 6, F1315–F1326 (2020). <https://doi.org/10.1152/ajprenal.00071.2020>.
21. Wafiyatunisa, Z., Rodiani: Hubungan obesitas dengan terjadinya preeklampsia. *Med. J. Lampung Univ.* 5, 1, 184–190 (2016).
22. Wahyuni, R. et al.: Hubungan obesitas dengan preeklampsia pada ibu hamil trimester II dan III. *Mahakam Midwifery J.* 2, 5, 312–323 (2019).
23. Wainstock, T. et al.: Who Is at Risk for Preeclampsia? Risk Factors for Developing Initial Preeclampsia in a Subsequent Pregnancy. *J. Clin. Med.* 9, 4, 1103 (2020). <https://doi.org/10.3390/jcm9041103>.
24. WHO: Maternal mortality, <https://www.who.int/news-room/fact-sheets/detail/maternal-mortality>, last accessed 2022/09/06.
25. Wu, C. et al.: Association of family history with incidence and gestational hypertension outcomes of preeclampsia. *Int. J. Cardiol. Hypertens.* 9, March, 100084 (2021). <https://doi.org/10.1016/j.ijch.2021.100084>.
26. Yani, M.D. et al.: Dukungan keluarga dan upaya pencegahan obesitas sebagai faktor risiko preeklampsia pada ibu hamil. *J. Ilm. Mhs. Fak. Keperawatan.* 5, 1, 152–161 (2021).
27. Yunita, A. et al.: Systematic review : deteksi dini pencegahan preeklampsia pada ibu hamil. *J. Med. Karya Ilm. Kesehat.* 6, 1, 1–15 (2021). <https://doi.org/https://doi.org/10.35728/jmkik.v6i1>.

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

