ORIGINAL PAPER

WILEY

Persistent hypertension after preeclampsia in a group of Cameroonians: Result of a cross-sectional study and perspectives to reduce its burden in Limited Income Countries

Chris Nadège Nganou-Gnindjio MD[1,2] 🔟 | Denise Kenmogne MD[3] | Doris Bibi Essama MD[1] | Jan Rene Nkeck MD[1] | Nathan Yanwou MD[1] | Pascal Foumane MD[1,4]

[1]Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1, Yaoundé, Cameroon

[2]Cardiology department, Yaoundé Central Hospital, Yaoundé, Cameroon

[3]Institut supérieur des Sciences de la santé, Université de Montagnes, Bangangte, Cameroon

[4]Yaoundé Gyneco-Obstetric and Pediatric Hospital, Yaoundé, Cameroon

Correspondence
Chris Nadège Nganou-Gnindjio is a cardiologist consultant at the Yaoundé central hospital and a senior lecturer at the FMSB of the University of Yaoundé 1. Email: cn_nganou@yahoo.fr

Abstract

Preeclampsia/eclampsia significantly increases the risk of future hypertension. Several factors may be involved in this process. The purpose of this study was to identify them in Cameroonians. We conduct a cross-sectional study including women aged 18 to 45 years, who deliver between December 2011 and 2016, and were diagnosed and followed up for preeclampsia/eclampsia in two major obstetrical and gynecologic units in Yaoundé (Cameroon). Those with persistent high-blood pressure after 6 months were classified as persistent hypertension (PH). Associated factors were investigated using multivariate analysis with logistic regression and presented with an adjusted odds ratio (aOR) and the 95% confidence interval. 92 participants were included, with 30 (32.6%) with PH. The independent factors associated with PH were as follows: maternal age during preeclampsia above 30 years (aOR = 6.30 [1.1; 35.4], p = .03), at least five deliveries prior preeclampsia (aOR = 1.50 [2; 6.6], p = .008), and family history of diabetes (aOR = 14.8 [2.6; 85.7], p = .003). About one in three women with preeclampsia/eclampsia will have PH. The clinician needs to pay more attention to the potential risk factors identified above. More appropriate strategies need to address the burden of this condition in the context of low resources.

1 | BACKGROUND

Preeclampsia/eclampsia refers to a syndrome characterized by the new onset of hypertension and proteinuria after 20 weeks of amenorrhea and/or 6 weeks postpartum in a previously normotensive woman.[1] Preeclampsia/eclampsia is one of the three leading causes of maternal morbidity and mortality worldwide: responsible for 50.000 maternal deaths each year.[2] It is a deadly disease, especially in Africa, where it is the most frequent cause of maternal death. Not surprisingly, preeclampsia and eclampsia rates are higher in developing countries because of a lack of

prenatal care and lack of proper hospital care access.[3] In sub-Saharan Africa, preeclampsia's prevalence is 25% (varying from 0.93% to 70% depending on the country), making it a real public health problem.[4] A hospital-based study in Cameroon reveals a prevalence of 8.2% in 2009 in urban areas.[5] Several women with a history of preeclampsia/eclampsia are not diagnosed with hypertension because women-specific risk factors are not consistently screened for in the daily clinic. As a result, high blood pressure can go undetected and unmanaged for many years, especially in sub-Saharan Africa, where access to care remains a public health issue.[6,7] After delivery, which is considered the best treatment for

preeclampsia, it is important to continue following these women. Even after pregnancy, there is a risk of persistent hypertension and cardiovascular events.[7]

Although blood pressure and albuminuria in patients with pre-eclampsia generally return to normal values in the months following delivery, there is now evidence that women with preeclampsia are more likely to develop cardiovascular diseases (CVDs) later in life.[8] Furthermore, the American Heart Association has already recognized preeclampsia as an independent risk factor for CVD. Over the past 20 years, several studies have shown that women after preeclampsia are at increased risk of developing hypertension before 55.[9] Behrens et al showed that women with hypertensive pregnancy disorders had a 30% risk of developing hypertension after pregnancy, especially in the first two years. In a meta-analysis by Bellamy et al, a relative risk of 3.70 (95% Confidence interval [2.70; 5.05]) was found for persistent hypertension (PH) after PE. Therefore, preeclampsia raises a wake-up call concerning the risk of cardiovascular and renal disease in later life.

There is currently little information on the associated clinical factors of PH after preeclampsia in sub-Saharan African studies. Understanding the determinants of hypertension in women with a history of preeclampsia and the concomitant risk for CVDs is critical for public health policy, especially in limited resources countries. Thus, this study aimed to determine the factors associated with persistent hypertension in a group of women who had preeclampsia over the last five years in Yaoundé, an urban city of Cameroon.

2 | METHODS

2.1 | Study design and setting

We carried out a cross-sectional study in two main obstetrical and gynecologic units of Yaoundé: The Yaoundé Central Hospital and Yaoundé Gynaeco-Obstetric and Paediatric Hospital. Study participants were recruited from December 2011 to December 2016.

2.2 | Participants

We included all women aged 18 to 45 years diagnosed with preeclampsia/eclampsia during pregnancy or postpartum during five years (from December 2011 to December 2016) in the selected hospitals. We excluded participants who had an added preeclampsia on chronic hypertension and women currently pregnant.

2.3 | Sample size estimation

The sample size was estimated at 86 using Cochran's formula, considering the prevalence found by Nakimuli et al with a precision of 10% and an error of 0.05. The sampling was consecutive.[10,11]

2.4 | Data collection

Ethical approvals were obtained from the Institutional committee review board of the *Université des Montagnes* (N°2018/090/UdM/PR/CIE), and administrative authorizations were obtained from all participating hospitals. Participants were identified through their medical records; we identified 727 cases of women with preeclampsia. Two hundred fifty-one records were complete, and only 135 had available addresses of these patients, of whom eight had died (seven strokes and one renal failure). We contacted them by phone and invited them to participate in the study. Informed consent was obtained from each participant before inclusion. Data were collected using a data collection sheet. It was first an interview to collect information on the past medical history, including cardiovascular risk factors, obstetrical history. Afterward, we performed a physical examination to measure weight and height for body mass index (BMI) calculation, blood pressure, and a complete physical exam. Office Blood pressure was measured according to European Society of Hypertension guidelines.[12] After the patient was sitting comfortably for at least 5 min, with the back supported, feet on the floor, arm supported in the horizontal position on a desk or table, three blood pressure measurements were taken at 1–2 min intervals, on the same arm, with a proper cuff size adjusted to the arm diameter and a validated automated device (OMRON®MX2 Basic, OMRON HEALTHCARE, INC. Bannockburn, Illinois 60015.CHINA), on two separate occasions at least 4 h apart. We considered the average of the last two values of each occasion. At the end of the interview, blood sampling was collected for lipid profile and fasting blood glucose.

2.5 | Operational terms

Persistent hypertension was defined as the presence after 6 months of delivery of a systolic blood pressure greater than 140 mmHg and/or diastolic blood pressure greater than 90 mmHg in women who experienced preeclampsia.[13]

2.6 | Statistical analysis

All the data collected were analyzed using the software SPSS version 23.0. Quantitative variables are presented with their mean and standard deviation (SD). Qualitative variables were expressed as counts and proportions. The comparison of means was made using the Student's T-test. Fisher's test was used to compare proportions. Determinants of persistent hypertension were sought using univariate and multivariate analysis with logistic regression. The odds ratio (OR) and its 95% confidence interval are used to a described association. The threshold of significance was set at 0.05 for all the statistical tests used.

3 | RESULTS

During the study period, we identified 727 cases of women with preeclampsia. Two hundred fifty-one records were complete, and only 135 had available addresses of these patients, of whom eight had died (seven strokes and one renal failure). Of the 127 women who were contacted, 107 women agreed to come for an appointment, including 11 pregnant women, four on postpartum (<6 months), and 28 who refused to participate. Finally, 92 participants were included in the study. The above is summarized in the flow chart shown in Figure 1.

3.1 | Baseline characteristics of the study population

Of the 92 participants finally included, 30 (32.6%) had PH. The study participants' mean age was 32.7 ± 5 years (37.43 ± 4.4 for those with PH and 30.45 ± 6.9 for the normotensive women), ranging between 18 and 45. The majority of women with PH (93%) had a BMI above 25 kg/m^2. More than half of the women with PH had given birth to children with a low birth weight (67.9%). Very few women with PH had dyslipidemia (3.3%) and none consumed tobacco. None have been diagnosed with diabetes. Table 1 summarizes the general characteristics of the study participants.

3.2 | Factors associated to PH

In univariate analysis, we found several potential factors that could be associated with PH: age above 30 years at the diagnosis of preeclampsia (OR = 12.5 [3; 34.5]), being married (OR = 2.9 [1.1;7.6]), having a number of pregnancies or parity ≥5 (OR = 7.7 [2.3;21.6]), gestational age <37 weeks at the time of diagnosis of preeclampsia (OR = 4.3[1.5;11.9]), 24 h Proteinuria ≥5 g/l at preeclampsia diagnosis (OR = 2.5 [1.12;10]), or a history of first degree familial diabetes (OR = 5.2[1.9;14.1]) (Table 1). On multivariate analysis, the independent associated factors were parity ≥5 (aOR = 1.50; [2; 6.6]; *p* = .008), age above 30 years at the diagnosis of preeclampsia (OR = 6.3 [1.1; 35.4]) and a familial history of diabetes (aOR = 14.8; [2.6; 85.6]; *p* = .003). See Table 2.

4 | DISCUSSION

In the present study, a group of women with preeclampsia between 2011 and 2016 was contacted at least 6 months after delivery and examined for hypertension persistence. Our results show that of the 92 women who had preeclampsia, 30 (32.6%) had persistent hypertension at least 6 months after delivery; and the independently associated factors were multiparity (≥5 pregnancies), a family
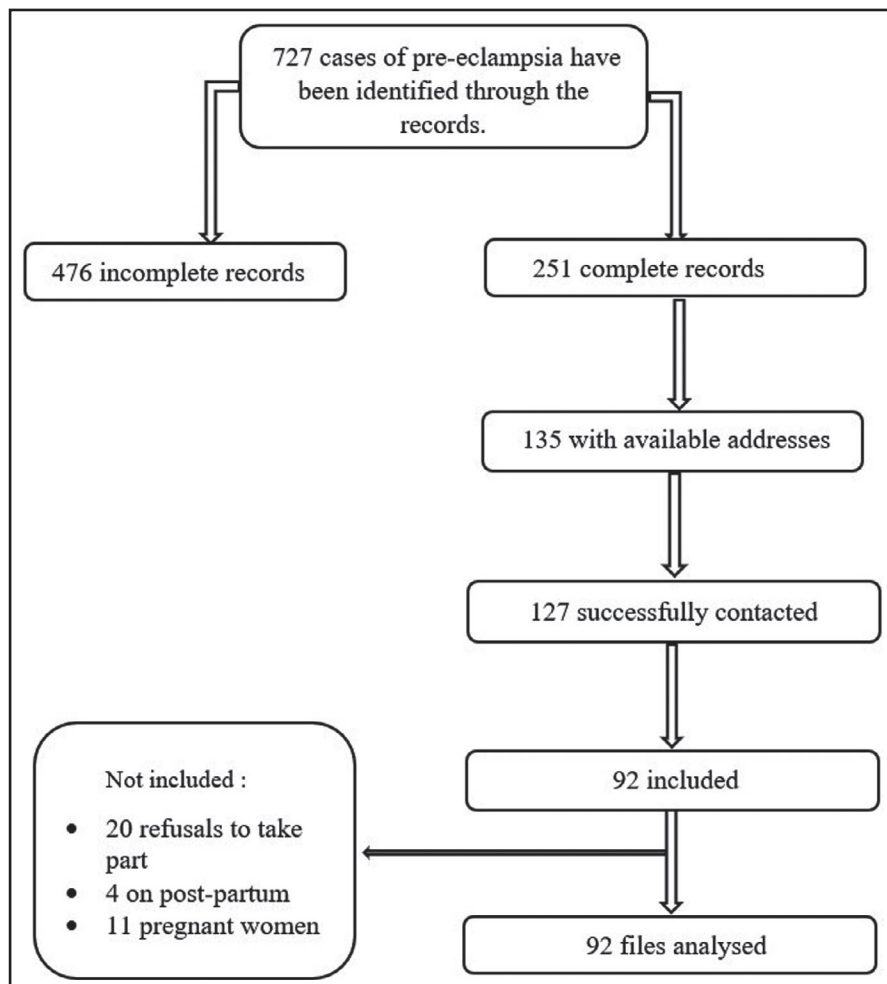

FIGURE 1 Flow chart of the study population

TABLE 1 General characteristics of the study population

Variables	Overall 92 (100%)	With PH 30 (32.6%)	Without PH 60 (67.4%)	OR [95% CI]	p value
Marital status					
Single	38 (41.3)	7 (23.3)	31 (50)	1	.024
Married	52 (56.5)	22 (73.3)	30 (48.4)	2.9 (1.1 - 7.6)	
Age during PE					
<30 years	50 (54.3)	5 (16.7)	45 (72.6)	1	<.001
≥30 years	42 (45.7)	25 (83.3)	17 (27.4)	12.5 (3 - 34.5)	
Number of pregnancies					
<5	59 (64.1)	11 (36.7)	48 (77.4)	1	<.001
≥5	33 (35.9)	19 (63.3)	14 (22.6)	5.9 (2.3 - 15.3)	
Parity					
<5	71 (79.3)	17 (56.7)	24 (88.8)	1	<.001
≥5	19 (20.7)	13 (43.3)	6 (9.7)	7.7 (2.3 - 21.6)	
Gestational age at the diagnosis of PE					
<37 weeks	54 (58.7)	24 (80)	30 (48.4)	4.3 (1.5 - 11.9)	.004
≥37 weeks	38 (41.3)	6 (20)	32 (51.6)	1	
Birth weight of newborn (Kg)					
[1500–2500]	34 (38.6)	19 (67.9)	15 (25)	6.3 (2.4 - 16.9)	<.001
[2500–3500]	48 (54.5)	8 (28.6)	40 (66.7)	1	
Family history of diabetes					
Yes	23 (25)	14 (46.7)	9 (14.5)	5.2 (1.9- 14.1)	.001
No	69 (75)	16 (53.3)	53 (85.5)	1	
Family history of hypertension					
Yes	62 (67.4)	24 (80)	38 (61.3)	2.5 (0.9 - 7.1)	.073
No	30 (32.6)	6 (20)	24 (38.7)	0.4(0.14 - 1.1)	.073
Body mass index					
<25 kg/m^2	14 (15.2)	2 (6.7)	12 (19.4)	0.3 (0.06 - 1.4)	.134
≥25 kg/m^2	78 (84.8)	28 (93.3)	48 (80.6)	3.5 (0.73 −16.79)	
24 h proteinuria at the time of diagnosis					
<5 g/24 h				1	.012
≥5 g/24 h	22 (23.9)	12 (40)	10 (19.4)	3.4 (1.3 - 9.4)	
Dyslipidemia					
Yes	4 (4.3)	1 (3.3)	3 (4.8)	0.7 (0.07 - 6.8)	1.000
No	88 (95.7)	29 (96.7)	59 (95.2)	1	1.000
Alcohol consumption					
Yes	17 (18.7)	8 (26.7)	9 (14.8)	2.1 (0.7 - 6.2)	.170
No	74 (81.3)	22 (73.3)	52 (85.2)	1	1.000
Tobacco consumption					
Yes	1 (1.1)	0 (0)	1 (1.6)	/	1.000
No	90 (98.9)	30 (100)	60 (98.4)		

Abbreviations: PE: Preeclampsia.

history of diabetes, and an age greater than 30 years at the time of preeclampsia.

The prevalence of PH in our study population was 32.6% (30/92). These results are similar to those of Veerbeek et al, in a study conducted in the Netherlands in 2012, who found a prevalence of 25 to 45% depending on the type of preeclampsia, 5 years after childbirth. Similarly, Nakimuli et al in Uganda, in a cohort study, reported that 34% of women with preeclampsia had PH.[11] The situation is undoubtedly the same in the rest of sub-Saharan Africa. Still, the low quality of medical records does not

TABLE 2 Associated factors of persistent hypertension: multivariate analysis

Variables	OR [95% CI]	aOR [95% CI]		p value
Being married	2.9 (1.1 - 7.6)	1.17	0.4 - 6.8	.475
Age during PE ≥30 years	12.5 (3.34 - 5)	**6.3**	**1.1 - 35.4**	**.037**
Gestation ≥ 5	5.9 (2.3 - 15.3)	1.2	0.2 - 6.6	.830
Parity ≥ 5	7.7 (2.3 - 21.6)	**1.50**	**2.0- 6.6**	**.008**
Gestational age at diagnosis of PE <37 weeks	4.3 (1.5 - 11.9)	3.9	0,7 - 23.1	.124
Family history of diabetes	5.2 (1.9- 14.1)	**14,8**	**2.6 - 85.6**	**.003**
24 h proteinuria at the time of diagnosis ≥5 g/l	3.4 (1.3 - 9.4)	1.04	0.2- 5.8	.963

Abbreviations: aOR, adjusted odds ration; PE, preeclampsia.

make it possible to measure the problem's full extent.[11] The cause of PH is not established. But recent studies indicate that preeclampsia and cardiovascular disease share similar risk factors, including metabolic disturbances, inflammatory disorders, oxidative stress, and hypercoagulability; these common factors can lead to endothelial dysfunction, thus increase the likelihood of developing hypertension in women who have had hypertensive disorders in pregnancy.[14,15] The cohort led by Selvaggi et al[16] in Italy reported that 50% of women with a history of preeclampsia were hypertensive 10 years after delivery. The third was already hypertensive at 5 years after childbirth. Therefore, it is crucial to adequately monitor these patients, establishing a particular schedule of visits and regular blood pressure monitoring, urine albumin, fasting glucose, and lipid balance. However, in our context, these assessments cannot always be performed routinely, even annually, due to limited resources. To prevent PH in addition to lifestyle modification (smoking cessation, healthy eating, exercise, and weight loss),[1] we shall identify associated risk factors.

In our study, we have identified three independent associated risk factors. One of them, multiparity (≥5 pregnancies), represents 87.1% of our study population. This result is similar to that found by Nakimuli et al[11] in Uganda in 2011, which showed that 47 out of 64 cases (73.4%) were multiparous. Chesley et al reported that among women with eclampsia, those who are multiparous are different and should be examined separately, as their study found an increased prevalence of chronic hypertension in 64 multiparous eclampsia survivors. Besides, Chesley et al highlighted the fact that hypertension in pregnancy in multiparous women was most likely an early expression of a higher risk of essential hypertension later in life.[17] We also found that the risk of PH was higher in women aged 30 years and above. The older you get, the higher the risk of high blood pressure due to the summation of the vascular effects of atherosclerosis accumulation, as shown by the data obtained during the Framingham

Heart Study.[18] Then indeed, preeclampsia is added to these factors because of the endothelial lesions that have already been reported by Maynard et al[19] This multiplication of the cardiovascular risk certainly brings the age of onset of hypertension closer, which would have occurred later. Advanced maternal age was associated with persistent hypertension in other studies.[11,20]

We found a family history of diabetes significantly increased the risk of PH (OR = 14.8; 95% CI = 2.6 - 85.6; p < .005). It is recognized and confirmed by numerous studies that a family history of diabetes reflects genetic and behavioral factors that predispose women to a higher risk of preeclampsia.[21,22] However, we did not find studies in the literature that evaluated the history of familial diabetes for hypertension in women with a history of preeclampsia. A history of familial diabetes itself is already a cardiovascular risk factor.

Our findings suggest that clinicians should be vigilant in examining pregnant women with the mentioned risk factors to guide them on lifestyle changes, such as reducing their weight, monitoring their blood pressure frequently, and ensuring a better postpartum follow-up. The role of health care providers is to provide patients with timely education, ongoing monitoring of signs and symptoms, and prompt management of urgent cases. Given the health context of low-income countries and the lack of peripheral doctors, midwives' and nurses' training in these women's initial management is essential before any transfer from urban hospitals. There is also a need to emphasize and raise awareness of the risks of hypertension, given that the number of women potentially at risk for hypertension-related to hypertensive disorders in pregnancy is large. That routine follow-up could last for years or even decades, and there is an urgent need to develop an algorithm to identify those women most at risk. In combination with the early diagnosis, the timely treatment of hypertension in women with a history of hypertensive disorders in pregnancy will reduce the cardiovascular disease burden in this population.

Our study has certain limitations. First, it was a cross-sectional study of a small group of cases. Recruitment of patients based on medical records was challenging, as only complete forms were usable. In a context where digital medical record-keeping is rare, the electronic medical record has proven to be an essential tool for optimizing patient data access and improving the quality of care services. However, it has not been widely implemented in Sub-Saharan Africa.[23] Furthermore, even if we had telephone addresses, some of them were incorrect or unavailable. Another point is that during the examination, the rise in blood pressure could be due to the white coat effect, the prevalence of which in our context is significant according to Noubiap et al.[24]

5 | CONCLUSION

About one in three women with preeclampsia/eclampsia could have PH. Women who experience this condition should be counselled regarding lifestyle modification and carefully ongoing blood pressure monitoring, especially for those with risk factors identified above.

ACKNOWLEDGEMENTS

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

AUTHOR CONTRIBUTIONS

CNNG, DK, and PF involved in conception and design of the research. CNNG and DK involved in acquisition of data and analysis and interpretation of the data. DK, DBE, JRN, and NY involved in statistical analysis. PF involved in Supervising the work. DBE, JRN, and NY drafting the manuscript. All the authors involved in critical revision of the manuscript for important intellectual content and approbation of the final version.

ORCID

Chris Nadège Nganou-Gnindjio https://orcid.org/0000-0001-8995-5038

REFERENCES

1. Garovic VD, August P. Preeclampsia and the future risk of hypertension: the pregnant evidence. *Curr Hypertens Rep.* 2013;15(2):114-121. https://doi.org/10.1007/s11906-013-0329-4. PMID: 23397213; PMCID: PMC3812434.
2. Behrens I, Basit S, Melbye M, et al. Risk of post-pregnancy hypertension in women with a history of hypertensive disorders of pregnancy: nationwide cohort study. *BMJ.* 2017;12(358):j3078. https://doi.org/10.1136/bmj.j3078. PMID: 28701333; PMCID: PMC5506851.
3. Ghulmiyyah L, Sibai B. Maternal mortality from pre-eclampsia/eclampsia. *Semin Perinatol.* 2012;36(1):56-59. https://doi.org/10.1053/j.semperi.2011.09.011. PMID: 22280867.
4. CADRE MEM. Hypertension artérielle et grossesse: aspects épidémiologiques et facteurs de risque. *Med Afr Noire.* 2000;47(10):422-425.
5. Mboudou ET, Foumane P, Priso EB, et al. Hypertension Au Cours De La Grossesse : Aspects cliniques et épidémiologiques a l'Hôpital Gynéco-Obstétrique et Pédiatrique de Yaounde, Cameroun. *Clin Mother Child Health.* 2009;6(2):1087-1093.
6. James PR, Nelson-Piercy C. Management of hypertension before, during, and after pregnancy. *Heart.* 2004;90(12):1499-1504. https://doi.org/10.1136/hrt.2004.035444. PMID: 15547046; PMCID: PMC1768605.
7. Muijsers HEC, van der Heijden OWH, de Boer K, et al. Blood pressure after PREeclampsia/HELLP by SELF monitoring (BP-PRESELF): rationale and design of a multicenter randomized controlled trial. *BMC Womens Health.* 2020;20(1):41. https://doi.org/10.1186/s12905-020-00910-0. PMID: 32131802; PMCID: PMC7055029.
8. Best LG, Lunday L, Webster E, Falcon GR, Beal JR. Pre-eclampsia and risk of subsequent hypertension: in an American Indian population. *Hypertens Pregnancy.* 2017;36(2):131-137. https://doi.org/10.1080/10641955.2016.1250905. Epub 2016 Dec 21. PMID: 28001098; PMCID: PMC6097877.
9. Drost JT, Arpaci G, Ottervanger JP, et al. Cardiovascular risk factors in women 10 years post early pre-eclampsia: the Preeclampsia Risk EValuation in FEMales study (PREVFEM). *Eur J Prev Cardiol.* 2012;19(5):1138-1144.
10. Whitley E, Ball J. Statistics review 4: sample size calculations. *Crit Care.* 2002;6(4):335-341. https://doi.org/10.1186/cc1521. Epub 2002 May 10. PMID: 12225610; PMCID: PMC137461.
11. Nakimuli A, Elliott AM, Kaleebu P, Moffett A, Mirembe F. Hypertension persisting after pre-eclampsia: a prospective cohort study at Mulago Hospital, Uganda. *PLoS One.* 2013;8(12):e85273. https://doi.org/10.1371/journal.pone.0085273. PMID: 24392003; PMCID: PMC3877387.
12. Ditisheim A, Wuerzner G, Ponte B, et al. Prevalence of hypertensive phenotypes after pre-eclampsia: a prospective cohort study. *Hypertension.* 2018;71(1):103-109.
13. Veerbeek JHW, Hermes W, Breimer AY, et al. Cardiovascular disease risk factors after early-onset pre-eclampsia, late-onset pre-eclampsia, and pregnancy-induced hypertension. *Hypertens Dallas Tex.* 2015;65(3):600-606.
14. Garovic VD, Hayman SR. Hypertension in pregnancy: an emerging risk factor for cardiovascular disease. *Nat Clin Pract Nephrol.* 2007;3(11):613-622. https://doi.org/10.1038/ncpneph0623. PMID: 17957198.
15. Craici I, Wagner S, Garovic VD. Preeclampsia and future cardiovascular risk: formal risk factor or failed stress test? *Ther Adv Cardiovasc Dis.* 2008;2(4):249-259. https://doi.org/10.1177/1753944708094227. PMID: 19124425; PMCID: PMC2674507.
16. Selvaggi L, Loverro G, Schena FP, Manno C, Cagnazzo G. Long term follow-up of women with hypertension in pregnancy. *Int J Gynaecol Obstet.* 1988;27(1):45-49. https://doi.org/10.1016/0020-7292(88)90086-0. PMID: 2905297
17. Chesley LC. Recognition of the long-term sequelae of eclampsia. *Am J Obstet Gynecol.* 2000;182(1 Pt 1):249-250. https://doi.org/10.1016/s0002-9378(00)70521-7. PMID: 10649187
18. Pinto E. Blood pressure and ageing. *Postgrad Med J.* 2007;83(976):109-114.
19. Maynard SE, Min JY, Merchan J, et al. Excess placental soluble fms-like tyrosine kinase 1 (sFlt1) may contribute to endothelial dysfunction, hypertension, and proteinuria in pre-eclampsia. *J Clin Invest.* 2003;111(5):649-658. https://doi.org/10.1172/JCI17189. PMID: 12618519; PMCID: PMC151901.
20. Ndayambagye EB, Nakalembe M, Kaye DK. Factors associated with persistent hypertension after puerperium among women with preeclampsia/eclampsia in Mulago hospital, Uganda. *BMC Pregnancy Childbirth.* 2010;12(10):12. https://doi.org/10.1186/1471-2393-10-12. PMID: 20222993; PMCID: PMC2848130.
21. Qiu C, Williams MA, Leisenring WM, et al. Family history of hypertension and type 2 diabetes in relation to pre-eclampsia risk. *Hypertension.* 2003;41(3):408-413. https://doi.org/10.1161/01.HYP.0000056996.25503.F5. Epub 2003 Feb 17 PMID: 12623936.
22. Weissgerber TL, Mudd LM. Pre-eclampsia and diabetes. *Curr Diab Rep.* 2015;15(3):9. https://doi.org/10.1007/s11892-015-0579-4. PMID: 25644816; PMCID: PMC4317712.
23. Odekunle FF, Odekunle RO, Shankar S. Why sub-Saharan Africa lags in electronic health record adoption and possible strategies to increase its adoption in this region. *Intern J Health Sci.* 2017;11(4):59.
24. Noubiap JJ, Nansseu JR, Nkeck JR, Nyaga UF, Bigna JJ. Prevalence of white coat and masked hypertension in Africa: a systematic review and meta-analysis. *J Clin Hypertens.* 2018;20(8):1165-1172. https://doi.org/10.1111/jch.13321. Epub ahead of print. PMID: 29984891.