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ORIGINAL ARTICLE

The prevalence of acute kidney injury in women in Africa with hypertensive disorders of pregnancy: A systematic review and meta-analysis

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ABSTRACT

Background: Hypertensive disorder of pregnancy (HDP) is a leading and preventable cause of pregnancy-related acute kidney injury globally. This systematic review and meta-analysis determined the prevalence of AKI in cases of HDP in Africa.

Methods: A systematic search of PubMed and African Journals Online (AJOL) was undertaken to identify articles with relevant data published between 1991 and 2022. The pooled prevalence of AKI in women with HDP was determined using meta-analytic techniques.

Results: Eighteen eligible articles were included in the systematic review and meta-analysis. The studies included reported on 8 703 pregnant women with HDP with a median age of 27.7 years. Most of the studies were cross-sectional and had medium or poor methodological quality. The overall prevalence of AKI was 6.0% (95% CI 3.4–9.3%, I^2 = 96.7%; p-value for heterogeneity <0.001). There was no difference in AKI prevalence by African subregion. There was a higher prevalence of AKI in the post-RIFLE era compared to the pre-RIFLE era [7.1% (4.3–10.5%) versus 1.6% (0.5–3.2%); p < 0.001]. The pooled AKI prevalence was higher in the studies that used established AKI consensus criteria than those where criteria were not used [19.6% (10.7–30.3%) versus 4.8 (2.4–8.0%); p = 0.001].

Conclusion: The pooled prevalence of AKI in HDP in Africa was 6.0%. Using consensus AKI definition criteria improves the sensitivity of AKI detection in HDP. The early involvement of nephrologists, as part of a multidisciplinary team taking care of women with HDP, may enhance early AKI detection and reduce the likelihood of renal complications.

Keywords: acute kidney injury; hypertensive disorders of pregnancy; Africa.

INTRODUCTION

Pregnancy-related acute kidney injury (PRAKI) significantly contributes to poor perinatal and maternal outcomes [1-3]. The prevalence of PRAKI varies across the continents and is relatively higher in low- and middle-income countries (LMICs) [3]. The pooled prevalence of PRAKI was reported to be 2% globally, according to a systematic review and meta-analysis conducted in 2022 [3]. Following improved access to abortion and post-abortion care over the years and improvement in obstetric services, there has been a significant decline in the global prevalence of PRAKI [4,5]. Nevertheless, the burden remains high in LMICs due to poverty, illiteracy and limited access to quality obstetric services [4,6]. Recent reports have also shown an increase in the pre-

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valence of PRAKI in high-income countries due to increased levels of awareness, prompt diagnoses and changes in the demographic and clinical characteristics of pregnant women in these countries [4,5]. Growing use of assisted reproductive technologies (ARTs) by older women with comorbidities that increase the risk of AKI, such as hypertension, diabetes mellitus and kidney diseases, also accounts for the rising prevalence of PRAKI in high-income countries [4,5]. This trend may occur in LMICs in the near future.

The common causes of PRAKI are hypertensive disorders in pregnancy (HDPs), obstetric haemorrhage and infections [1,2,6,7]. These are also the main factors responsible for maternal morbidity and mortality in Africa [8]. Globally, about 18.1 million women were affected by HDP in 2019. This reflects an 11% increase over the past three decades [9]. It also accounted for approximately 28 000 maternal deaths in 2019 [9]. The burden of HDPs is higher in Asia and sub-Saharan Africa (SSA) than in other regions of the world, with a pooled prevalence of 8% in SSA [10].

The spectra of HDP include gestational hypertension, chronic hypertension, pre-eclampsia, eclampsia and chronic hypertension in pregnancy superimposed with pre-eclampsia [11,12]. HDP is associated with a 17-fold and 8.2-fold increase in maternal and perinatal mortality risk, respectively [10]. Acute maternal complications of HDPs include placental abruption, kidney failure, HELLP (haemolysis, elevated liver enzymes and low platelets) syndrome, stroke, acute pulmonary oedema, heart failure and disseminated coagulopathy [13]. HDP increases the long-term risk of development of cardiovascular diseases such as arrhythmia, coronary heart disease, stroke and kidney disease [14,15].

HDP-related AKI accounts for a significant number of PRAKI cases and is believed to be caused by antiangiogenic and vasoconstrictive effects of endothelin-1 and soluble feline McDonough sarcoma-like tyrosine kinase 1 (sFLT-1), which are substances released following endothelial injury [16,17]. The study reported here involved a comprehensive and systematic review and meta-analysis of AKI prevalence in cases of HDP in Africa. It provides evidence-based data on the magnitude of HDP-related AKI, which will be useful as a basis for the implementation of policies to reduce the continent's burden of the condition.

METHODOLOGY

A systematic literature search was conducted on all published articles reporting on pregnant African women who had hypertension and revealed information on complications of pregnancy-related hypertension, including AKI. We included studies published before and after May 2004 (designated Pre-Risk, Injury, Failure, Loss and End-stage kidney disease (Pre-RIFLE) studies and Post-RIFLE studies, respectively) when the first consensus statement on AKI definition and staging was released [19].

We searched PubMed and African Journals Online (AJOL) using terms related to kidney failure in pregnancy-related hypertension, including "acute kidney injury", "AKI", "Acute renal failure", "ARF", "acute kidney disease", "acute renal dysfunction", "acute renal insufficiency", "acute renal impairment", "hypertension", "high blood pressure", "elevated blood pressure", "eclampsia", "pre-eclampsia", "pregnancy-induced hypertension", "hypertensive disorders of pregnancy", "HELLP syndrome", "gestational hypertension", "chronic hypertension in pregnancy", "gestational proteinuric hypertension", and "severe pre-eclampsia" in conjunction with the names of all the African countries referred to in the search. The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guideline was used to report our findings [18].The protocol for this review was registered with PROSPERO (Registration number CRD42018075578). The search strategy is detailed in Supplementary Table 1.

The title, abstract, and full article were independently screened and extracted by authors AIU and OAA. All conflicts were resolved by a third reviewer, EEA. The following variables were extracted from selected studies: the last name of the first author, year of publication, country, African Union subregion where the country is located, the sample size of the study, the speciality of the primary investigator, duration of the study, study design, mean age of the study participants, the respective proportions with pre-eclampsia, eclampsia, chronic kidney disease, chronic hypertension, with HELLP syndrome, mean gestational age, mean systolic and diastolic blood pressure, and the use of RIFLE [19], Acute Kidney Injury Network (AKIN) [20] and Kidney Disease Improving Global Outcome (KDIGO) guidelines in diagnosing AKI [21]. Where available, we aimed to document the proportion of AKI patients who ended up having kidney replacement therapy and the outcomes of AKI in this unique population – kidney recovery, progression to chronic kidney disease (CKD) or death from AKI.

The Joanna-Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data was used to assess the methodological quality of the constituent studies [22], which had a score of 1 for each of the nine questions that had a "yes" response. Studies with scores 0 to 3 were regarded as poor quality, 4 to 6 as of intermediate or medium quality, and 7 to 9 as high-quality.

Stata 17.0 (Stata Corp., 2021. Stata Statistical Software: Release 17, College Station, TX) was used for statistical analysis. The pooled prevalence of PRAKI in women with

pregnancy-related hypertension was determined using meta-analytic techniques. The study-specific estimates derived from the DerSimonian–Laird random effects model [23] were pooled to estimate the prevalence of AKI in this population. To minimise the effect of extreme values, the Freeman–Tukey double arcsine transformation [24] was used to stabilise the individual study variances before using the random effects model to obtain the pooled estimates. Publication bias was assessed using the Begg test [25]. We also undertook subgroup analyses of pooled prevalence by African Union subregion, pre- versus post-RIFLE period and studies that used AKI definition criteria versus those that did not. Subgroup analysis was performed using the Q-test based on ANOVA. The I^2 statistic was used to determine the between-study heterogeneity.

RESULTS

The initial literature search retrieved 819 articles, of which 45 were selected for full-text assessment for eligibility. Finally, 18 articles [26-43] proved eligible and were included in the systematic review and meta-analysis (Figure 1). The corresponding studies reported on 8 703 pregnant women with various cases of HDP, with sample sizes ranging from 103 to 1 547 women. Pre-eclampsia was the predominant diagnosis, occurring in 5 653 women and eclampsia in 2 124 women. Other hypertensive disorders recorded included chronic hypertension preceding pregnancy, gestational hypertension and HELLP syndrome. No study reported on patients with chronic kidney disease in pregnancy. These studies were from 10 countries (Figure 2) representing five African subregions: North Africa (two studies, 342 patients [40,41]), West Africa (7 studies, 3 343 patients [31-34,37-39]), Central Africa (1 study, 170 patients [36]), East Africa (2 studies, 431 patients [42,43]), and southern Africa (6 studies, 4 417 patients [26-30,35]) (Table 1). The year of publication ranged from 1991 to 2022. The median maternal and gestational ages were 27.7 years (IQR 25.0–29.0 years) and 33 weeks (IQR 32–36 weeks), respectively. All the studies reported were conducted in tertiary hospitals.

Most (13, 72%) of the studies were cross-sectional. The medical speciality distribution of the first authors consisted predominantly of obstetricians (12, 67%). Only one study [40] had a first author who was a nephrologist. One study [26] diagnosed AKI using the KDIGO criteria, while another [40] used the RIFLE criteria. Only two studies [27,28] were published before a unified definition of AKI, the RIFLE staging, was made public. The 14 other studies used the need for kidney replacement therapy as a definition of AKI. Most of the component studies had medium or poor methodological quality (Table 1), with only one article being of high quality.

AKI prevalence among women with hypertensive disorders of pregnancy

The overall prevalence of AKI was 6.0% (95% CI 3.4–9.3%, n = 18 studies, 8 703 participants, I^2 = 96.7%, p-value for heterogeneity <0.001) (Figure 3). There was no difference in prevalence by African subregion, 5.7% (1.2–13.1%) in southern Africa versus 5.0% (1.9-9.5%) in West Africa; 13.4% (0.4–38.8%) in North Africa; 4.3% (1.3–8.9%) in East Africa; p = 0.76 for difference between the groups. The p-value for Begg's test was 0.85, suggesting no publication bias.

There was a higher prevalence of AKI in the post-RIFLE era compared to the pre-RIFLE era [7.1% (4.3–10.5%) versus 1.6% (0.5–3.2%); p< 0.001 (Supplementary Figure 1)]. Also, the pooled AKI prevalence in the studies that used established AKI consensus criteria was significantly higher than in those that did not use any criteria [19.6% (10.7–30.3%) versus 4.8% (2.4–8.0%); p = 0.001 (Supplementary Figure 2)].

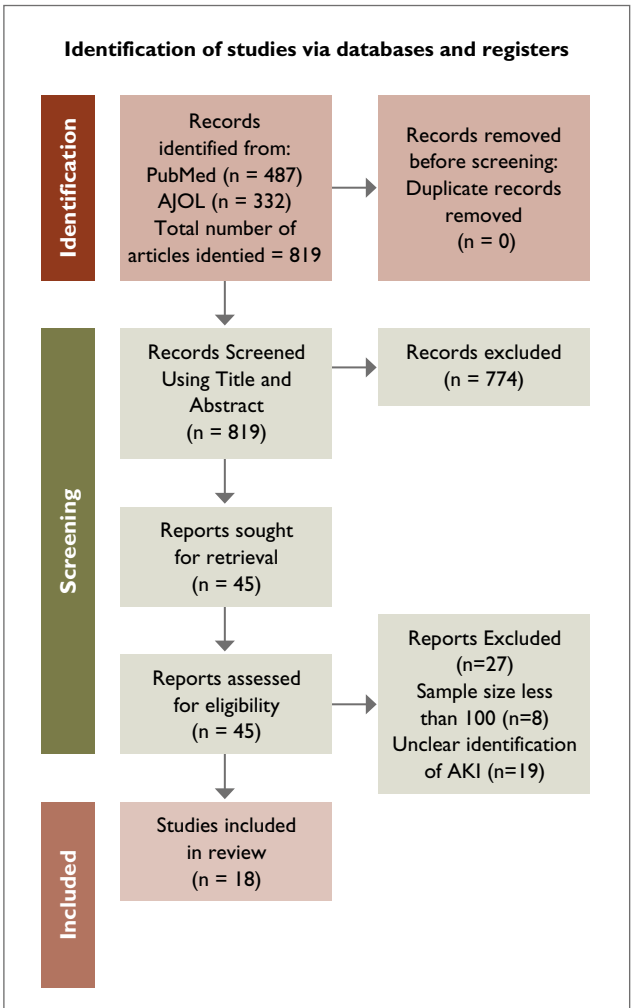


Figure 1. PRISMA flow diagram – Identification and Screening of Articles.
Abbreviations: AJOL – African Journals Online

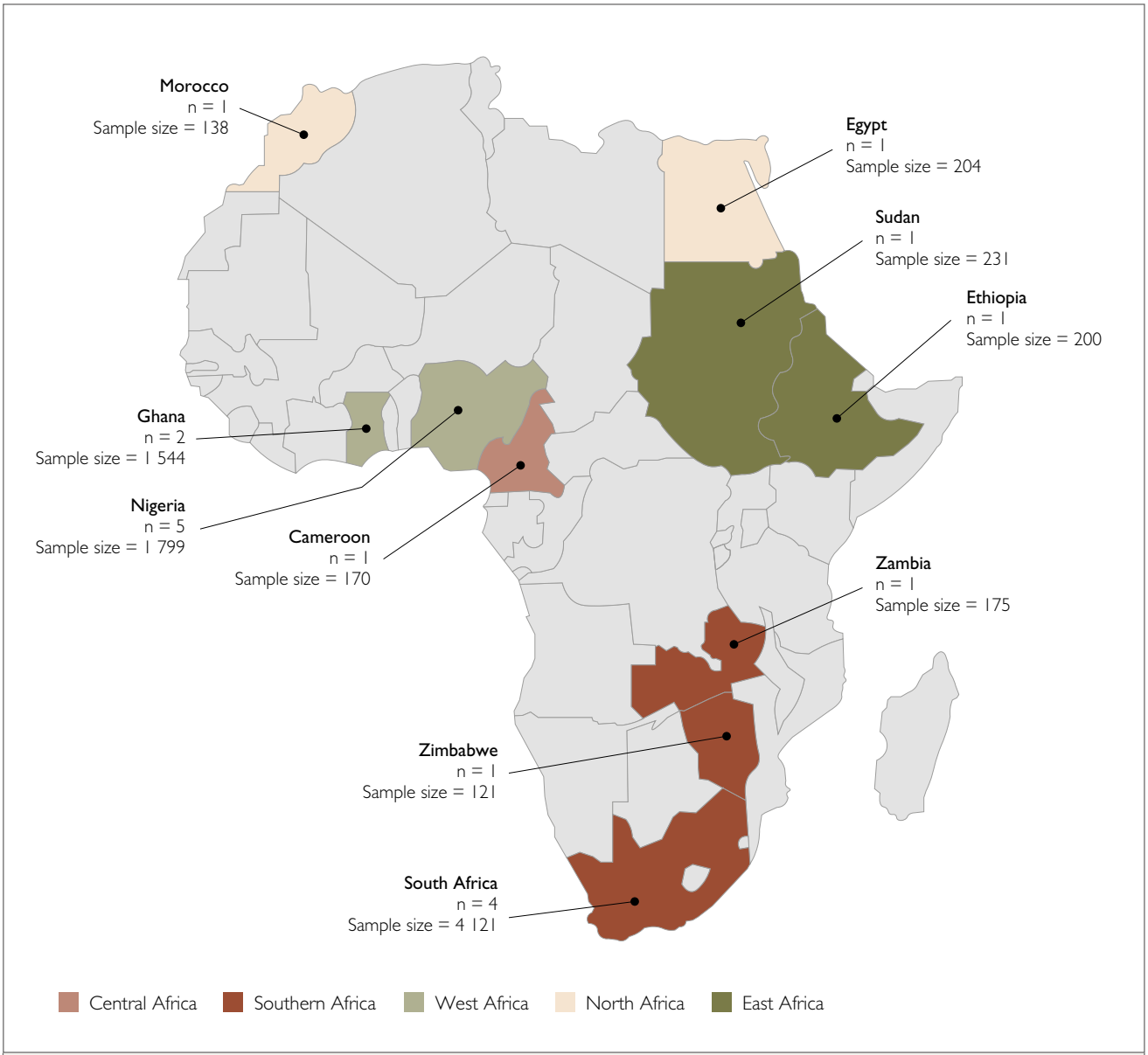


Figure 2. Geographical Distribution of Included Studies.

DISCUSSION

This review and meta-analysis determined the prevalence of AKI among patients with HDP in Africa. The pooled prevalence from the eighteen studies assessed was 6.0%. There was no significant variation in the pooled prevalence of AKI among HDP patients across the subregions of Africa. Studies that reported the use of established criteria for the diagnosis had a higher pooled prevalence of AKI. Following from this, the prevalence of AKI among HDP patients was higher in the post-RIFLE compared to the pre-RIFLE era.

According to recent reports [3-5,7], HDP is becoming a relatively common cause of PRAKI when compared with sepsis and haemorrhage, especially in middle- and high-income countries. This could be partly explained by the contracted intravascular volume associated with pre-eclampsia [44], an increase in the frequency of high-risk pregnancies in females of greater age; comorbidities such as chronic hypertension, diabetes mellitus and CKD, and a reduction in cases of obstetric haemorrhage and puerperal sepsis [4,5,45,46]. The increasing popularity and acceptance of assisted reproductive techniques in Africa may also account for this development.

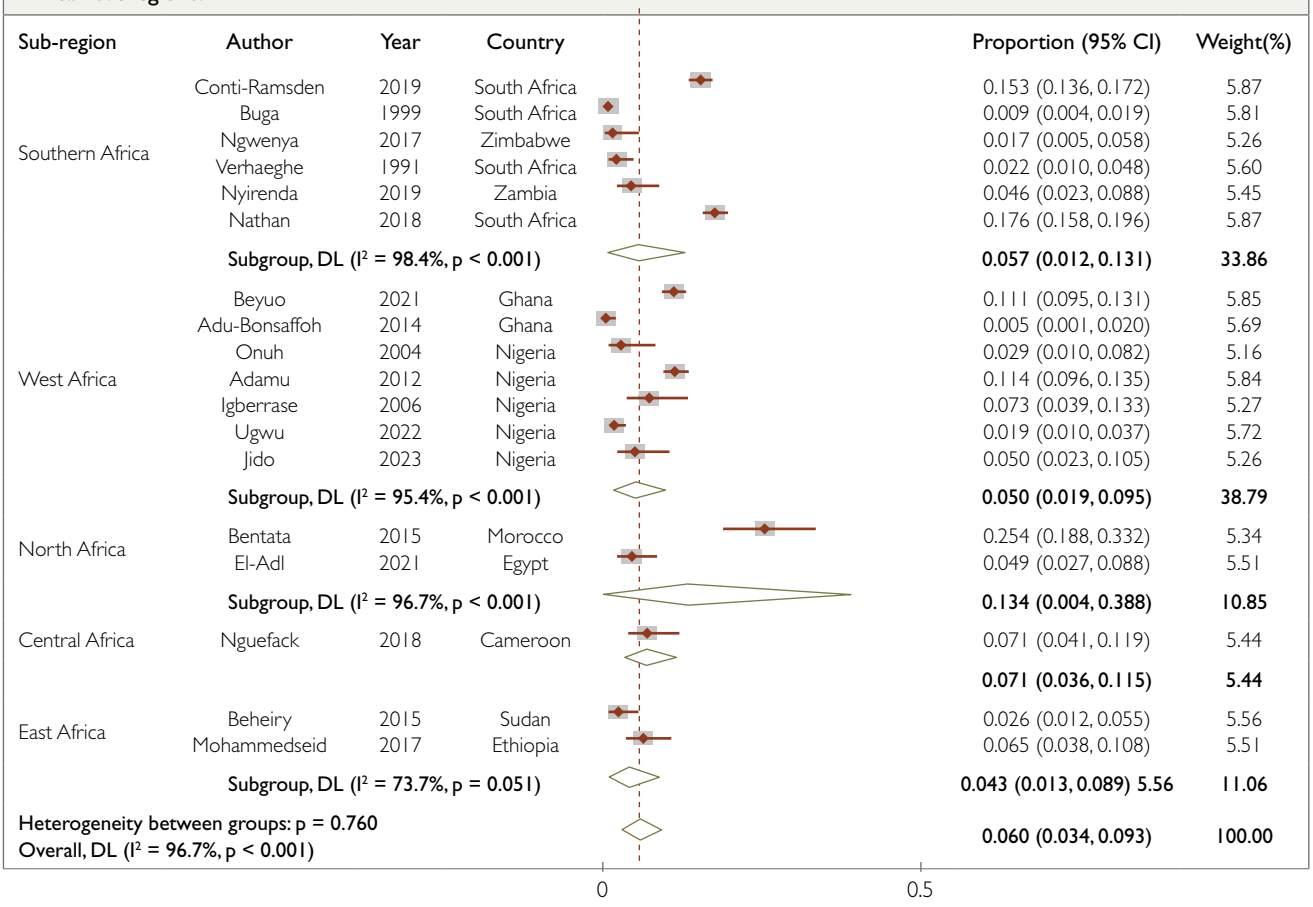
The pooled prevalence of AKI in HDP in this review is likely to be an underrepresentation of the burden of the disease due to several factors. First, most of the studies reported here did not use standard KDIGO, AKIN and RIFLE criteria to define the diagnosis of AKI in their study populations even though they were conducted after these criteria were established and published. Second, most of the studies relied solely on the increase in serum creatinine, which may

Table 1. Summary of extracted data from all included studies.

Author	Publication Year	Country	Sub-region	Speciality	Sample size	Study duration (months)	Study design	HTN Pregnancy	Eclampsia	Pre-eclampsia	Nulli-parous	ANC	Mean age	Median GA delivery	Mean SBP	Mean DBP	KDIGO criteria	RIFLE criteria	AKIN criteria	AKI number	Dialysis number	JBI Score
Conti-Ramsden	2019	South Africa	SA	Women & Child Health	1547	17	Cohort	NA	147	1547	564	47	28	32	178	108	Yes	No	No	237	4	6
Beyuo	2021	Ghana	WA	O & G	1176	24	RCT	NA	116	1060	376	522	31	36	180	111	No	No	No	131	3	6
Bonsaffoh	2014	Ghana	WA	O & G	368	2	Cross Sect	184	58	140	138	NA	31.45	37	157	102	No	No	No	2	NA	5
Onuh	2004	Nigeria	WA	O & G	103	96	Cross Sect	NA	103	NA	54	13	27.10	NA	NA	NA	No	No	No	3	NA	6
Adamu	2012	Nigeria	WA	O & G	1027	120	Cross Sect	NA	1027	NA	778	68	21	NA	NA	NA	No	No	No	117	NA	5
Bentata	2015	Morocco	NA	Nephrology	138	84	Cross Sect	NA	72	138	76	NA	29	33	179	110	No	Yes	No	35	6	5
Buga	1999	South Africa	SA	O & G	760	24	Cross Sect	NA	114	502	NA	NA	25	NA	NA	NA	No	No	No	7	NA	6
Ngwenya	2017	Zimbabwe	SA	O & G	121	12	Cohort	NA	26	95	NA	89	27.7	33	168	113	No	No	No	2	NA	6
Nguefack	2018	Cameroon	CA	O & G	170	5	Cross Sect	30	22	148	48	NA	30	NA	NA	NA	No	No	No	12	NA	6
Igberase	2006	Nigeria	WA	O & G	123	120	Cross Sect	NA	123	NA	72	17	24.3	NA	174	112	No	No	No	9	NA	7
Ugwu	2022	Nigeria	WA	O & G	426	60	Cross Sect	NA	33	NA	NA	NA	NA	NA	NA	NA	No	No	No	8	NA	6
Beheiry	2015	Sudan	EA	Physiology	231	25	Case-Control	72	NA	72	NA	NA	NA	NA	143	97	No	No	No	6	NA	6
Verhaeghe	1991	South Africa	SA	O & G	267	10	Case-Control	267	16	NA	98	NA	NA	NA	NA	NA	No	No	No	6	NA	6
Nyirenda	2019	Zambia	SA	Biochemistry	175	6	Cross Sect	175	NA	NA	55	NA	NA	NA	NA	NA	No	No	No	8	NA	4
Jido	2012	Nigeria	WA	O & G	120	NA	Cross Sect	NA	120	NA	66	37	21.5	NA	NA	NA	No	No	No	6	1	5
Nathan	2018	South Africa	SA	Women & Child Health	1547	17	Cross Sect	NA	147	1547	564	NA	27.6	32	172	104	No	No	No	272	NA	5
El-Adl	2021	Egypt	NA	O & G	204	12	Cross Sect	NA	204	NA	NA	NA	28	34	165	100	No	No	No	10	NA	5
Mohammedseid	2017	Ethiopia	EA	Pharmacy	200	12	Cross Sect	NA	200	NA	NA	NA	NA	NA	NA	NA	No	No	No	13	NA	5

Abbreviations: SA, Southern Africa; WA, West Africa; NA, North Africa; CA, Central Africa; EA, East Africa; O & G, Obstetrics & Gynaecology; RCT, Randomized Control Trial; Cross Sect, Cross Sectional STudy; HTN, Hypertension; ANC, Antenatal care; GA, Gestational age; SBP, Systolic blood pressure; DBP, Diastolic blood pressure; KDIGO, Kidney Disease Improving Global Outcomes; RIFLE, Risk, Injury, Failure, Loss and End-stage Kidney; AKIN, Acute Kidney Injury Network; AKI, Acute Kidney Injury; JBI, Joanna Briggs Institute Scoring; NA, No data available.

Figure 3. Forest plot showing the pooled prevalence of acute kidney injury in hypertensive disorders of pregnancy across the African subregions.



NOTE: Weights and between-subgroup heterogeneity test are from random-effects model.

raise the likelihood of missing out on the diagnosis of those with early AKI. This is primarily because the biochemical changes in AKI lag behind the injury [47]. Third, most of the studies were led by obstetricians, and did not obviously report the input of nephrologists in their methodology. This may also contribute to the non-recognition of early stages of AKI. Reports from previous studies have shown that physicians who are not nephrologists have poor knowledge of how to recognise and manage AKI [48,49].

The 15% prevalence of AKI reported among 3 515 patients with pre-eclampsia with severe features in the United States using KDIGO criteria [50] is higher than the 6% recorded in our study but closer to the 19.6% pooled prevalence reported among the subgroup of studies that used defined AKI criteria. The selection criteria used in the different studies may account for this difference. Although this review included patients with HDP irrespective of the severity, the US study involved patients with pre-eclampsia who had severe features and, therefore, were more prone to complications such as AKI. In addition, this US study used KDIGO criteria, which is a standard procedure and permits early diagnosis of AKI. It is noteworthy, however, that about 80% of the patients with AKI in the American study had stage 1 AKI based on the KDIGO classification. This shows the importance of making deliberate efforts promptly to diagnose AKI in at-risk populations. The prevalence reported in our systematic review is also lower than the 25.8% recorded among patients with eclampsia admitted to the intensive care unit in a study conducted in Morocco where AKI was defined by a serum creatinine greater than 140 µmol/L [51]. The higher value reported in the Moroccan study may be due to the fact that they observed patients with severe HDP who were very ill and more likely to develop AKI.

The prevalence of AKI in our study is higher than the 4.7% reported by Novotny et al. [52] in another US study involving 810 patients with pre-eclampsia, in which serum creatinine above 107µmol/L was used to define AKI. It is also higher than the 3.3% reported in French Guiana for patients with HDP [53]. The lower prevalence in the French study may be because the population consisted of patients with less severe HDP. However, the prevalence of AKI is comparable to 6.3% and 5.4% reported in two countries in

Asia [54,55]. This is not surprising because many countries in Africa and Asia are classified as low- to middle-income countries with similar health indices and challenges.

The wide variation in prevalence rates of AKI in cases of HDP in various studies may be due to the differences in criteria used in the diagnosis. There are no unified criteria for the diagnosis of PRAKI. The current RIFLE, AKIN and KDIGO criteria used in the general population have not been validated in the pregnant population [17-19]. Physiological changes associated with pregnancy, such as glomerular hyperfiltration, elevated kidney plasma flow and vasodilatation, lead to reduced serum creatinine [56]. The implication is that in pregnancy, lower creatinine values may still indicate early AKI and not be recognised as such as they fall within normal ranges outside pregnancy [57]. The KDIGO criteria may be of use in HDP patients with a baseline serum creatinine when pregnancy is confirmed, where a 50% increase in serum creatinine from the baseline already indicates stage 1 AKI.

This review also observed that using well-defined AKI criteria improves the sensitivity of detecting AKI in cases of HDP. There was a higher prevalence of AKI in the post-RIFLE era than in the pre-RIFLE era. Also, the pooled AKI prevalence in the studies that used established AKI consensus criteria was significantly higher than in those that did not use any criteria. This underscores the importance of using established criteria for AKI diagnosis in PRAKI while working on standard criteria that will recognise the peculiarities of the physiological changes associated with pregnancy.

The role of baseline kidney function in the early diagnosis and management of AKI cannot be over-emphasised. While it may not be practical and cost-effective to confirm baseline kidney function in those living in low- and middle-income countries, patients with risk factors for AKI, such as HDP, should have kidney function tests done at the time of diagnosis or when booking for pregnancy care. In addition, such patients should be co-managed by nephrologists in order to prevent AKI or ensure prompt diagnosis and management to obviate the need for kidney replacement therapy, which is not affordable by patients subject to most health systems in low- and middle-income countries.

A systematic review and meta-analysis by Soares et al. showed that delayed involvement of nephrologists in the management of AKI is associated with higher mortality [58]. Alghamdi et al. also reported that longer hospital stays and the need for KRT are associated with delayed consultation with nephrologists [59]. These reports highlight the need to involve nephrologists in the management of patients with HDP even before AKI sets in. Training obstetricians and midwives to recognize early PRAKI may offer a substitute pathway in African countries or subregions with inadequate nephrology cover. The provision of multidisciplinary care involving nephrologists for patients with HDP before the onset of kidney complications will consequently reduce the prevalence of CKD, which has become an epidemic in Africa since AKI is an established risk factor for the development and progression of CKD [60]. This approach will also help to reduce morbidity and mortality associated with AKI in cases of HDP. The provision of multidisciplinary care involving nephrologists for patients with HDP before the onset of kidney complications will consequently reduce the prevalence of CKD, which has become an epidemic in Africa since AKI is an established risk factor for the development and progression of CKD [60]. This approach will also help to reduce morbidity and mortality associated with AKI in cases of HDP.

The strength of our study lies in the fact that it is the first to record the pooled prevalence of AKI in HDP in the African continent. Also, the review has brought to the fore the need to involve nephrologists in the management of HDP, which is pivotal to reducing associated morbidity and mortality. This study, however, has some limitations. First, most of the studies reported here were of moderate quality and did not diagnose AKI based on the established standard criteria. Second, most of the studies did not have baseline kidney function tests for comparison. Third, we could not compare the prevalence of AKI in the various types of HDP because there were no available data. Early AKI could therefore have been unrecognised, leading to an underestimation of the true prevalence of AKI. Finally, there is a need to validate the KDIGO criteria for the diagnosis of PRAKI in sub-Saharan Africa.

CONCLUSION

The pooled prevalence of AKI in cases of HDP in Africa was 6.0%. The use of well-defined AKI criteria improves the sensitivity of AKI detection. Most obstetric centres in Africa do not adopt a multidisciplinary approach in the management of HDP until severe AKI sets in as a complication. There is thus a need to involve nephrologists in the management of HDP as soon as a diagnosis is made, preferably during antenatal visits, to reduce the burden of AKI. It is imperative to develop standard criteria to use in diagnosing PRAKI, considering pregnancy-related factors.

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Conflict of interest

The authors have no conflict of interest to declare.

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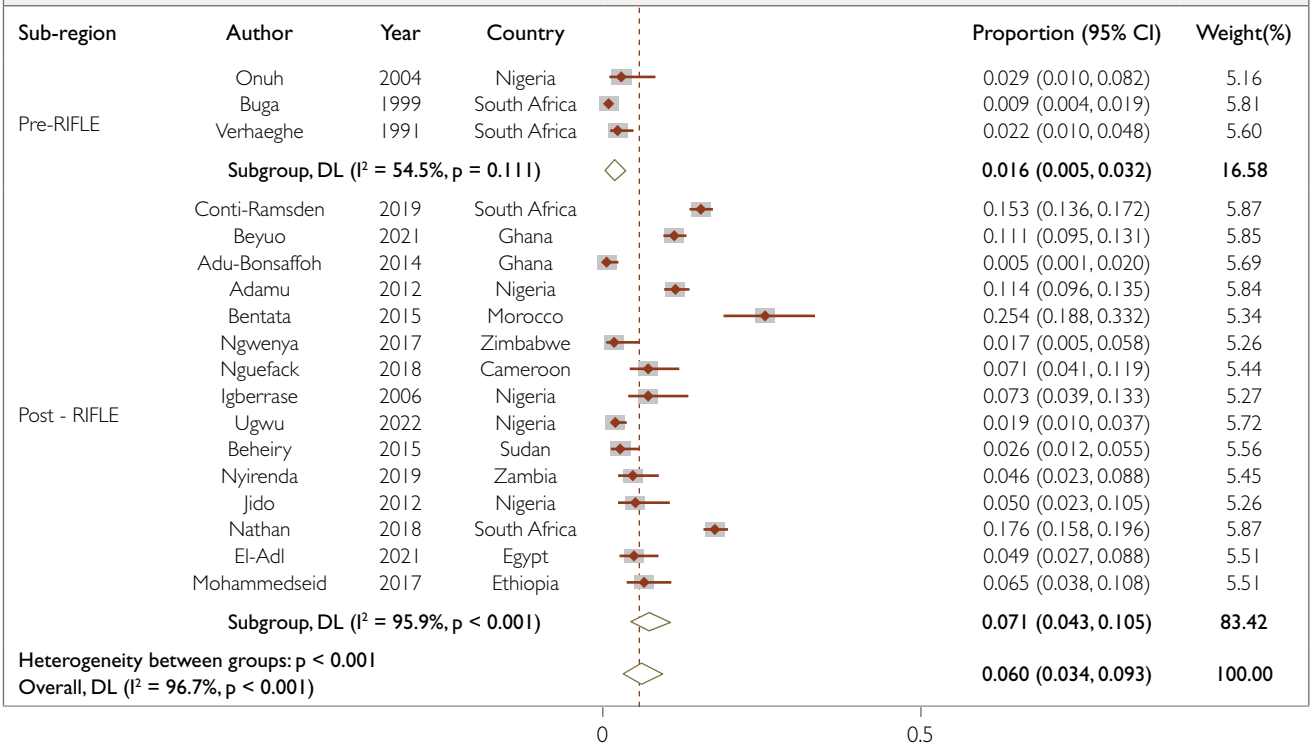
SUPPLEMENTARY FILES

Supplementary Table 1. Search Strategy on PubMed.

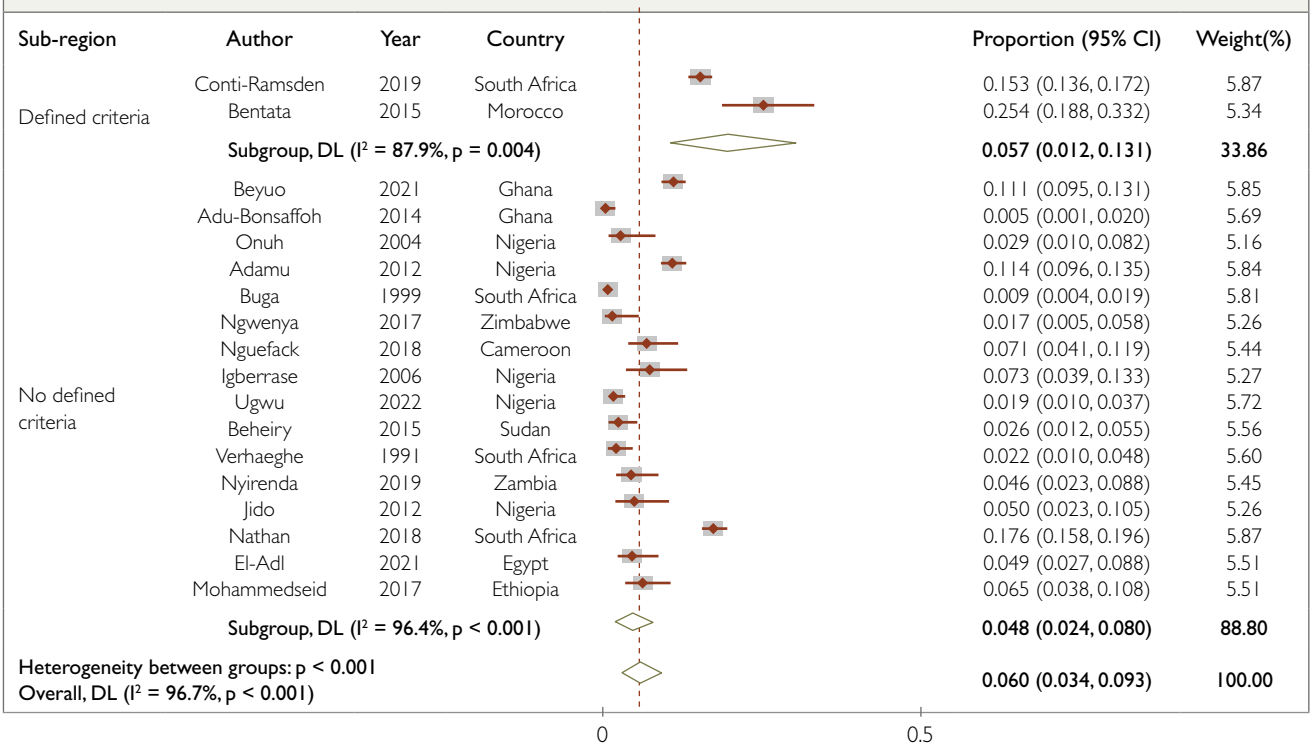
Search Number	Query	Result
4	((#1) AND (#2)) AND (#3)	487
3	((((((((((Hypertension) OR (High blood pressure)) OR (elevated blood pressure)) OR (eclampsia)) OR (pre-eclampsia)) OR (pregnancy-induced hypertension)) OR (hypertensive disorders of pregnancy)) OR (HELLP syndrome)) OR (gestational hypertension)) OR (chronic hypertension in pregnancy)) OR (gestational proteinuric hypertension)) OR (severe pre-eclampsia)	766 321
2	(((((((Acute kidney injury) OR (AKI)) OR (Acute renal failure)) OR (ARF)) OR (Acute Kidney Disease)) OR (acute renal dysfunction)) OR (acute renal insufficiency)) OR (acute kidney failure)) OR (acute renal impairment)	152 182
1	"Africa"[MeSH] OR Africa*[tw] OR Algeria[tw] OR Angola[tw] OR Benin[tw] OR Botswana[tw] OR "Burkina Faso"[tw] OR Burundi[tw] OR Cameroon[tw] OR "Canary Islands"[tw] OR "Cape Verde"[tw] OR "Central African Republic"[tw] OR Chad[tw] OR Comoros[tw] OR Congo[tw] OR "Democratic Republic of Congo"[tw] OR Djibouti[tw] OR Egypt[tw] OR "Equatorial Guinea"[tw] OR Eritrea[tw] OR Ethiopia[tw] OR Gabon[tw] OR Gambia[tw] OR Ghana[tw] OR Guinea[tw] OR "Guinea Bissau"[tw] OR "Ivory Coast"[tw] OR "Cote d'Ivoire"[tw] OR Jamahiriya[tw] OR Jamahiryia[tw] OR Kenya[tw] OR Lesotho[tw] OR Liberia[tw] OR Libya[tw] OR Libia[tw] OR Madagascar[tw] OR Malawi[tw] OR Mali[tw] OR Mauritania[tw] OR Mauritius[tw] OR Mayote[tw] OR Morocco[tw] OR Mozambique[tw] OR Mocambique[tw] OR Namibia[tw] OR Niger[tw] OR Nigeria[tw] OR Principe[tw] OR Reunion[tw] OR Rwanda[tw] OR "Sao Tome"[tw] OR Senegal[tw] OR Seychelles[tw] OR "Sierra Leone"[tw] OR Somalia[tw] OR "South Africa"[tw] OR "St Helena"[tw] OR Sudan[tw] OR Swaziland[tw] OR Tanzania[tw] OR Togo[tw] OR Tunisia[tw] OR Uganda[tw] OR "Western Sahara"[tw] OR Zaire[tw] OR Zambia[tw] OR Zimbabwe[tw] OR "Central Africa"[tw] OR "Central African"[tw] OR "West Africa"[tw] OR "West African"[tw] OR "Western Africa"[tw] OR "Western African"[tw] OR "East Africa"[tw] OR "East African"[tw] OR "Eastern Africa"[tw] OR "Eastern African"[tw] OR "North Africa"[tw] OR "North African"[tw] OR "Northern Africa"[tw] OR "Northern African"[tw] OR "South African"[tw] OR "Southern Africa"[tw] OR "Southern African"[tw] OR "sub Saharan Africa"[tw] OR "sub Saharan African"[tw] OR "subSaharan Africa"[tw] OR "subSaharan African"[tw])	748 639

Supplementary Figure 1. Forest plot showing the pooled prevalence in the pre and post-RIFLE era.



NOTE: Weights and between-subgroup heterogeneity test are from random-effects model.

Supplementary Figure 2. Forest plot showing pooled prevalence of acute kidney injury (AKI) in studies with or without defined AKI criteria.



NOTE: Weights and between-subgroup heterogeneity test are from random-effects model.