

**Original article**

## Knowledge, Attitudes, and Practices of Healthcare Personnel Regarding Hypertensive Disorders in Pregnancy: A preliminary Cross-Sectional Study

Connaissances, attitudes et pratiques du personnel de santé concernant les troubles hypertensifs pendant la grossesse : une étude transversale préliminaire

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**Résumé**

**InContexte :** Les troubles hypertensifs de la grossesse (THG) sont une cause majeure de morbidité/mortalité materno-fœtale, nécessitant des connaissances, attitudes et pratiques solides chez le personnel soignant.

**Méthodologie :** Étude transversale (mars–avril 2025) à l'Hôpital Notre Dame de la Paix auprès de 32 professionnels (sages-femmes, infirmiers, médecins, aides-soignants) via questionnaire prétesté. Scores : connaissances (31 pts), attitudes (10 pts), pratiques (24 pts) ; classés Mauvais (<50 %), Insuffisant (50–65 %), Modéré (65–85 %), Bon (>85 %). Test exact de Fisher pour associations profession/sexe.

**Résultats :** Scores médians : connaissances 17/31 (54,8 %), attitudes 5/10 (50 %), pratiques 11/24 (45,8 %). Connaissances Mauvaises (43,8 %), Insuffisantes (28,1 %) ; aucun Bon. Sages-femmes : plus de Modéré en connaissances ( $p<0,001$ ) et pratiques ( $p=0,004$ )

; infirmiers/aides-soignants dominant Mauvais. Attitudes sans lien avec profession ( $p=0,223$ ). Les définitions de pré-éclampsie et éclampsie n'étaient que partiellement correctes (31,25 % et 46,88 % respectivement) ; l'hypertension chronique n'était reconnue que par 53,1 %.

**Conclusion :** Les CAP relatives aux THG restent sous-optimales, surtout chez les infirmiers et aides-soignants. Des formations ciblées spécifiques à la profession sont indispensables pour améliorer les issues maternelles et néonatales.

**Mots-clés :** Troubles hypertensifs, grossesse, connaissances, attitudes, pratiques, personnel soignant.

**Abstract**

**Background:** Hypertensive disorders in pregnancy (HDP) are a major cause of maternal and foetal morbidity/mortality, demanding strong knowledge,

attitudes, and practices among healthcare staff.

**Methods:** Cross-sectional study (March–April 2025) at “Hôpital Notre Dame de la Paix” with 32 professionals (midwives, nurses, physicians, assistants) using a pretested questionnaire. Scores: knowledge (31 pts), attitudes (10 pts), practices (24 pts); categorized Poor (<50%), Insufficient (50–65%), Moderate (65–85%), Good (>85%). Fisher’s exact test assessed profession/sex associations.

**Results:** Median scores: knowledge 17/31 (54.8%), attitudes 5/10 (50%), practices 11/24 (45.8%). Knowledge Poor (43.8%), Insufficient (28.1%); no Good. Midwives showed highest Moderate knowledge ( $p<0.001$ ) and practices ( $p=0.004$ ); nurses/assistants dominated Poor. Attitudes unrelated to profession ( $p=0.223$ ). Definitions of pre-eclampsia and eclampsia were only partially correct (31.25% and 46.88% respectively); chronic hypertension recognized by only 53.1%.

**Conclusion:** KAP regarding HDP remains suboptimal, particularly among nurses and nursing assistants. Profession-specific targeted training is urgently needed to improve maternal and neonatal outcomes.

**Keywords:** Hypertensive disorders, pregnancy, knowledge, attitudes, practices, healthcare personnel.

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## Introduction

Hypertensive disorders of pregnancy (HDP), encompassing chronic hypertension, gestational hypertension, pre-eclampsia, and eclampsia, represent a significant global health challenge, complicating 5–10% of pregnancies and contributing substantially to maternal and foetal morbidity and mortality [1–3]. In high-income countries, hypertension is a leading cause of maternal mortality, accounting for 16% of maternal deaths, with the incidence of HDP in countries like the United States of America reported to have risen from 2.79% in 1989 to 8.22% in 2020 [4]. Pre-eclampsia alone affects approximately 3% of U.S. pregnancies, with higher risks (25–50%) among women with prior HDP or chronic hypertension

compared to low-risk women with singleton gestations (<10%) [5]. Untreated HDP can lead to severe complications, including preterm delivery, low birthweight, and maternal risks such as pulmonary oedema, renal injury, and increased long-term cardiovascular disease risk [6,7].

Effective management of HDP requires healthcare professionals to have robust knowledge of diagnostic criteria, risk factors, and evidence-based interventions, as well as positive attitudes and consistent clinical practices [8]. In resource-constrained settings, where access to specialized obstetric care is often limited, midwives, nurses, and nursing assistants play a pivotal role in maternal care [9,10]. However, gaps in training, resource availability, and adherence to current guidelines can compromise care quality, exacerbating adverse outcomes [11].

This study evaluates the knowledge, attitudes, and practices (KAP) of healthcare professionals in a specific healthcare setting regarding HDP. By assessing their understanding of HDP definitions, risk factors, complications, and management protocols, this research aims to identify deficiencies and inform targeted interventions to enhance maternal and neonatal outcomes in resource-limited environments.

## Methodology

### • *Study Design*

This was a cross-sectional observational study conducted among healthcare personnel in a clinical setting, adhering to the STROBE guidelines for reporting observational studies.

### • *Setting*

The study was conducted at “Hôpital Notre Dame de la Paix” between March–April 2025. The facility is a confessional hospital at the outskirts of the city of Garoua and serving a diverse population, predominantly rural. Services, which include managing a high volume of obstetric cases, including hypertensive disorders in pregnancy, are primarily handled by non-physiocan personnel with a supervising general practitioner. There is no

gynaecologist in this facility and therefore day to day services are handled by nurses, nurse assistants and midwives

- *Participants*

Eligible participants included healthcare professionals (midwives, nurses, physicians, and nursing assistants) actively involved in maternal care. Inclusion criteria were: (1) employment in the facility during the study period, and (2) direct involvement in obstetric care. Exclusion criteria included incomplete questionnaire responses or refusal to participate. A convenience sampling method was used.

- *Variables*

- *Primary variables*

**Knowledge:** Assessed using a 31-point sub-questionnaire covering definitions, classifications, risk factors, clinical manifestations, and complications of hypertensive disorders in pregnancy. See supplementary files.

**Attitudes:** Evaluated using a 10-point sub-questionnaire on preventive behaviours, patient counselling, and referral decisions.

**Practices:** Assessed using a 24-point sub-questionnaire on diagnostic examinations, treatment thresholds, and medication contraindications.

- *Secondary variables*

These included age, years of professional experience, profession, and sex.

- *Data Sources/Measurement*

Data were collected using a structured questionnaire administered in person. The knowledge section included 31 questions (e.g., definition of hypertension as TA  $\geq$  140/90 mmHg, risk factors like obesity, and complications like HELLP syndrome). The attitudes section included 10 questions (e.g., use of low-dose aspirin for pre-eclampsia prevention), and the practices section included 24 questions (e.g., use of labetalol for treatment). Responses were scored as correct or incorrect, with total correct scores categorised as Poor (<50%), Insufficient (50–65%), Average (65–85%), or Good (>85%).

- *Bias*

To minimize selection bias, all eligible healthcare

personnel in the facility were invited to participate. Response bias was addressed by ensuring anonymity and using standardized questions. Though the questionnaire used in this study was pretested, it was not validated using robust indices like Cronbach alpha, intraclass correlation or factor analysis.

- *Study Size*

No sample size calculation was done, as purposive sampling related to the number of eligible healthcare workers available during the study period. No formal sample size calculation was performed due to the preliminary nature of this study.

- *Statistical Methods*

Descriptive statistics were used to summarize age, years of experience, and KAP scores (median and interquartile range [IQR]). Fisher's exact test was used to assess associations between categorical variables (profession, sex) and KAP categories. Statistical significance was set at  $p < 0.05$ . Analyses were performed using SPSS v.29.

## Results

- *Participants*

The study included 32 healthcare professionals: 13 midwives (40.6%), 10 nurses (31.2%), 8 nursing assistants (25%), and 1 physician (3.1%), mostly female (78.1%,  $n=25$ ), with a median age of 30 (IQR: 28.7–37.3) and 4 years of experience (IQR: 4–7).

- *Descriptive Data*

Overall KAP performance was suboptimal across all domains. The median knowledge score was 17/31 (54.8%, IQR: 12–21), attitudes 5/10 (50%, IQR: 4.7–6.0), and practices 11/24 (45.8%, IQR: 9–13). No participant achieved a “Good” score (>85%) in any domain. Detailed item-level responses are presented in Tables I, II, and III.

- *Knowledge*

There was universal recognition of severe pre-eclampsia manifestations such as intense headaches (100%) and visual disturbances (87.5%), as well as major complications like maternal/infant mortality (100%) and placental abruption (90.6%).

Hypertension threshold was correctly identified by only 59.4%, chronic hypertension by 53.1%, pre-eclampsia definition by 31.25%, and eclampsia definition by 46.88%. Risk factors (e.g., nulliparity, obesity) were poorly recognized (31.25–43.75%). Rare complications such as HELLP syndrome were almost never identified (3.1%). See Table I for details.

#### - Attitudes

Routine blood pressure monitoring was reported by 90.63% (n=29), but only 25% (n=8) correctly recommended low-dose aspirin and calcium for pre-eclampsia prevention, while 50% (n=16) incorrectly suggested low protein/high sodium intake. Counselling correctly included low-sodium diet (81.25%, n=26) and recognizing danger signs (78.13%, n=25), but 78.13% (n=25) incorrectly recommended physical exercise and strict rest. Referral for uncontrolled blood pressure was correctly chosen by 34.38% (n=11), and postpartum follow-up by 78.13% (n=25). HDP history inquiries were always made by 40.63% (n=13) as shown in Table II.

#### - Practices

Correct blood pressure measurement after 5 minutes of rest was reported by 46.88% (n=15), and baseline blood pressure importance by 65.63% (n=21). Only 25% (n=8) managed elevated blood pressure directly. Diagnostic tests like urinary dipstick (78.13%, n=25) and creatinine (71.88%, n=23) were correctly ordered, but 59.38% (n=19) incorrectly ordered blood culture. Treatment thresholds were correctly identified by 21.88% (n=7) as BP  $\geq$ 140/90 mmHg. Medications like magnesium sulfate (96.88%, n=31) and nifedipine (93.75%, n=30) were correctly recommended, but phenobarbital (87.5%, n=28) was incorrectly chosen. Target blood pressure (<140/90 mmHg) was correctly aimed for by 34.38% (n=11). Contraindicated medications were correctly identified by few, with 28.13% (n=9) noting angiotensin II receptor blockers as shown in Table III.

#### • Outcome Data

Knowledge was classified as Poor in 43.8% (n=14), Insufficient in 28.1% (n=9), and Moderate in 28.1% (n=9), with no Good scores. Attitude was classified as

Poor in 46.9% (n=15), Insufficient in 34.4% (n=11), and Moderate in 18.8% (n=6), with no Good scores. Practices were classified as Poor in 50.0% (n=16), Insufficient in 34.4% (n=11), and Moderate in 15.6% (n=5), with no Good scores.

#### • Main Results

Fisher's exact test showed significant associations between knowledge ( $p < 0.001$ ) and practices ( $p = 0.004$ ) with profession, but no association with attitudes ( $p = 0.223$ ) or sex (knowledge:  $p = 0.667$ ; attitudes:  $p = 0.804$ ; practices:  $p = 0.747$ ).

Midwives had the highest proportion of Moderate knowledge scores, while nurses and nursing assistants dominated the Poor category (50% each). Midwives had the highest proportion of Moderate attitudes (80.0%), while nurses (36.4%) and nursing assistants (31.8%) dominated Poor categories. Midwives had the highest proportion of Moderate practices (66.7%), while nurses and nursing assistants dominated Poor categories (50% each).

#### • Other Analyses

The small sample size (n=32) and single physician limited robust subgroup comparisons. No additional statistical tests were performed due to the categorical nature of outcomes.

Table I: Knowledge Regarding Hypertensive Disorders in Pregnancy

Question	Correct Answer	Correct Responses (n, %)	Incorrect/Unsure (n, %)
Hypertension definition	TA $\geq$ 140/90 mmHg	19 (59.38%)	13 (40.62%)
Chronic hypertension as HDP	Yes	17 (53.13%)	15 (46.88%)
Loss of consciousness as HDP manifestation	Yes	19 (59.38%)	13 (40.62%)
Nephroangiosclerosis as HDP	Yes	15 (46.9%)	17 (53.1%)
Eclampsia as HDP	Yes	28 (87.5%)	4 (12.5%)
Gestational hypertension as HDP	Yes	22 (68.75%)	10 (31.25%)
Gestational hypertension definition manifestation	HTA without proteinuria after 20 weeks	13 (40.63%)	19 (59.37%)
Chronic hypertension definition	HTA before pregnancy or <20 weeks	15 (46.88%)	17 (53.12%)
Pre-eclampsia definition	HTA with proteinuria after 20 weeks	10 (31.25%)	22 (68.75%)
Eclampsia definition	Seizures in hypertensive woman with proteinuria	15 (46.88%)	17 (53.12%)
Prior/family history of pre-eclampsia	Yes	17 (53.13%)	15 (46.87%)
Chronic HTN/renal disease/diabetes	Yes	11 (34.38%)	21 (65.62%)
Obesity (BMI >30)	Yes	14 (43.75%)	18 (56.25%)
Multiple pregnancy	Yes	13 (40.63%)	19 (59.37%)
Nulliparity	Yes	10 (31.25%)	22 (68.75%)
Extreme maternal age (<18 or >40)	Yes	10 (31.25%)	22 (68.75%)
Severe pre-eclampsia: Severe HTA ( $\geq$ 160/110 mmHg)	Yes	14 (43.75%)	18 (56.25%)
Severe pre-eclampsia: Renal impairment	Yes	11 (34.38%)	21 (65.62%)
Severe pre-eclampsia: Chest pain/dyspnoea/pulmonary oedema	Yes	12 (37.5%)	20 (62.5%)
Severe pre-eclampsia: Epigastric/right hypochondrial pain	Yes	21 (65.63%)	11 (34.37%)
Severe pre-eclampsia: Hepatic cytolysis	Yes	9 (28.13%)	23 (71.87%)
Severe pre-eclampsia: Thrombocytopenia	Yes	23 (71.88%)	9 (28.12%)
Severe pre-eclampsia: Intense headaches	Yes	32 (100%)	0 (0%)
Severe pre-eclampsia: Visual disturbances	Yes	28 (87.5%)	4 (12.5%)

Eclampsia manifestations	Vision loss, intense headaches, seizures	15 (46.88%)	17 (53.12%)
HDP complications exist	Yes	32 (100%)	0 (0%)
Cerebral haemorrhage	Yes	17 (53.13%)	15 (46.87%)
Renal failure	Yes	11 (34.38%)	21 (65.62%)
Placental abruption	Yes	29 (90.63%)	3 (9.37%)
Maternal/infant mortality	Yes	32 (100%)	0 (0%)
Other complications (e.g., HELLP, FGR, preterm delivery)	Yes	1 (3.13%)	31 (96.87%)

Table II: Attitudes Regarding Hypertensive Disorders in Pregnancy

Question	Correct Answer	Correct Responses (n, %)	Incorrect/Unsure (n, %)
Routine BP monitoring	Yes	29 (90.63%)	3 (9.37%)
Pre-eclampsia prevention	Low-dose aspirin and calcium	8 (25%)	24 (75%)
Physical exercise for pre-eclampsia	No	6 (18.75%)	25 (78.13%)
Low-sodium diet for pre-eclampsia	Yes	26 (81.25%)	6 (18.75%)
Recognizing danger signs	Yes	25 (78.13%)	6 (18.75%)
Strict rest for pre-eclampsia	No	6 (18.75%)	25 (78.13%)
High-protein/lipid diet	No	13 (40.63%)	19 (59.38%)
Referral timing	When BP uncontrolled	11 (34.38%)	21 (65.62%)
Postpartum BP follow-up	Yes	25 (78.13%)	7 (21.87%)
Inquire about HDP history	Always	13 (40.63%)	19 (59.37%)

Table III: Practices Regarding Hypertensive Disorders in Pregnancy

Question	Correct Answer	Correct Responses (n, %)	Incorrect/Unsure (n, %)
BP measurement timing	After 5 min rest	15 (46.88%)	17 (53.12%)
Baseline BP importance	Yes	21 (65.63%)	11 (34.37%)
Response to elevated BP	Manage directly	8 (25%)	24 (75%)
Urinary dipstick	Yes	25 (78.13%)	7 (21.87%)
Complete blood count	Yes	15 (48.39%)	16 (51.61%)
Creatinine	Yes	23 (71.88%)	9 (28.12%)
Blood culture	No	8 (25%)	24 (75%)
Obstetric ultrasound	Yes	10 (31.25%)	22 (68.75%)
Treatment threshold	TA $\geq$ 140/90 mmHg	7 (21.88%)	25 (78.12%)
Phenobarbital	No	1 (3.13%)	31 (96.87%)
Labetalol	Yes	24 (75%)	8 (25%)
Nifedipine	Yes	30 (93.75%)	2 (6.25%)
Nicardipine	Yes	27 (84.38%)	5 (15.62%)
Methyldopa	Yes	23 (71.88%)	9 (28.12%)
Hydrochlorothiazide	No	15 (46.88%)	17 (53.12%)
Magnesium sulfate	Yes	31 (96.88%)	1 (3.12%)
Diuretics (e.g., Lasilix) if no PE	No	6 (18.75%)	26 (81.25%)
Target BP (renal/diabetes)	TA < 140/90 mmHg	11 (34.38%)	21 (65.62%)
Magnesium sulfate administration	IV or IM	14 (43.75%)	18 (56.25%)
Beta-blockers contraindicated	No	5 (15.63%)	27 (84.37%)
ARB contraindicated	Yes	9 (28.13%)	23 (71.87%)
Diuretics contraindicated if no PE	Yes	6 (18.75%)	26 (81.25%)
Calcium channel blockers	No	11 (34.38%)	21 (65.62%)
ACE inhibitors	Yes	5 (15.63%)	27 (84.37%)

PE=Pulmonary oedema. ARB=Angiotensin II receptor blockers, ACE=Angiotensin Converting Enzyme

## Discussion

This preliminary study documents important deficiencies in KAP regarding HDP among healthcare workers in a Cameroonian hospital setting. Median scores remained low across domains, with no “Good” performers. Midwives consistently performed better, likely reflecting more specialized obstetric training.

The findings of the study by Anuranjani et al. (2022) align with prior research highlighting gaps in knowledge, attitudes, and practices (KAP) among healthcare professionals managing hypertensive disorders of pregnancy (HDP), particularly in resource-constrained settings [12]. For instance, Ndirahisha et al. (2022) [13] reported comparable knowledge levels, with 85.7% of physicians and 65.3% of nurses correctly defining HDP, higher than the 59.38% in this study correctly defining hypertension threshold. The recognition of pre-eclampsia symptoms, such as headache (100%), mirrors findings by Olaoye et al. (2019), where 88.1% identified headache as a key symptom [14]. Attitude scores in this study (median, 50.0%) are slightly lower than those reported by Stellenberg et al. (2016) [15], where 66.3% of midwives demonstrated positive attitudes, possibly due to differences in training exposure in South Africa. The endorsement of inappropriate preventive measures, such as rest and reduced salt intake, contradicts WHO guidelines advocating low-dose aspirin and calcium supplementation, a finding also noted by Ramadurg et al. (2016) [16]. Practices like waiting for 5 minutes for BP measurement was reported in 46.9%, a finding much lower than that reported by Olaoye et al. (2019) [14], where only 64% of providers adhered to blood pressure measurement protocols.

Only 40.63% correctly defined gestational hypertension, suggesting a need for targeted education on diagnostic criteria. The association between profession and KAP highlight the impact of midwifery training, likely exposed to more obstetric education, outperformed nurses. While practices like blood pressure monitoring (90.63%) and magnesium sulfate use (96.9%) are encouraging, inconsistencies

remain, such as only 46.9% adhering to proper blood pressure measurement conditions. These gaps highlight systemic issues in training and guideline dissemination, consistent with Safaa et al. (2017) [17], who noted improved knowledge post-intensive education.

These deficiencies may stem from systemic causes such as inadequate pre-service training curricula that do not emphasize HDP in depth for nurses and assistants, limited access to continuing medical education (CME) in resource-poor settings [18,19] like Cameroon, and institutional barriers including high workloads, lack of updated guidelines, and insufficient diagnostic tools. For example, the low recognition of chronic hypertension (53.1%) could reflect outdated educational materials or infrequent exposure to HDP cases in non-specialized roles. Similarly, attitudinal misconceptions (e.g., endorsing physical exercise) may arise from cultural beliefs or misinformation not addressed in formal training.

This study however has several limitations. The very small sample size (n=32, including only one physician) severely limits statistical power, increases the risk of type II errors, and precludes reliable physician subgroup analysis. Associations with profession should therefore be interpreted with caution. Results cannot be generalized beyond this single facility in Cameroon. Self-reported attitudes and practices are susceptible to social desirability bias. The questionnaire, while pretested, lacked formal psychometric validation (Cronbach’s alpha, factor analysis, test-retest reliability), representing a major weakness that may affect score interpretability and introduce measurement bias. Single-centre design and absence of contextual variables (resource availability, training exposure) further limit depth. Despite its limitations, this preliminary study has several strengths. It provides much-needed baseline data on KAP regarding HDP in a resource-constrained Cameroonian hospital setting, where non-physician providers deliver the majority of maternal care. The comprehensive questionnaire and profession-stratified analysis offer detailed insights into specific

gaps (e.g., poor recognition of treatment thresholds despite good emergency drug knowledge), enabling targeted recommendations. As a cross-sectional design, it is efficient, low-cost, and well-suited for generating hypotheses and informing future larger-scale or interventional research in similar low-resource African contexts.

For research, policy and practice, we recommend the following: Implementing profession-specific workshops: for nurses and assistants, 2-day modules on HDP diagnostics and contraindications; for all staff, annual CME with simulations on BP measurement and aspirin/calcium protocols. At the policy level, mandating HDP certification for maternal care roles and integrating updated WHO guidelines into national curricula could mitigate systemic issues. Future studies should prioritize multi-center, quasi-experimental or randomized intervention trials evaluating practical, low-cost training packages (simulation workshops, low-bandwidth e-learning, clinical audits, and mentorship) targeted at nurses and nursing assistants, with longitudinal follow-up to assess sustained improvements in knowledge, attitudes, practices, and, ideally, clinical outcomes such as timely HDP detection, appropriate management, and reduced maternal/neonatal morbidity in resource-limited settings.

## Conclusion

This study highlights critical gaps in the knowledge, attitudes, and practices of healthcare professionals regarding hypertensive disorders of pregnancy. With median scores of 54.8% for knowledge, 50.0% for attitudes, and 45.8% for practices, and no participants achieving “good” scores, there is a clear need for targeted interventions to enhance competency. Midwives demonstrated relatively better performance, suggesting that specialized training improves outcomes. Knowledge deficits in diagnostic criteria, attitudinal misconceptions about prevention, and inconsistent practices underscore the urgency of educational and systemic interventions.

Addressing these gaps through tailored training, guideline dissemination, and resource support could improve the management of HDP, ultimately reducing maternal and neonatal morbidity and mortality. Future research should focus on scalable interventions and their impact on clinical outcomes in diverse settings.

## What is known about the topic

Hypertensive disorders in pregnancy (HDP) complicate 5–10% of pregnancies globally, contributing significantly to maternal and foetal morbidity/mortality, with rising incidence in high-income settings.

Healthcare professionals in resource-limited areas often exhibit gaps in HDP knowledge (e.g., diagnostic criteria, risk factors), attitudes (e.g., prevention strategies), and practices (e.g., BP measurement, treatment thresholds).

Although, different professions may exhibit differing knowledge and adherence to guideline and exacerbate poor outcomes, few studies have explored this research gap.

## What this study adds

In this study, median KAP scores were suboptimal (knowledge 54.8%, attitudes 50%, practices 45.8%), with no “good” performers and nurses/assistants dominating poor categories.

Midwives achieved the highest moderate scores in knowledge ( $p < 0.001$ ) and practices ( $p = 0.004$ ), highlighting profession-specific disparities independent of sex or attitudes ( $p = 0.223$ ).

Specific gaps included low recognition of chronic hypertension (53.1%), inappropriate prevention attitudes (e.g., only 25% endorsed aspirin/calcium), and poor treatment thresholds (21.9%), urging targeted training.

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## Reporting Checklist

The authors have completed the STROBE reporting checklist.

## Data Availability Statement

Data supporting the findings of this study are available from the corresponding author (SD) upon reasonable request.

## Funding

This study received no specific funding.

## Ethical Approval

The study was approved by the Regional Ethic Board for Health Research of the North Region (Ref: 00187/CERSH/N0/2025). The requirement for informed consent was waived due to the retrospective nature of the study. All procedures were carried out in accordance with applicable guidelines and regulations for the use of anonymized secondary data.

## Contributions

Study concept and design: SD and EMM. Data collection: EMM. Analysis and interpretation of data: FMB. Manuscript writing: All authors. Final approval of manuscript: All authors. KF supervised the study. SD, and EMM had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors agreed to submit the manuscript in its current form

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**Conflict of interest :** None

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