University of Dongola

Faculty of Medicine

Research Methodology Course

RESEARCH PROPOSAL

A proposal submitted in partial fulfillment of the academic requirements of the MBBS degree

Title

Prevalence of Hypertension Among the Adult Rural Population in Jertoude Village, Northern State, Sudan, 2026–2027

Submitted by:

Asmar Mohamed Idris Mohamed Ahmed

Saria Sati Mohamed Sati

Supervisor

Prof. Mohamed Osman Abdelaziz

Date submitted: September 2026

Academic Year: October 2026 – January 2027

• *Proposal table contents*

No.	Subject	Page
1.	**Contents**	2
2.	**Introduction and Background**	3
3.	**Problem Statement**	3
4.	**Rationale**	3
5.	**Research Questions**	3
6.	**Literature Review**	4–5
7.	**Objectives**	5
8.	**Materials and Methods**	6–8
9.	**Study Design, Area and Population**	6
10.	**Inclusion and Exclusion Criteria**	6
11.	**Sample Size and Sampling**	6–7
12.	**Data Collection and Variables**	7
13.	**Data Analysis**	7
14.	**Ethical Considerations**	8
15.	**Timeline (Gantt Chart)**	8
16.	**Budget Estimate for Research Study**	9
17.	**References**	9–10
18.	**Annexes**	11

Introduction

1a. Background of the Study

Hypertension is one of the most common non-communicable diseases worldwide and a leading risk factor for cardiovascular disease, stroke, and chronic kidney disease. Because it usually causes no symptoms, regular screening is essential for early detection [1].

The WHO estimates that 1.4 billion adults aged 30–79 years had hypertension in 2024, two-thirds of them in low- and middle-income countries. About 44% are unaware of their condition, and only about 23% have it controlled [1].

In sub-Saharan Africa the burden is rising with population ageing, urbanization, obesity, and unhealthy lifestyles [2], and in seven East and West African communities about 40% of adults with hypertension were unaware of it [3]. A 2025 meta-analysis of African studies published between 2002 and 2023 reported a pooled prevalence of 28.5% [4].

In Sudan, the 2016 national STEPS survey found a prevalence of 33.1%, and about eight in ten cases (79.2%) were undiagnosed [5]. Community studies reported 40.8% in Gadarif [6], 35.7% in urban River Nile State [7], and 56.0% in four River Nile State villages [8], which shows how widely estimates vary.

The conflict that began in April 2023 has further weakened the health system [9]. In Dongola Locality, where Jertoude is located, hypertension was the most common chronic condition among displaced people sheltered there, and about 46% of those with non-communicable diseases had interrupted their medication [10].

These findings show a heavy, largely unrecognized burden and the need for locally representative data from rural villages.

1b. Problem Statement

Hypertension is highly prevalent in Sudan, yet local data on its burden among adults in rural Northern State are lacking. Available studies are mostly national or from other regions, and recent estimates range from 33.1% [5] to 56.0% [8], so figures from elsewhere cannot simply be applied to Jertoude. Nationally, about eight in ten hypertensive adults are unaware of their condition [5], and the ongoing conflict has further disrupted diagnosis and continuity of care [9,10]. Without local data, planning effective screening and management is difficult, and untreated hypertension leads to cardiovascular disease, stroke, and kidney damage [1].

1c. Rationale

Hypertension is a leading modifiable risk factor for stroke, heart disease, and kidney failure. During a recent medical convoy to Jertoude village, our team noticed that non-communicable diseases were common among the residents. To our knowledge, no published study has measured the prevalence of hypertension among adults here, and rural health services are limited and strained by the conflict, so many cases probably remain undiagnosed. This study aims to provide reliable local data to guide screening, service planning, and future research.

- ## 1d. Research Questions

1. What is the prevalence of hypertension among adults in Jertoude Village?

2. What sociodemographic factors are associated with hypertension among adults in Jertoude Village?

3. What lifestyle and clinical factors are associated with hypertension among adults in Jertoude Village?

4. What proportion of hypertensive adults were previously undiagnosed?

5. What proportion of adults with hypertension are currently receiving antihypertensive treatment?

1e. Research Hypothesis

H0: There will be no association between selected sociodemographic, lifestyle, and clinical factors and hypertension among adults in Jertoude Village, Dongola Locality, Northern State, Sudan.

H1: There will be an association between selected sociodemographic, lifestyle, and clinical factors and hypertension among adults in Jertoude Village, Dongola Locality, Northern State, Sudan.

1f. Operational Definitions

Adult: a resident of Jertoude village aged 18 years or older who has lived there for at least six months. **Hypertension:** an average of the second and third blood-pressure readings of ≥140/90 mmHg, or self-reported current use of antihypertensive medication. **Previously undiagnosed hypertension:** hypertension identified during the study in a participant who reports no previous diagnosis. **Current antihypertensive treatment:** self-reported current use of prescribed medication for hypertension. **Body mass index (BMI):** measured weight in kilograms divided by measured height in meters squared. **Smoking or toombak use:** current or previous use of cigarettes and/or toombak, as reported by the participant. **Physical activity and salt intake:** assessed with the relevant items of the adapted WHO STEPS questionnaire (Annex A).

2. Literature Review

a. Background and pathophysiology

Hypertension results from the interaction of genetic, renal, vascular, neural, endocrine, and environmental factors. Excess salt, obesity, physical inactivity, and ageing increase the risk [11].

b. Globally (including Africa and the Middle East)

The strongest global evidence comes from the NCD-RisC pooled analysis [12]. In the Middle East and North Africa, the pooled prevalence was 24.36% [13], and only about 41% of adults with hypertension were treated and 19% had controlled blood pressure [14].

> **summary [12] – NCD-RisC, Lancet 2021:** Study: "Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants." Methods: pooled survey data on adults aged 30–79 years from 200 countries. Results: cases rose from about 650 million (1990) to 1.28 billion (2019); only about half were diagnosed and one in five had controlled BP. Relevance: it shows the global detection gap that our study addresses.

c. Nationally – Sudan

Sudanese surveys that used the WHO STEPS approach consistently report older age, obesity, and diabetes as the main factors associated with hypertension [5–7]. The two studies below are the closest to our design.

> **summary [5] – Pengpid and Peltzer, Pan Afr Med J 2022:** Study: "Undiagnosed hypertension in Sudan: results of the cross-sectional national STEPS survey in 2016." Methods: analysis of the national STEPS survey, 7,226 adults aged 18–69 years. Results: hypertension 33.1%; 26.2% undiagnosed (79.2% of cases) and 6.9% previously diagnosed. Relevance: Sudan's national benchmark, using the same STEPS approach as ours.

> **summary [6] – Omar et al., BMC Public Health 2020:** Study: "Prevalence and associated factors of hypertension among adults in Gadarif in eastern Sudan: a community-based study." Methods: multistage survey of 600 adults in 2018 using the WHO STEPS questionnaire. Results: hypertension 40.8%, of which 33.5% was newly diagnosed; older age (aOR 3.20) and obesity (aOR 2.41) were associated. Relevance: a similar community-based adult survey in another region.

d. Locally – Northern Sudan

In Northern State, a community-based study of 757 adults in rural areas examined prevalence, awareness, and social determinants [15]. The closest village-level comparison is a household survey in neighbouring River Nile State [8]. To our knowledge, no study reports a prevalence for Jertoude.

> **summary [8] – Bashir et al., BMC Public Health 2024:** Study: "Snoring is associated with hypertension and diabetes mellitus among adults in north Sudan: a cross-sectional study." Methods: multistage community survey in four River Nile State villages (2021), with 135 randomly selected households and 384 adults. Results: hypertension 56.0%; older age, higher BMI, and female sex were associated. Limitation: the sample size was calculated for snoring. Relevance: the closest village-level survey to Jertoude.

e. Summary and knowledge gap

Global and national evidence is strong, but village-level data from northern Sudan are limited, and no population-based study with systematic household sampling was found for Jertoude. This study therefore aims to estimate the prevalence of hypertension, its associated factors, and the proportion of undiagnosed cases among adults in Jertoude Village.

3. Objectives

General objective: To assess the prevalence of hypertension among adults in Jertoude village, Dongola Locality, Northern State, Sudan, 2026.

Specific objectives:

1. To estimate the prevalence of hypertension among adults aged 18 years and above in Jertoude village.
2. To describe the sociodemographic characteristics of the participants: age, sex, marital status, education, occupation, and income.
3. To determine the association between sociodemographic characteristics and hypertension.
4. To determine the association between lifestyle factors (cigarette smoking, toombak use, physical activity, and salt intake) and hypertension.
5. To determine the association between clinical factors (body mass index, diabetes mellitus, and family history of hypertension) and hypertension.
6. To estimate the proportion of previously undiagnosed hypertension among hypertensive adults.
7. To estimate the proportion of hypertensive adults who are currently taking antihypertensive treatment.

4. Materials and Methods

Study design: A community-based analytic cross-sectional study will be conducted to determine the prevalence of hypertension and to assess factors associated with hypertension among adults aged 18 years and above in Jertoude village.

Study area: The study will be conducted in Jertoude village, East Nile administrative unit, Dongola Locality, Northern State, Sudan, approximately 25–30 km from Dongola. The area will be selected because it will represent the target community for the study.

Study period: The study will be conducted from September 2026 to January 2027. Data collection will be planned for October 2026, and data entry, cleaning, and analysis will be conducted during October–November 2026.

Study population: The study population will comprise adults aged ≥18 years who will be living in Jertoude village during the study period.

Inclusion criteria: Adults aged ≥18 years who will have lived in the village for at least 6 months and who will provide informed consent will be eligible to participate.

Exclusion criteria: Pregnant women, severely ill individuals who will be unable to provide reliable information or measurements, and eligible adults who will not be available after repeated household visits will be excluded.

Sample size: First we estimated how many adults live in Jertoude. The village has about 150 households with around 5 people in each, so roughly 750 residents. About half of Sudan's population is under 18 years old [16], so we expect about 375 adults (150 × 5 × 0.50). This number will be checked when the households are listed.

Step 1 – Basic sample size: We used the standard formula for estimating a single proportion [17]:

$$\mathbf{n_0 = Z^2 \times p \times (1 - p) / d^2}$$

Here Z = 1.96 (95% confidence), p = 0.50 (no reliable local prevalence is available, and 0.50 gives the largest sample), and d = 0.05 (5% margin of error).

$$\mathbf{n_0 = (1.96^2 \times 0.50 \times 0.50) / 0.05^2 = 384.16}$$

Step 2 – Correction for a small population: Jertoude is small, so 384 adults is more than we need. We corrected for the population size (N = 375):

$$\mathbf{n = n_0 / [1 + (n_0 - 1) / N] = 384.16 / [1 + 383.16 / 375] = 190.0, \text{ rounded up to } 191 \text{ adults}}$$

Step 3 – Non-response: We added 10% for refusals and incomplete forms:

$$\mathbf{191 / 0.90 = 212.2, \text{ rounded up to } 213 \text{ adults}}$$

Final target: We will recruit 213 adults. With about 2.5 adults per household (5 × 0.50), this means about 86 households (213 ÷ 2.5), which is roughly 57% of the village. If the household list shows a very different number of adults, we will repeat the calculation before sampling starts.

Sampling method: We will use systematic random sampling of households. All eligible adults (18 years and above) in each selected household will be invited to take part.

Sampling procedure: We will first list and number all households in the village (about 150). The sampling interval is the number of households divided by the number we need: $k = 150 / 86 \approx 1.7$. Because k is not a whole number, we will use a fractional interval: choose a random start between 1 and 1.7, add 1.7 each time, and select the household whose number matches the whole-number part of each result, until 86 households are chosen.

Non-response and replacement: Households will be revisited 2–3 times at different times of the day. Remaining non-response will be documented, and replacement will follow the pre-specified sampling procedure rather than convenience selection.

Data collection: An English-language, interviewer-administered questionnaire adapted from the WHO STEPS instrument [18] will be used (Annex A). Interviewers will ask the questions verbally in Arabic and record the answers on the English form. The questionnaire will be pilot-tested on about 10% of the planned sample (about 20 adults) in a nearby village with similar characteristics, so that eligible households in Jertoude are not used up. Pilot participants will not be included in the final analysis.

Measurements: Blood pressure will be measured with a validated monitor and an appropriate cuff size after at least 15 minutes of seated rest. Three readings will be taken about 3 minutes apart, and the average of the second and third readings will be used. Weight and height will be measured with a digital scale and a measuring tape (light clothing, no shoes), and BMI will be calculated.

Study variables: The dependent variable is hypertension. Independent variables are age, sex, marital status, education, occupation, income, smoking or toombak use, physical activity, salt intake, family history of hypertension, diabetes, and BMI. Previous diagnosis and current treatment will be used to describe awareness and treatment, not as risk factors.

Quality control and bias: Data collectors will be trained, including agreeing on one standard Arabic wording for each question, and supervisors will review completed forms during fieldwork. Equipment will be checked before use. Systematic household sampling with a random start and repeat visits will limit selection bias. Data will be checked for completeness, duplicates, and out-of-range values against the original forms, and the researchers will be responsible for coding, entry, cleaning, and secure storage under the supervisor.

Data analysis: Data will be analyzed using SPSS. Categorical variables will be summarized as frequencies and percentages, and continuous variables as mean ± SD or median (IQR). Prevalence, the undiagnosed proportion, and the treated proportion will be reported with 95% confidence intervals. The chi-square test (categories merged where expected counts are small) and the independent t-test or Mann–Whitney U test will compare hypertensive and non-hypertensive participants. Variables with $p < 0.05$ in the bivariate analysis will enter a multivariable binary logistic regression model, and adjusted odds ratios with 95% confidence intervals will be reported.

5. Ethical considerations

Ethical approval will be obtained from the Faculty of Medicine, University of Dongola, and permission will be obtained from the Ministry of Health, the Locality authorities, and the local leaders of Jertoude village.

- Informed consent will be obtained (written, or verbal for participants who cannot read).

- All data will be kept anonymous and confidential.
- Anyone with high BP will be referred to the nearest health facility.
- The study will follow the Declaration of Helsinki [19].

6. Timeline (Gantt Chart)

No.	Activity	Period	September 2026	October 2026	November 2026	December 2026	January 2027
1	Research proposal submission	September 2026	✔				
2	Research proposal presentation	September–October 2026	✔	✔			
3	Data collection	October 2026		✔			
4	Data analysis	October–November 2026		✔	✔		
5	Results writing and discussion	November 2026			✔		
6	Final report writing	November–December 2026			✔	✔	
7	Electronic submission of research to the Department of Community Medicine	December 2026				✔	
8	Research evaluation	December 2026				✔	
9	Research revision	December 2026				✔	
10	Research defense	January 2027					✔

Shaded cells (✔) show the month(s) in which each activity is carried out.

Research Work Plan

The research work plan summarizes the main activities, responsible persons, and expected outputs of the study.

Table. Research work plan.

Phase	Main activities	Responsible	Output
1. Preparation	Topic selection, literature review, proposal writing, and research proposal presentation.	All group members; supervisor	Approved research proposal
2. Approvals	Submission for ethical approval and obtaining permission from the Ministry of Health, Locality authorities, and local leaders.	Researchers; supervisor	Ethical approval and local permissions
3. Tool development	Adaptation and preparation of the English interviewer-administered questionnaire based on the WHO STEPS instrument (questions asked verbally in Arabic); preparation of consent form and BP measurement checklist.	Researchers; supervisor	Final study tools
4. Pilot study	Pilot-testing of the questionnaire on about 10% of the planned sample to check clarity, timing, and field procedures.	Researchers	Finalized questionnaire and field procedures
5. Data collection	Household listing and systematic sampling; interviewer-administered questionnaire; blood-pressure measurements and anthropometric measurements.	Researchers / data collectors	Completed questionnaires and measurements
6. Data management	Coding, data entry, cleaning, verification, and preparation of the dataset in SPSS.	Researchers	Clean dataset
7. Analysis	Descriptive statistics, Chi-square tests, and binary	Researchers;	Statistical tables and

Phase	Main activities	Responsible	Output
	logistic regression with 95% CI and $p < 0.05$.	statistician/supervisor	results
8. Reporting	Writing results and discussion, final report preparation, electronic submission, research evaluation, revision, and defense.	All group members; supervisor	Final research report and defense

7. Budget Estimate for Research Study

- **All costs are estimated in Sudanese pounds (SDG).**

Item	Quantity	Unit Cost (SDG)	Total (SDG)
Blood pressure monitors	8	80,000	640,000
Digital scale	1	70,000	70,000
Measuring tapes	4	5,000	20,000
Questionnaires and study forms	235 sets	—	200,000
Local transport	1	200,000	200,000
Data entry and statistical analysis	1	150,000	150,000
Field team refreshments and allowances	1	220,000	220,000
Total estimated cost (SDG)			1,500,000

8. References

1. World Health Organization. Hypertension [Internet]. Geneva: World Health Organization; 2025 Sep 25 [cited 2026 Sep 21]. Available from: https://www.who.int/news-room/fact-sheets/detail/hypertension
2. Gafane-Matemane LF, Craig A, Kruger R, Alaofin OS, Ware LJ, Jones ESW, et al. Hypertension in sub-Saharan Africa: the current profile, recent advances, gaps, and priorities. J Hum Hypertens. 2024 May 2. doi:10.1038/s41371-024-00913-6
3. Okello S, Muhihi A, Mohamed SF, Ameh S, Ochimana C, Oluwasanu AO, et al. Hypertension prevalence, awareness, treatment, and control and predicted 10-year CVD risk: a cross-sectional study of seven communities in East and West Africa (SevenCEWA). BMC Public Health. 2020;20:1706. doi:10.1186/s12889-020-09829-5.
4. Olowoyo P, Okekunle AP, Asowata OJ, Atolani S, Morsy MI, Caiazzo E, et al. Prevalence of hypertension in Africa in the last two decades: systematic review and meta-analysis. Cardiovasc Res. 2025;121(12):1815-1829. doi:10.1093/cvr/cvaf125. PMID:40662276.
5. Pengpid S, Peltzer K. Undiagnosed hypertension in Sudan: results of the cross-sectional national STEPS survey in 2016. Pan Afr Med J. 2022;42:205. doi:10.11604/pamj.2022.42.205.35478. PMID:36284571.
6. Omar SM, Musa IR, Osman OE, Adam I. Prevalence and associated factors of hypertension among adults in Gadarif in eastern Sudan: a community-based study. BMC Public Health. 2020;20:291. doi:10.1186/s12889-020-8386-5
7. Bushara SO, Noor SK, Ibraheem AAH, Elmadhoun WM, Ahmed MH. Prevalence of and risk factors for hypertension among urban communities of North Sudan: detecting a silent killer. J Family Med Prim Care. 2016;5(3):605-610. doi:10.4103/2249-4863.197317
8. Bashir AO, Elimam MA, Elimam MA, Adam I. Snoring is associated with hypertension and diabetes mellitus among adults in north Sudan: a cross-sectional study. BMC Public Health. 2024;24:974. doi:10.1186/s12889-024-18505-x
9. Khogali A, Homeida A. Impact of the 2023 armed conflict on Sudan's healthcare system. Public Health Challenges. 2023;2(4):e134. doi:10.1002/puh2.134

10. Elyas HM, Hamid HTA, Arbab AH, Moukhtar OA, Abdelaziz MO. Prevalence of non-communicable diseases and access to healthcare among internally displaced people during the armed conflict, Northern State (Sudan). Risk Manag Healthc Policy. 2024;17:2493-2501. doi:10.2147/RMHP.S484284
11. Oparil S, Acelajado MC, Bakris GL, Berlowitz DR, Cífková R, Dominiczak AF, et al. Hypertension. Nat Rev Dis Primers. 2018;4:18014. doi:10.1038/nrdp.2018.14
12. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. Lancet. 2021;398(10304):957-980. doi:10.1016/S0140-6736(21)01330-1. PMID:34450083.
13. Okati-Aliabad H, Ansari-Moghaddam A, Kargar S, Mohammadi M. Prevalence of hypertension and pre-hypertension in the Middle East region: a systematic review & meta-analysis. J Hum Hypertens. 2022;36(9):794-804. doi:10.1038/s41371-021-00647-9. PMID:35031669.
14. Khonsari NM, Shahrestanaki E, Ejtahed HS, et al. Long-term Trends in Hypertension Prevalence, Awareness, Treatment, and Control Rate in the Middle East and North Africa: a Systematic Review and Meta-analysis of 178 Population-Based Studies. Curr Hypertens Rep. 2021;23(9):41. doi:10.1007/s11906-021-01159-0. PMID:34625888.
15. Alzain MA. Prevalence, awareness, and social determinants of hypertension: a cross-sectional study in Northern State, Sudan. Jordan J Appl Sci Nat Sci Ser. 2020;14(2):13-8. doi:10.35192/jjoas-n.v14i2.280
16. United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects 2024 [Internet]. New York: United Nations; 2024 [cited 2026 Oct 11]. Available from: https://population.un.org/wpp/
17. Naing L, Nordin RB, Abdul Rahman H, Naing YT. Sample size calculation for prevalence studies using Scalex and ScalaR calculators. BMC Med Res Methodol. 2022;22:209. doi:10.1186/s12874-022-01694-7
18. World Health Organization. WHO STEPS surveillance manual [Internet]. Geneva: World Health Organization; [updated 2024; cited 2026 Sep 21]. Available from: https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/steps/manuals
19. World Medical Association. WMA Declaration of Helsinki – Ethical principles for medical research involving human participants. JAMA. 2025;333(1):71-74. doi:10.1001/jama.2024.21972

9. Annexes

Three annexes accompany this proposal: Annex A (study questionnaire), Annex B (consent form, Arabic and English), and Annex C (ethical approval certificate, to be added once granted).

Annex A: Questionnaire

- **Source:** Adapted from the WHO STEPS instrument.
- **Structure:** The questionnaire has five sections and 26 items, summarized in the table below.

Section	Content	Items	Response format / classification
1. Identification	Questionnaire ID, interview date, household number, interviewer name.	4	Identification fields; no score.
2. Sociodemographic characteristics	Age, sex, marital status, education, occupation, estimated monthly household income.	6	Categorical and numeric responses; no score.
3. Lifestyle factors	Cigarette smoking, toombak use, physical activity, usual salt intake.	4	Yes/No or categorical responses; no score.
4. Clinical and family history	Previous diagnosis of hypertension, current antihypertensive treatment, diabetes mellitus, family history of hypertension.	4	Yes/No/Not sure responses; used to describe clinical risk factors.
5. Anthropometric and blood-pressure measurements	Weight, height, BMI, three BP readings, average of readings 2 and 3, and hypertension classification.	8	Numeric measurements. Hypertension: average BP ≥140/90 mmHg or current antihypertensive medication.

- **Administration:** Interviewer-administered. The form is in English; interviewers ask the questions verbally in Arabic and record the answers on the form.
- **Blood pressure measurement:** After 15 minutes of seated rest; three readings taken 3 minutes apart, and the last two readings averaged.

Annex B: Consent Form

- The informed consent form is provided in Arabic and English and is attached at the end of the final proposal.

Annex C: Ethical Approval Certificate

- Issued by the Faculty of Medicine, University of Dongola. .