



Burden, Barriers, and Behavioral Adaptation: A Mixed-Method Study of Hypertension and Diabetes Management among the Geriatric Population in the Drought-Prone Barind Tract of Bangladesh

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Master of Public Health

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Declaration

I, Kazi Maruf Quadir, hereby declare that this thesis entitled "Burden, Barriers, and Behavioral Adaptation: A Mixed-Method Study of Hypertension and Diabetes Management among the Geriatric Population in the Drought-Prone Barind Tract of Bangladesh" is an original work submitted in partial fulfilment of the requirements for the degree of Master of Public Health (MPH) at the James P. Grant School of Public Health (JPGSPH), BRAC University, Dhaka, Bangladesh.

I further declare that this work has not been submitted previously, in whole or in part, for any other degree or examination at this or any other university or institution.

All sources used in this thesis have been duly acknowledged and cited. Any assistance received has been mentioned in the acknowledgements section.

I have also added a separate declaration on GenAI use at the end of this work.

Kazi Maruf Quadir

Date: 9th June, 2026

Approval

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Ethics Statement

This investigation's research protocol was formally reviewed and given ethical approval by the BRAC James P. Grant School of Public Health's Institutional Review Board (IRB Protocol no. MPH-2025-021). Bioethical considerations were always observed and ensured the protection and dignity of all the subjects, especially the vulnerable geriatric population in the rural Barind Tract throughout the study.

One of the principle of the ethical approach was the strict procedure of informed consent. Prior to any data collection, voluntary written and/or verbal informed consent was obtained from each participant. To overcome potential literacy barriers in rural areas, all participants were provided with an information sheet that explained the objectives, methodology and specific risks and benefits of the study. Specific written consent was also obtained from participants for the use of audio recording during the qualitative interviews. For institutional key informants, administrative approvals were secured from the relevant authorities before interviews commenced.

Each participant was made aware of his/her absolute right to participate or not participate in the study, and the participant's right to withdraw from the study at any time without any negative consequences. Participants were also ensured to skip any questions which made them feel uncomfortable or to halt the interview process as needed. All requests for data deletion were satisfied, up to the level of data anonymization and aggregation.

All interviews were held in private, household locations or quiet office areas to help prevent conversational fatigue and emotional distress, therefore ensuring privacy and safety. No deception or concealment was used at any point in the study. As an extra precaution, emergency information about the local healthcare services was also provided to relatives/caregivers in case a participant suffered physical or medical distress during a field visit.

Data management and confidentiality was handled carefully. The secondary data set for the quantitative component was fully anonymized with unique alphanumeric study codes used instead of direct identifiers. During the qualitative phase, the verbatim transcripts were double checked, with all direct identifiers then permanently redacted.

Abstract

Background:

Intense heat and extended periods of drought is a growing concern for the rural elderly in the north-western Barind tract of Bangladesh, both physiologically and economically. Bangladesh is currently experiencing an epidemiological transition, where geriatric population is suffering from non-communicable diseases such as hypertension and diabetes, and there is a need to understand the impact of environmental precarity on the management of chronic diseases.

Objectives:

Overall the goal was to determine the burden and climate sensitive management of HTN and DM in the geriatric population in the rural drought-prone Barind tract. Specific objectives were to establish prevalence of these conditions, exposure to predisposing risk factors and coping and challenges faced by the people in extreme climatic conditions.

Methods:

The study was conducted in Niamatpur Upazila, Naogaon District using mixed method study approach. The secondary data for phase 2 (quantitative) was obtained from a climate-sensitive surveillance database for 225 geriatric subjects (60 years old and above) through the two-stage stratification random sampling technique. Purposive sampling was used to select 12 in-depth interviews (IDIs) with patients and 3 key informant interviews (KIIs) with healthcare providers. Thematic analysis with a hybrid coding structure was used for the qualitative data, and descriptive statistics were used to analyze the quantitative data using Stata.

Results:

Diagnosed cases of hypertension presented 37.33% and diabetes 10.67%. A critical treatment gap was identified with 47.62% of hypertensive patients reporting not taking treatment medication and 41.67% of diabetic patients reported doing the same. 58.3% among the diabetic individuals and 60.7% among the hypertensive individuals are on low level of physical activity. Qualitative results emphasized a reactive care tendency whereby patients are dependent on physical signs and not routine screening. The significant obstacles to care were high carrying costs of treatment, institutional friction (long queues) and forgetfulness. The seasonal adaptation was to range across dietary behavior change to physical activity moderation to cope with seasonal extremities.

Conclusions:

The geriatric population in Barind tract is exposed to various risk factors due to aging, chronic metabolic diseases and environmental stress factors. The large treatment gaps stem from the lack of resources and the dysfunction of the primary health care supply chain. Public health implications include the need for climate-resilient health infrastructure, subsidized geriatric medications and seasonally focused health education to offset the cumulative effects of drought and heat on the outcomes of chronic diseases.

Keywords:

Hypertension, Diabetes Mellitus, Geriatric Health, Barind Tract, Drought, Climate Change Adaptation

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List of Acronyms

Acronyms	Full Form
AR4	Fourth Assessment Report
BDT	Bangladeshi Taka
BHP	BRAC Health Programme
CCEH	Hub for Climate Change, Environment and Health
CHCP	Community Health Care Provider
CI	Confidence Interval
DBP	Diastolic Blood Pressure
DM	Diabetes Mellitus
FBG	Fasting Blood Glucose
HT	Hypertension
HTN	Hypertension
ID	Identification
IDI	In-Depth Interview
IPCC	Intergovernmental Panel on Climate Change
IRB	Institutional Review Board
KII	Key Informant Interview
LMICs	Low- and middle-income countries
MHFW	Ministry of Health and Family Welfare
MPH	Master of Public Health
NCDs	Non-communicable diseases
PI	Principal Investigator
PM	Particulate Matter (PM2.5 and PM10)
RBG	Random Blood Glucose

SBP	Systolic Blood Pressure
SSC	Secondary School Certificate
UHC	Upazila Health Complex
WHO	World Health Organization

Chapter 1: Introduction

1.1 Background and Rationale

Global climate change is resulting in a huge increase in the frequency and severity of extreme weather events, particularly the occurrence of droughts that can be defined as acute shortage of moisture in soil as a result of deficiency of rain (Alam et al., 2021). According to Bangladesh Meteorological Department, extreme heat is defined as a period where daily maximum temperature exceeds 43°C in a specific area; These phenomena are divided into meteorological, hydrological, agronomical, and socioeconomic, and it is estimated that the world temperatures will increase by 0.3°C to 4.8°C by the end of the century (Alam et al., 2021). The rate of temperature rise in Bangladesh is higher than the global average (Alam et al., 2021); which makes it highly susceptible. The country has three drought prone regions, the most vulnerable being the northwestern region that is naturally drought prone and because of human activities like dam construction, which led to rapid desertification (Alam et al., 2021).

Hypertension and diabetes are non-communicable diseases (NCDs) causing most of the deaths worldwide, and more than 75% of deaths in the world are linked to low- and middle-income countries (LMICs) (Xu et al., 2021). In the case of Bangladesh, infectious causes of death are starting to be replaced by the NCDs (Xie et al., 2023). National surveys show that the prevalence of hypertension and diabetes among adults is 27.4% and 9.8%, respectively (Xie et al., 2023). The geriatric population is burdened by these chronic diseases as age is an independent risk factor for these diseases (Kalra et al., 2022). Now, over 2 million elderly individuals are suffering from diabetes in Bangladesh (Kalra et al., 2022).

Based on the studies existing before them, the four main factors that can predispose geriatric population to such conditions are the sedentary lifestyle, water consumption, salt intake and family history. In terms of behaviour, one of the common risk factors is physical inactivity resulting in poor glycemic control and blood pressure management (Irwan et al., 2022; Xie et al., 2023). High sodium intake is one of the key causes of hypertension in rural Bangladesh, where eating habits are usually

challenging to change (Boitchi et al., 2021; Kalra et al., 2022). It is difficult to maintain metabolic stability in the elderly patient in the face of lack of hydration in addition to the heat of the environment (Kalra et al., 2022). Genetic predisposition/family history is a risk factor and is important in South Asian ethnicities (Boitchi et al., 2021; Kalra et al., 2022).

A cumulative crisis also occurs when the extreme heat and drought are coupled with hypertension and diabetes (Alam et al., 2021). Rural residents are limited in accessing care at sub-district hospitals due to very high transportation costs, durability and physical fatigue due to excessive heat (Xie et al., 2023). Rural women who are typically subject to gendered forms of neglect, also have to rely on permission or even transport by male relatives to go to a clinic (Boitchi et al., 2021). Even low-cost medication is often out of reach for people during periods of financial hardship in droughts (Rummi et al., 2022). This in turn results in patients neglecting medicine since they can only tolerate the symptom a certain time before taking it and then reverting to the previous practice (Boitchi et al., 2021; Rummi et al., 2022). Physical activity, a key factor to NCD control, is constrained by environmental stressors like extreme heat.

There was an association between exposure to extreme heat and Chowdhury et al., 2024). Furthermore, water scarcity during droughts puts water security at risk, which adds to the challenge of maintaining hydration of diabetic patients (Kalra et al., 2022). Another dimension of biomedical adherence is home management or herbal treatment, which rural patients who may not know about the biomedical side effects or may be unaware of the medication, prefer over taking medication (Boitchi et al., 2021; Irwan et al., 2022). There is a need for a lot of research of focus here, to answer all these points in detail. There are some projects like that, which are currently being continued in Bangladesh. A climate sensitive surveillance system for environmental exposures and health outcomes, the BRAC Health Programme (BHP), is in place in the drought- and saline-prone areas of Bangladesh. The surveillance platform combines climate parameters with physical and mental health data in all age groups with an m-health infrastructure.

Rationale

While climate is associated with health, in the case of Barind tract, research on the specific effects of drought on the management of NCDs is lacking (Alam et al., 2021). Most of the literature available on this topic is related to the impacts on agriculture or socio-economic aspects and there is a lack of knowledge on how the vulnerability of the geriatric population to environmental stressors like extreme heat and drought affects their health-seeking behavior and self-care practices, (Alam et al., 2021; Xie et al., 2023). Research is needed to inform culturally and environmentally based interventions. This study aims to investigate the burden and management of hypertension and diabetes among elderly people living in the Barind Tract, the influence of extreme heat and drought on the vulnerability to diseases, management practices, and coping strategies.

1.2 Problem Statement

Increasing hypertension (HTN) and diabetes mellitus (DM) are becoming an escalating problem in the population of older adults, especially in low and middle income countries. Bangladesh, like other South Asian countries, is extremely vulnerable to climate change and also suffers from a heavy burden of non-communicable diseases (Chandrasekara et al., 2021). Chronic diseases outcomes may also be further exacerbated by the climate change stressors like extreme heat and drought, which can have an impact on physical health, medication adherence and accessing healthcare. The Barind Tract is a drought prone area with prolonged heat exposure and environmental stress which might pose an extra burden for the elderly with chronic diseases. However, there has been little research that has tried to understand the impact of drought and extreme temperature on the disease management practices, healthcare seeking behavior and coping strategies of geriatric population with HTN and DM in rural Bangladesh. Thus, this study is designed to investigate the burden and lived experiences of hypertension and diabetes management of the elderly population in rural communities of Bangladesh, which are prone to drought.

1.3 Research Questions

1. What is the burden of hypertension and diabetes among geriatric population of north-western drought prone rural area of Bangladesh and what proportion of them are exposed to the predisposing factors?
2. How do the geriatric population of north-western drought prone rural area of Bangladesh perceive the experience and management of medication use, healthcare-seeking behavior, and disease self-management?

1.4 Study Objectives

1.4.1 Overall Objective

To assess the burden and climate-sensitive management of hypertension and diabetes among elderly individuals in rural drought-prone barind tract of north western Bangladesh.

1.4.2 Specific Objectives

1. To determine the prevalence of hypertension and diabetes among the geriatric population in drought-prone rural areas of northwestern Bangladesh.
2. To assess the exposure of this population to predisposing factors, specifically sedentary lifestyles, salt intake, water intake, and family history.
3. To explore practices regarding hypertension and diabetes self-care, including physical activity, hydration, diet, and symptom monitoring.
4. To identify the challenges individuals face in maintaining blood pressure/glucose levels and the coping strategies they adopt.
5. To explore what affect their decisions about seeking healthcare, attending follow-up visits, or accessing medications

1.5 Structure of the Thesis

This thesis is organized into six chapters. Chapter 1 provides the introduction, background, and study objectives. Chapter 2 presents a comprehensive review of existing literature. Chapter 3 outlines the methodology used in this study. Chapter 4 presents the findings. Chapter 5 provides a discussion and interpretation of the results in light of existing evidence. Chapter 6 concludes the thesis with key conclusions, recommendations, and limitations.

Chapter 2: Literature Review

Non-communicable diseases (NCDs), including hypertension (HTN) and diabetes mellitus (DM), are among the most common diseases worldwide, and are a major cause of morbidity, mortality and disability in older people. Population ageing, urbanization, sedentary lifestyle, unhealthy diets and environmental changes are some of the factors contributing to the rising burden of these diseases. Climate change has become an added public health risk, adding to chronic disease burden as a result of extreme heat events, food insecurity, decreased access to health care and physiological stress. Climate change is one of the biggest threats to human health in the 21st Century according to the World Health Organization (Sharma et al., 2026).

Climate-sensitive health risks are especially high in the older population due to lower physiological capabilities to adapt, the presence of chronic conditions, and lower adaptive abilities. The effects of extreme heat exposure on cardiovascular stress, dehydration, glycemic control and mortality have been reported in individuals with HTN and DM. Likewise, research indicates that the management of chronic diseases may be complicated during climate-related events, as healthcare services may be disrupted, medications may become scarce, and mobility may be limited (Sharma et al., 2026). Around the world, hypertension (HTN) is a major risk factor for cardiovascular disease and early death and it affects more than one billion people. There has also been a gradual increase in diabetes prevalence, especially in low and middle-income countries where health systems are often not well-equipped to deliver long-term NCD care (Chowdhury et al., 2020).

South Asia is one of the most climate-vulnerable areas in the world, with vulnerable factors such as high population density, poverty, reliance on agriculture and inadequate healthcare facilities. For the past few decades, climate change occurrences such as droughts, heat waves and other climate hazards have been observed to be occurring more frequently and with greater severity in the region (Chandrasekara et al., 2021). There are significant implications of climate change to chronic disease management for South Asia. Excessive heat can exacerbate cardiovascular stress and dehydration especially in older adults suffering from hypertension and diabetes. Further, livelihood disruption due to drought and heat can contribute to making health care less affordable, and less continuous use of medicines (Chandrasekara et al., 2021).

South Asian studies show that NCDs are becoming more of a problem in the region, and are highly vulnerable to climate change. The prevalence of HTN and DM has been increasing throughout the region due to rapid urbanization, nutrition transition, physical inactivity and ageing population. But the majority of climate-health research in South Asian countries has concentrated mainly on infectious diseases, nutrition or disaster-related mortality, and there is little work examining how climate stressors affect the management of chronic diseases in an elderly population (Sharma et al., 2026). The significance of community resilience, local coping mechanisms, and health system preparedness in coping with health challenges sensitive to climate change has been highlighted in adaptation studies in South Asia. However, there is still limited evidence of the management of hypertension (HT) and diabetes (DM) in elderly people in extreme climatic conditions (Sud et al., 2015).

Bangladesh is currently undergoing an epidemiological transition with the rising burden of NCDs and remaining climate vulnerability. Elevated blood pressure and diabetes have become emerging health problems in the country due to the ageing, sedentary lifestyle, change in dietary habits, obesity and decreasing physical activity Chowdhury et al. (2020). In the Bangladeshi context, Chowdhury et al. (2020) conducted a systematic review and meta-analysis and found that the prevalence of hypertension has significantly risen over the years in Bangladesh with the overall pooled prevalence of approximately 20%. The burden was high among the older people and female

Chowdhury et al. (2020). Likewise, Saquib et al. (2012) observed that hypertension and type 2 diabetes are an increasing trend in Bangladesh during 1995–2010. Their review showed that elderly populations were especially affected and the urban-rural gap was decreasing with time. Hoq et al. (2022) performed another systematic review and found a pooled prevalence of hypertension as 21.6% and type 2 diabetes as 13.6%, suggesting that the burden of chronic diseases has been increasing in Bangladesh.

Bangladesh is also very vulnerable to other climate change hazards such as drought, heat stress, flood and salinity intrusion. The Barind Tract region in the north-west of the country is prone to drought and long exposure to heat, adversely affecting livelihoods, agricultural productivity, availability of water and health outcomes (Chandrasekara et al., 2021).

Although the climate sensitive health problems are getting more and more attention in Bangladesh, the majority of studies have been conducted on infectious diseases, nutrition, maternal health or outcomes related to the disaster. Very little studies have examined the impact of drought and extreme heat on the management of chronic diseases for older people with HTN and DM in rural Bangladesh. Also, qualitative studies on medication adherence, healthcare seeking, coping mechanisms and lived experience in the context of climate stress have yet to be undertaken.

Thus, this study is to fill up an important knowledge gap by knowing the burden and lived experiences of hypertension and diabetes management among the elderly population in rural areas of Bangladesh where the dual burden of extreme heat and drought is common.

2.3 Conceptual Framework

Conceptual Framework: IPCC Vulnerability Model

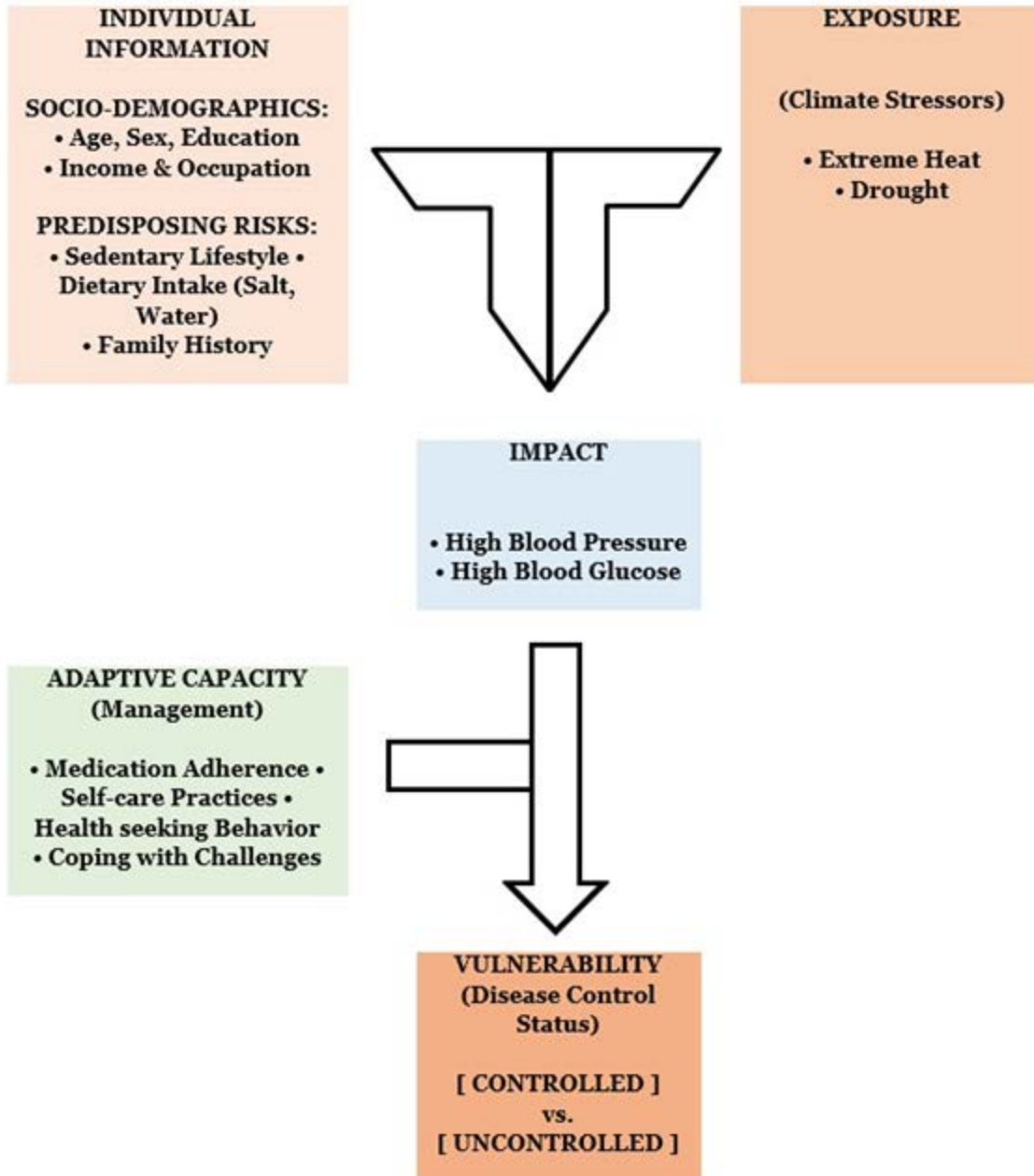


Figure 1: Conceptual Framework

The conceptual framework for this study is adapted from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4 Climate Change 2007: Impacts, Adaptation, and Vulnerability — IPCC, n.d.), which defines vulnerability as a function of exposure to climatic stressors, the sensitivity of the target population, and their adaptive capacity to manage impacts.

Chapter 3: Methods

3.1 Study Design

The study was designed using a mixed method approach to cover all aspects of the burden of hypertension (HTN) and diabetes mellitus (DM) and to understand the practice of disease management by geriatric population residing in drought prone areas.

In this method the quantitative phase was performed first to verify secondary cross sectional baseline data analysis, and thus provide general statistical profiles, prevalence rates and trends of environmental exposure among the study population. This was followed by a primary qualitative phase, aimed at explaining, contextualizing and expanding the initial statistical findings, using the detailed lived experiences, behavioral constraints and adaptations of the participants in relation to climate.

Qualitative thematic insights were then used to explain the quantitative statistics observed, and this occurred during the interpretation and discussion phase when the two strands of the investigation were brought together. This design is well justified, because quantitative data alone would not adequately reflect the complex behavioral changes and structural obstacles older adults experience under environmental stress and qualitative data alone would not assure generalizable prevalence estimates.

3.2 Study Area and Setting



Figure 2: Map of study area (Niamatpur Upazila in Naogaon district)

The study was carried out in a rural sub-district called Niamatpur Upazila of Naogaon District in the higher elevation Barind Tract of the Northwest of the country. This geographic space is ecologically unique, with a semi-arid climate, frequent seasonal droughts, low rainfall and high summer temperatures.

For the quantitative component, secondary data was used from four rural unions that were part of a climate-sensitive surveillance system in the BRAC Health Programme (BHP):

1. Chandannagar
2. Sreemantapur
3. Hajinagar
4. Rasulpur

Primary qualitative fieldwork and field-level tracking was focused in Rasulpur and Sreemantapur unions, where more meaningful context was established with the baseline community profiles. Qualitative tracking was operationalised at the micro-level as follows:

- Household Level: In-depth interviews (IDIs) were conducted in older adults' homes to encourage long, uninterrupted stories of everyday disease management experiences and household microclimates.
- Institutional Level: Key informant interviews (KIIs) were held at local health care facilities, such as Upazila Health Complexes, rural Community Clinics and retail Village Pharmacies.

3.3 Study Period

The study period lasted six months from January 2026 to June 2026, including the data processing, field planning and synthesis. In this period, primary qualitative fieldwork and monitoring of the field level took place in a dedicated data collection window from 1st-7th April 2026.

3.4 Study Population

3.4.1 Study Population

The target population was divided in two phases of research:

- Quantitative Phase: All older adults (aged 60 years and older) formally registered in the active database of BHP climate sensitive surveillance system in Niamatpur Upazila were included.
- Qualitative Phase: This consisted of two different sub-sets:
 1. Geriatric individuals (aged 60 years old or older) with a diagnosis of hypertension and/or diabetes mellitus from the baseline surveillance pool.
 2. Formal and informal healthcare providers in the locality, including Upazila Medical Officers, Community Health Care Providers (CHCPs) and the local retail drug vendors.

3.4.2 Inclusion and Exclusion Criteria

Quantitative Phase

Inclusion criteria:

- Participants had to be at least 60 years old when the surveillance was entered
- Having a complete verified data record in the surveillance system archive

Exclusion criteria:

- Surveillance records were excluded if there was a significant amount of missing data present (if at key clinical or demographic indicators) or if there were inconsistencies between historical records.

Qualitative Phase (In-Depth Interviews - IDIs)

- **Inclusion Criteria:**

1. Written age of 60 years or older.
2. Diagnosed as hypertensive and/or diabetic mellitus by a registered physician.
3. Residing continuously in the Barind Tract setting for at least 5 years.
4. Pre-registered in the main BHP surveillance pool.
5. Showed ability to and willingness to give informed consent voluntarily.

- **Exclusion Criteria:**

1. Active severe cognitive impairment or critical physiological illness which impaired the ability to participate in rational conversation.
2. If applicable, severe speech or hearing loss which was not reasonably accommodated by the investigator.

Qualitative Phase (Key Informant Interviews - KIIs)

- **Inclusion Criteria:** Formal or informal healthcare providers currently working in the unions who had at least one year of localized clinical experience dealing with healthcare management, treatment or counseling geriatric chronic disease patients.
- **Exclusion criteria:** Institutional health providers with no direct engagement in providing cardiovascular, diabetic or primary chronic care for the elderly in the selected study area.

3.5 Sample Size Calculation

Quantitative Component: The number of geriatric records available in the secondary BHP surveillance database determined the number of records for the quantitative sample. The total sample size of older adults (N = 225) was extracted and analyzed to ensure statistical power and

representation of the community. The underlying surveillance registry was developed based on a two stage stratified sampling model, with a 95% confidence interval (CI), a 5% margin of error, a 10% estimated non-response rate, and a threshold of 1% for missing data variables.

Qualitative Component: Sample size was informed by the principles of thematic saturation, which dictates that data collection and interviewing should be carried on until no further insights or themes are generated from new transcripts and the addition of more respondents does not add anything new. The original research design proposed conducting 15 IDIs in balanced disease strata; however, due to field conditions and time constraints, the final saturated qualitative sample included 12 In-Depth Interviews (IDIs) (5 males, 7 females) and 3 Key Informant Interviews (KIIs) from the formal medical sector, community clinics, and the informal health care provider.

3.6 Sampling Technique

- **Quantitative Part:** The participants were selected by two-stage stratified random sampling model to ensure geographic and socio-demographic distribution among the Barind microclimates at the time of quantitative secondary extraction.
- **Qualitative Part:** Purposive sampling method was used in the recruitment of participants. Stratification was built into the recruitment process so that the maximum possible variation within each gender, union and specific diagnostic profile of patients (solo hyper-tension, solo diabetes, multi-morbid presentations) would be achieved. Healthcare key informants were purposefully sampled at three levels of healthcare provision to gain systemic, community and informal perspectives on local health provision.

3.7 Variables

3.7.1 Dependent Variable(s)

The main outcome variables of interest for the quantitative statistical calculation were binary clinical metrics:

- **Hypertension Status:** Hypertension was classified as a binary variable (Yes / No) according to clinical criteria or current use of antihypertensive medications.

- **Diabetes Mellitus Status:** The clinical threshold metrics or active treatment compliance will be used to categorize as a binary outcome (Yes / No).

Qualitative was the central phenomenon of interest, which was the lived experience of chronic illness like diabetes and hypertension; barriers to medication compliance, pathways to health-care seeking and effects of drought and indoor thermal stress on daily health behaviors.

3.7.2 Independent Variables

The quantitative model included a number of independent predictor variables:

- **Socio-Demographic Profiles:** Age (years); Sex (Gender lens application); Educational status; Primary occupational type and Wealth quintile etc.
- **Behavioral and Clinical Factors:** Sedentary lifestyle patterns, raw dietary salt intake, bmi status, alcohol consumption, smoking status, medication adherence etc.
- **Environmental Exposures:** Temperature around and inside of residential units (in °C) and fine particulate matter concentration (PM2.5 and PM10).

Thematic focus areas for the qualitative inquiry were organized around therapeutic compliance, structural barriers for the supply chain, seasonal adjustments and economic constraints.

3.7.3 Operational Definitions

- **Geriatric Population** - Individuals documented as being aged 60 years or older, matching the WHO South-East Asia regional definition.
- **Hypertension (HTN)**- Documented Systolic Blood Pressure (SBP) greater than or equal to 140 mmHg and/or Diastolic Blood Pressure (DBP) greater than or equal to 90 mmHg, or individuals with a history of hypertension currently managed with anti-hypertensive medication.
- **Diabetes Mellitus (DM)** - Documented Fasting Blood Glucose (FBG) greater than or equal to 7.0 mmol/L, or a Random Blood Glucose (RBG) greater than or equal to 11.1 mmol/L, or individuals currently managed with anti-diabetic pharmacological regimens.

- **Drought** - A prolonged, unseasonable period of below-average precipitation resulting in localized water deficits, environmental dryness, and agricultural stress.
- **Barind Tract** - The specific distinct semi-arid region in northwestern Bangladesh characterized by low annual rainfall, high thermal vulnerability, and clay soils; includes parts of Naogaon, Rajshahi, and Dinajpur.
- **Healthcare Providers** - Any personnel actively delivering formal care or informal community-based health services, including: Medical Officers, Community Health Care Providers (CHCPs), and informal retail drug sellers.

3.8 Data Collection

3.8.1 Data Collection Tools

- **Quantitative:** Data was digitally extracted from the secondary BHP climate sensitive surveillance platform database. The original platform used structured field-tracking electronic screening forms.
- **Qualitative:** Semi structured, open ended interview guides were used for both IDIs and KIIs in the collection of primary data. The conceptual framework of the study was used to develop these guides that focused on medication compliance, economic constraints in the household, and seasonality.

3.8.2 Pretesting

The major qualitative semi-structured interview guides were pilot tested to ensure clarity, conceptual validity and linguistic appropriateness in the local Barind context. For participants, friends and relatives were taken to assess the effectiveness. Feedback from these pilot sessions was used to reword any ambiguous terms in providing microclimatic descriptions and to re-sequence the questions to avoid conversational fatigue and preserve the narrative sequence. From this observation some of the guidelines have been modified to obtain the best feedback possible.

3.8.3 Data Collection Procedure

Quantitative Extraction: The needed anonymized geriatric records (N = 225) were formally extracted from the secure BHP surveillance dataset with the help of geographic indicators for Niamatpur Upazila by the primary investigator.

Qualitative Field Execution: Primary qualitative data was collected from the field face-to-face by the principal investigator in the local language (Bangla) to get the natural narration of the people. The dialogues were held in private home-based spaces or in a quiet institutional office to preserve privacy. Each session was about 45-60 minutes, and was audio-recorded with participants' informed consent. During the period of fieldwork, reflexive field notes were kept in a systematic way so as to capture contextual nuances and non-verbal behaviours.

3.9 Data Management and Quality Assurance

In order to ensure integrity of data, the following quality assurance routines were carried out with respect to both research aspects:

- **Quantitative Data Handling:** Before data transfer, the secondary dataset was completely anonymised by the substitution of direct identifiers by unique alphanumeric study codes. Data cleaning, outlier checks and consistency verifications were conducted using the routines in the statistical software Stata version - MP 17.0. Non-identifiable aggregated records will be kept in encrypted folders for a maximum period of 10 years for possible further verification, auditing or secondary publication processes.
- **Qualitative Quality Safeguards:** Verbatim transcription of audio files was done and translated to English by principal investigator and a transcriber to maintain flow. Concurrent research team data review was used for data accuracy verification. Only the Principal Investigator (PI) was identified with direct identifiers, and these were removed after transcription, double verification and cross-checking were completed. Non-identifiable thematic files continue to be safeguarded within secure institutional data-sharing procedures.

3.10 Data Analysis

Quantitative Analysis Plan

Quantitative tracking by statistical software Stata version - MP 17.0. Descriptive statistical methods were used to calculate absolute frequencies (n) and relative percentages (%) for baseline demographic, disease prevalence rates, and behavioral and micro environmental risk exposures. Finally, a gender-stratified analytical lens was used throughout all steps to examine differences in risk exposure and chronic disease burdens between older men and women.

Qualitative Analysis Plan

Thematic analysis with a hybrid coding structure was used to process qualitative transcripts.

The a priori codes were mapped out in Deductive Codes, with the core inquiry domains being the issues of medication supply, cost barriers and heatwave adaptations. Inductive Codes Developed directly from the participant narratives through repeated readings and getting to know the transcripts well. Codes were grouped into sub-themes and overall themes, which represented the structural and environmental issues that faced older people. To ensure methodological rigor, data were triangulated with patient stories and provider interviews, a reflexive journal was kept, and an audit trail of coding decisions was maintained.

3.11 Ethical Considerations

The BRAC James P. Grant School of Public Health's Institutional Review Board (IRB) reviewed and formally approved the study protocol (IRB Protocol no. MPH-2025-021).

Standard bioethical practices were adhered to in the fieldwork:

- **Informed Consent:** Each participant gave voluntary written and/or verbal informed consent before primary data collection began. All participants had an information sheet read to them in clear, simple local language, explaining the purpose, method, risks and benefits of the study. Written consent was given for audio recordings. Administrative approvals were obtained for institutional key informants before arranging for interviews.

- **Voluntariness and Right to Withdraw:** Participation was voluntary and participants had the right to withdraw at any point. Participants were made aware of the option to skip any question, stop the interview or leave the study if they wished to at any time without negative consequences or loss of care. Requests for data removal were considered and met, up to the level of data anonymization and aggregation.

The study was considered low risk intervention. Conversational interviews were planned for risk mitigation and safeguarding. Interviews were held in a private and comfortable home setting to avoid fatigue or emotional distress. The researcher was ready to give contact information and information regarding local health care services to relatives or caregivers in case a vulnerable older person would have an emergency problem during the field visit. No elements of deception or concealment were used. Confidentiality and anonymity was assured throughout the study.

Chapter 4: Results

4.1 Quantitative Findings:

Table 1: Prevalence of Diabetes Mellitus and Hypertension (N=225)

Disease	Category	Frequency (n)	Percentage (%)
Diabetes	No	196	87.11
	Yes	24	10.67
	Don't know	5	2.22
Hypertension	No	137	60.89
	Yes	84	37.33
	Don't know	4	1.78

The prevalence of self-reported physician-diagnosed chronic Hypertension and Diabetes within the total study population (N = 225) reveals distinct health variations across the region. Out of the entire sample, 10.67% (n = 24) of the participants were diagnosed with Diabetes Mellitus, while 87.11% (n = 196) did not have the condition, and 2.22% (n = 5) reported that they did not know their diagnosis status. For hypertension, the prevalence of diagnosed cases was 37.33% (n = 84),

whereas 60.89% (n = 137) were not diagnosed, and 1.78% (n = 4) did not know their diagnosis status, also 14 individuals appeared to have both the disease condition.

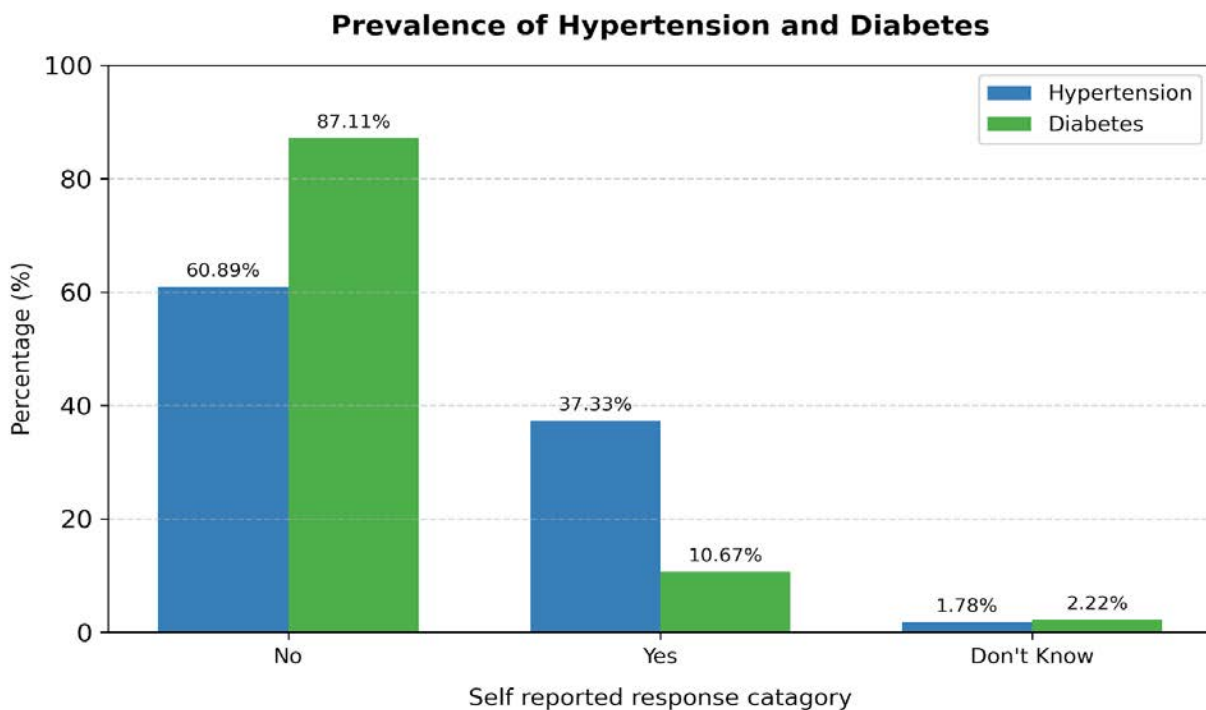


Figure 3: Prevalence of Hypertension and Diabetes

Table 2 : Socio-demographic Profile of Participants by Diabetes and Hypertension Status (N=225)

Variable	Diabetic n=24 (%)	Non-Diabetic n=196 (%)	Hypertensive n=84 (%)	Non-Hypertensive n=137 (%)
Age Group				
60–64 years	12 (50.00)	91 (46.43)	37 (44.05)	67 (48.91)
65–69 years	6 (25.00)	67 (34.18)	25 (29.76)	48 (35.04)
≥ 70 years	6 (25.00)	38 (19.39)	22 (26.19)	22 (16.06)
Wealth Quintile				
Lowest	2 (8.33)	21 (10.88)	10 (12.20)	13 (9.56)
Second	0 (0.00)	44 (22.80)	16 (19.51)	28 (20.59)
Middle	6 (25.00)	39 (20.21)	18 (21.95)	28 (20.59)
Fourth	7 (29.17)	51 (26.42)	22 (26.83)	36 (26.47)
Highest	9 (37.50)	38 (19.69)	16 (19.51)	31 (22.79)
Educational Status				

Variable	Diabetic n=24 (%)	Non-Diabetic n=196 (%)	Hypertensive n=84 (%)	Non-Hypertensive n=137 (%)
Completed Education	0 (0.00)	1 (0.51)	0 (0.00)	1 (0.73)
Drop out	15 (62.50)	80 (40.82)	33 (39.29)	63 (45.99)
Never went to School	9 (37.50)	115 (58.67)	51 (60.71)	73 (53.28)
Occupation Type*				
Non-sedentary	17 (70.83)	127 (67.20)	47 (57.32)	98 (74.24)
Sedentary	7 (29.17)	62 (32.80)	35 (42.68)	34 (25.76)
*For Occupation Type, N=218 instead of 225 as some entries (n=7) have their profession listed as “Other” which can’t be classified into either category.				

The baseline socio-demographic parameters according to Hypertensive and Diabetes condition status provide a picture of important structural distributions within the study population.

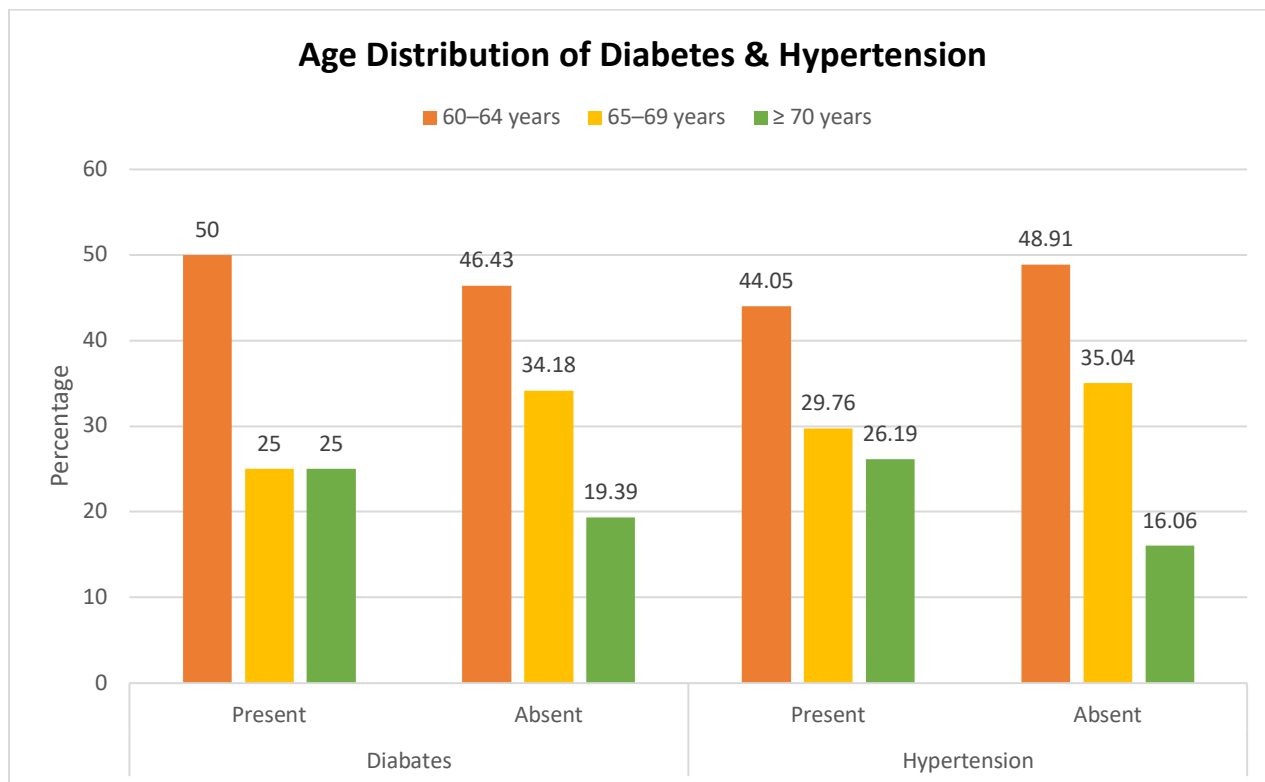


Figure 4: Age distribution of Hypertensive and Diabetes

In Figure 2, age distribution shows that the group of age 60-64 years has the highest percentage among all age groups (50% of all diabetics, 46.43% of non-diabetics, 44.05% of hypertensive and 48.91% of non-hypertensive). The remaining diabetics are equally divided between 65 - 69 years (25%) and the oldest age group of ≥ 70 years (25%). The age group 65–69 years old has 29.76% of the hypertensive and 35% of non-hypertensive individuals and the age group 70 years and above has 26.19% of the hypertensive and 16.06% of non-hypertensive individuals among those who were monitored for blood pressure.

Tracking socioeconomic status shows a clear economic gradient for metabolic disorders. In particular, 37.50 % of the diabetic population is in the highest wealth quintile; while 0.00 % is in the second quintile. By contrast, 19.69% of non-diabetic population are in the highest wealth group. Among the population followed, there is a more even distribution for cardiovascular health, with 26.83% of people with hypertension in the fourth wealth quintile and 19.51% in the highest, whereas, when considering people without hypertension, the values for these two wealth quintiles are 26.47% and 22.79%, respectively. The level of education is low throughout the community. There are 62.50% who dropped out of school in the diabetic subpopulation and 37.50% who never went to school compared to the non-diabetic group with 40.82% dropouts and 58.67% who never went to school. Similarly, the hypertensive group had 60.71% who never went to school and 39.29% who dropped out, while the non-hypertensive group had 53.28% who never went to school and 45.99% dropouts.

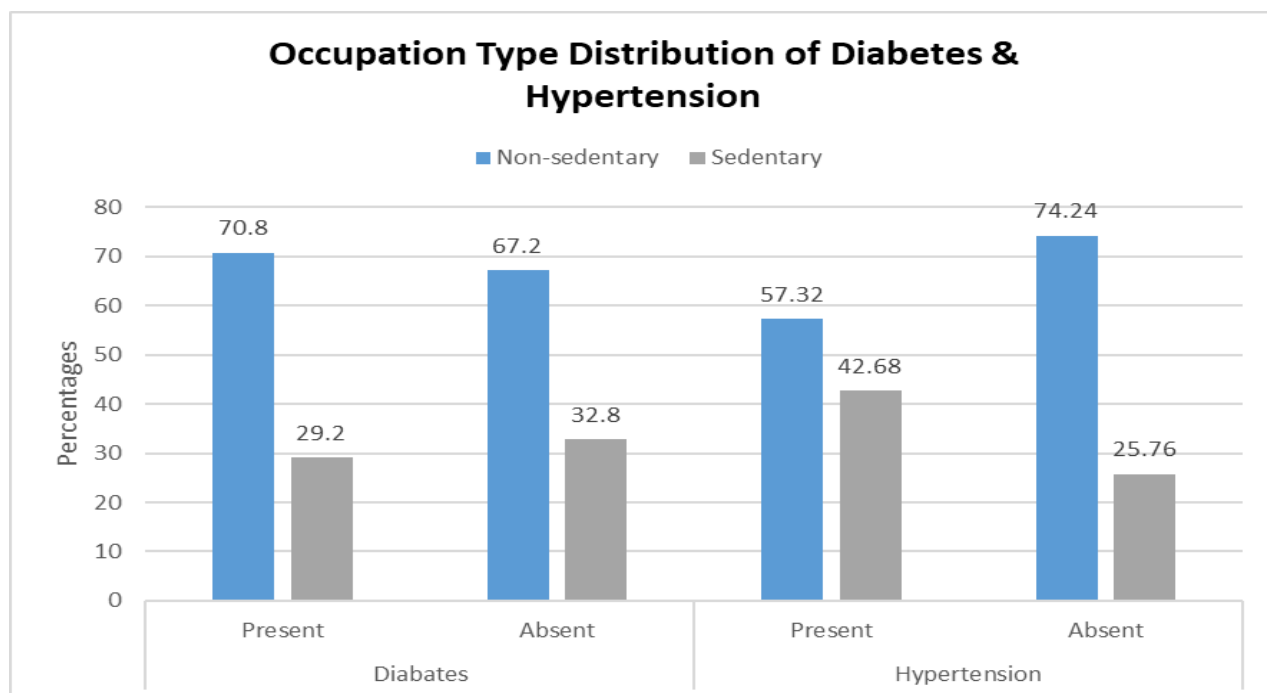


Figure 5: Distribution of Hypertensive and Diabetes by occupation type

Within Diabetic subjects and non-diabetic subjects, respectively 70.83% and 67.20% are working in non-sedentary occupations. A sedentary occupation type, however, is significantly more common among the hypertensive participants (42.68%) as compared to the non-hypertensive controls (25.76%).

Table 3: Profile of Participants by Clinical Metrics and Medication Gaps (N=225)

Variable	Diabetic n=24 (%)	Non-Diabetic n=196 (%)	Hypertensive n=84 (%)	Non-Hypertensive n=137 (%)
BMI Status				
Normal (<25)	17 (70.83)	177 (90.31)	68 (80.95)	127 (92.70)
Overweight [25–30)	5 (20.83)	17 (8.67)	13 (15.48)	9 (6.57)
Obese (≥ 30)	2 (8.33)	2 (1.02)	3 (3.57)	1 (0.73)
Blood Pressure level				
Normal (<120 & <80)	6 (25.00)	51 (26.02)	15 (17.86)	42 (30.66)
Elevated (120-129)	2 (8.33)	21 (10.71)	5 ((5.95	19 (13.87)
Stage 1 HTN (130-139)	4 (16.67)	54 (27.55)	14 (16.67)	43 (31.39)

Variable	Diabetic n=24 (%)	Non-Diabetic n=196 (%)	Hypertensive n=84 (%)	Non-Hypertensive n=137 (%)
Stage 2 HTN (≥ 140)	12 (50.00)	70 (35.71)	50 (59.52)	33 (24.09)
Blood Glucose Level				
Normal (< 7.8 mmol/L)	8 (33.33)	157 (80.1)	64 (76.19)	101 (73.72)
Prediabetes (7.8–11 mmol/L)	5 (20.83)	36 (18.37)	14 (16.67)	28 (20.44)
Diabetes (≥ 11.1 mmol/L)	11 (45.83)	3 (1.53)	6 (7.14)	8 (5.84)
Diabetic Medication				
On Medication	14 (58.33)	—	—	—
Off Medication	10 (41.67)	—	—	—
HTN Medication				
On Medication	—	—	44 (52.38)	—
Off Medication	—	—	40 (47.62)	—

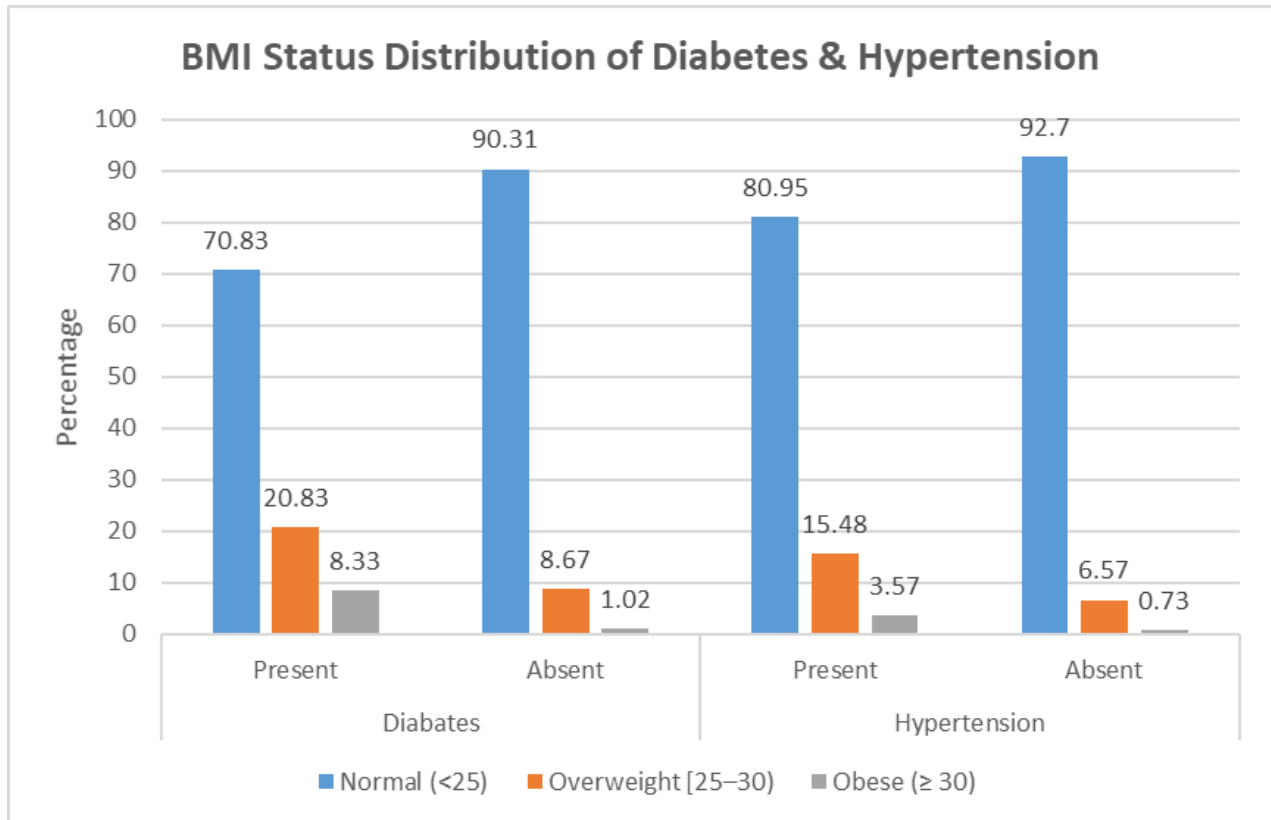


Figure 6: Distribution of Hypertensive and Diabetes by BMI status

Using anthropometric screening parameters, body composition and blood pressure level stratification and blood glucose testing, there are marked health risks that exist. Healthy cohorts maintain a normal level of BMI (less than 25) in high proportion, 90.31% in non-diabetic and 92.70% in non-hypertensive. On the other hand, overweight and obesity have a minimal but very evident presence in the diagnosed sub-types. Of the diabetic, 70.83% have normal BMI, 20.83% are overweight and 8.33% are obese. In the hypertensive group, the percentage of normal BMI is 80.95%, overweight is 15.48% and obese is 3.57%.

There are significant health trends across groups on cross-clinical assessments. Diabetic people have their blood pressure level at Stage-2 Hypertension (50.00%) and non-diabetic people have Stage-2 Hypertension (35.71%). Of all those monitored with cardiovascular status, 59.52% of hypertensive individuals had Stage-2 blood pressure and 24.09% of individuals without hypertension also screened at this high level. Based on blood glucose data, 33.33% of diabetic persons and 80.10% of non-diabetic persons, 76.19% of hypertensive and 73.72% of non-

hypertensive persons had normal blood glucose levels (<7.8 mmol/L). The percentages of diabetic, non-diabetic, hypertensive and non-hypertensive individuals with prediabetes ranges (7.8 to 11 mmol/L) are 20.83%, 18.37%, 16.67% and 20.44% respectively. 45.83%, 1.53%, 7.14% and 5.84% of the diabetic, non-diabetic, hypertensive and non-hypertensive groups respectively have active blood glucose level of ≥ 11.1 mmol/L.

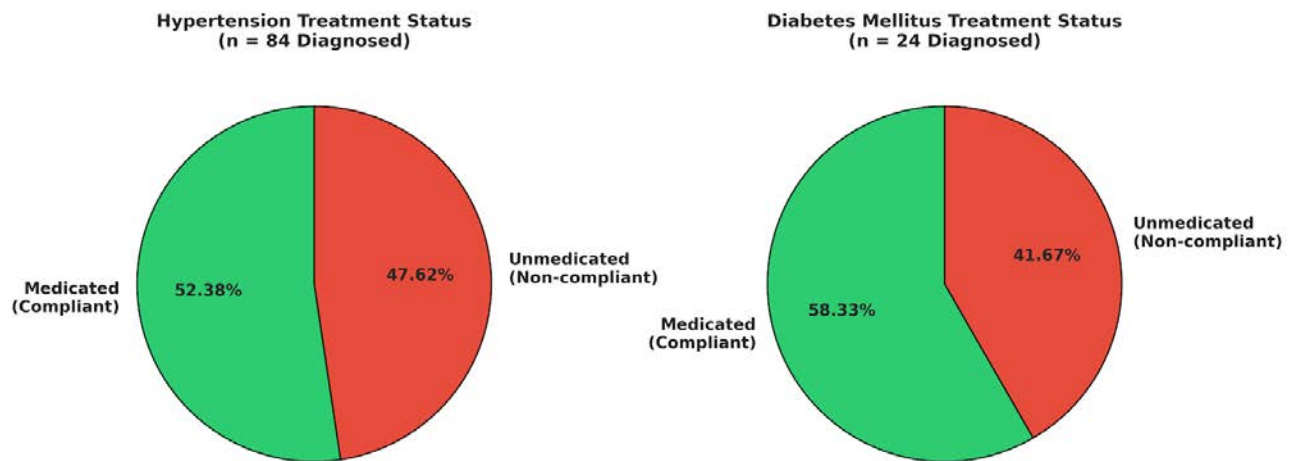


Figure 7: Medication adherence rate in diabetic and hypertensive cases

There are significant variations seen across figure 7 in the management and treatment rates indicating important gaps in local healthcare use. Only 58.33% of the diagnosed diabetic persons report using prescribed drugs, 41.67% are not under treatment. Similarly, for therapeutic coverage, 52.38% of blood pressure patients report using blood pressure drugs and 47.62% report that they are not taking any medicine for blood pressure.

Table 4: Profile of Participants by Behavioral factors (N=225)

Variable	Diabetic n=24 (%)	Non-Diabetic n=196 (%)	Hypertensive n=84 (%)	Non-Hypertensive n=137 (%)
Sedentary Lifestyle				
Yes (Lack of physical activity)	14 (58.3)	97 (49.5)	51 (60.7)	61 (44.5)

Variable	Diabetic n=24 (%)	Non-Diabetic n=196 (%)	Hypertensive n=84 (%)	Non-Hypertensive n=137 (%)
No (Engages in vigorous activity)	10 (41.7)	99 (50.5)	33 (39.3)	76 (55.5)
Smoking Status				
Current Smoker	5 (20.83)	54 (27.55)	15 (17.86)	45 (32.85)
Past Smoker	4 (16.67)	41 (20.92)	11 (13.10)	35 (25.55)
Never Smoked	15 (62.50)	101 (51.53)	58 (69.05)	57 (41.61)
Alcohol Consumption				
Ever Consumed	2 (8.33)	13 (6.63)	11 (13.10)	36 (26.28)
Never Consumed	22 (91.67)	183 (93.37)	73 (86.90)	101 (73.72)
Salt Intake				
3+ meals per day	4 (16.67)	66 (33.67)	33 (39.29)	54 (39.42)
Sometimes (2 meals)	1 (4.17)	6 (3.06)	3 (3.57)	4 (2.92)
Rarely (1 meal)	5 (20.83)	41 (20.92)	14 (16.67)	31 (22.63)
Never	14 (58.33)	66 (33.67)	34 (40.48)	48 (35.04)

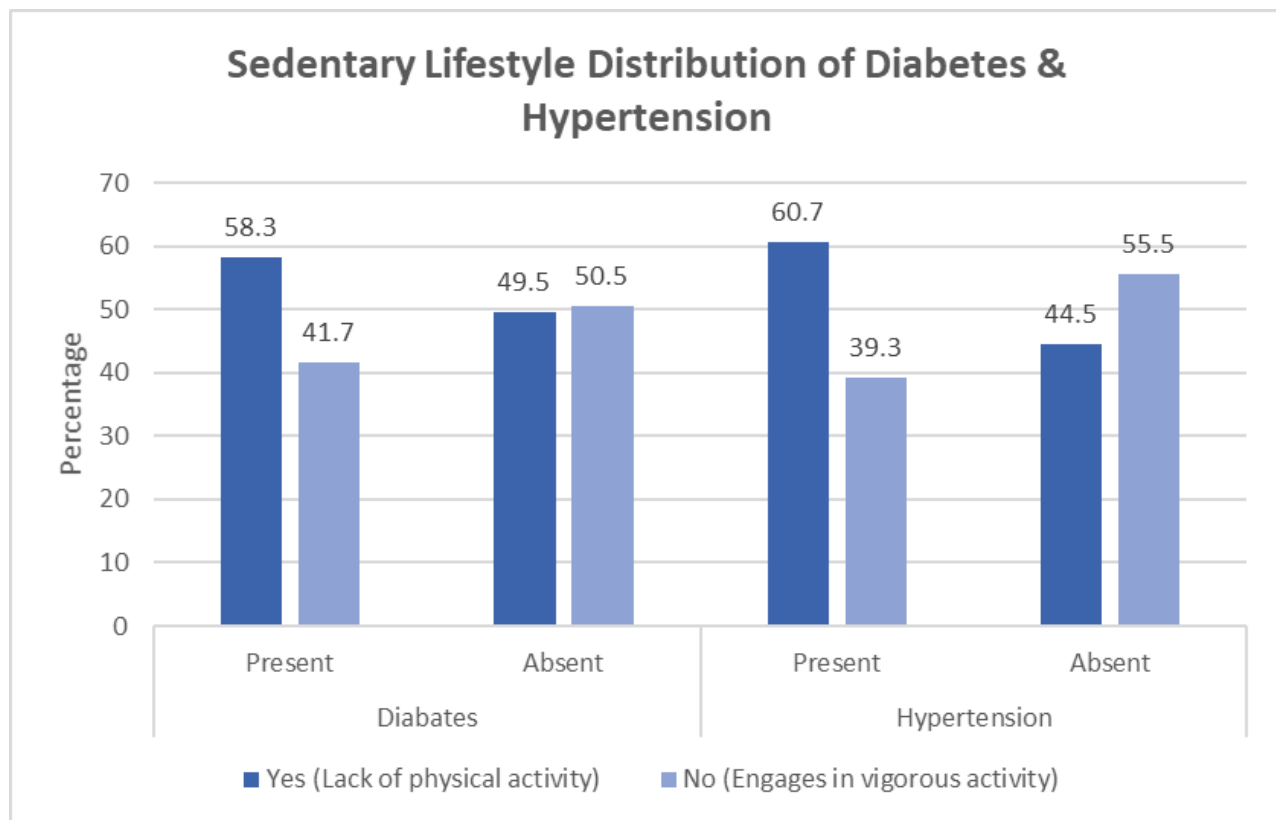


Figure 8: Distribution of Hypertensive and Diabetes by occupation type

A lifestyle assessment, followed by the assessment of tobacco use and dietary habits, reveal differences in the risk profile of the study cohorts. Sedentary lifestyle (low level of physical activity) was highly prevalent at 58.3% among the diabetic individuals compared with 49.5% of the non-diabetic individuals, and at 60.7% among the hypertensive individuals compared with 44.5% among the non-hypertensive individuals.

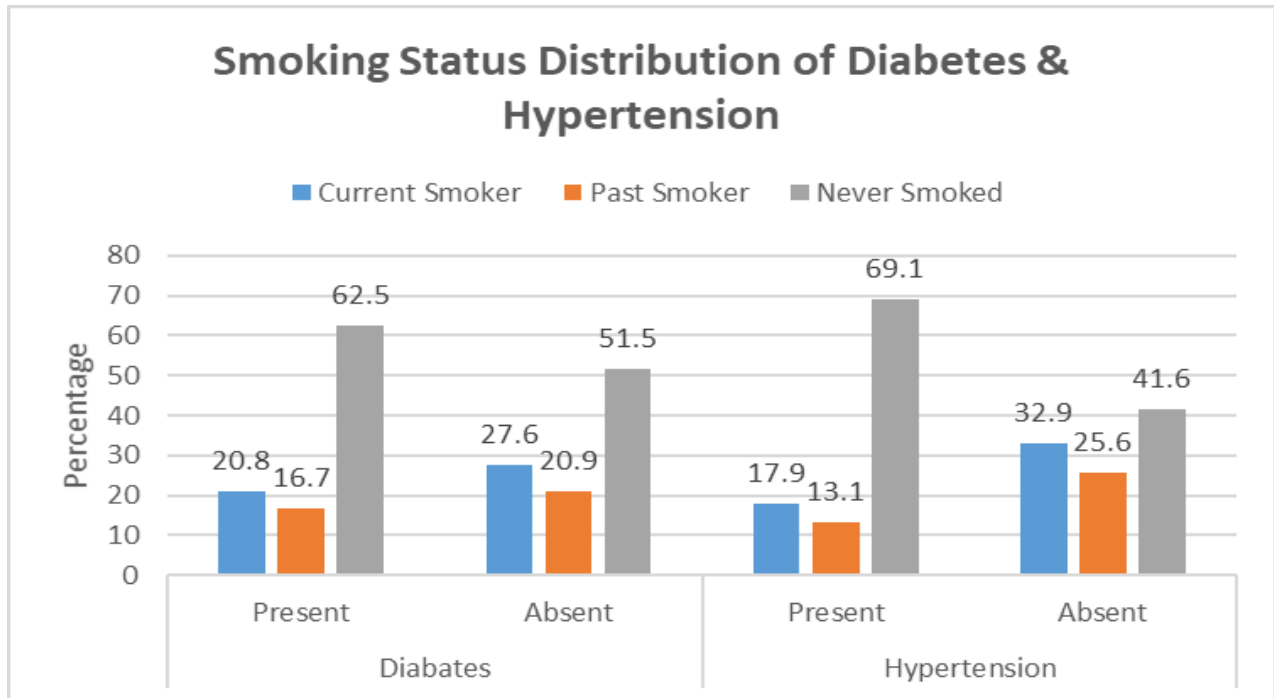


Figure 9: Distribution of Hypertensive and Diabetes by smoking status

Lifestyle habits of tobacco use show that the diagnosed subsets abstain from smoking for a lifetime at the highest rate. In fact, 62.50% diabetic people were never smokers, 20.83% were current smokers, and 16.67% were past smokers while 51.53% non-diabetic people were never smokers, 27.55% were current smokers, and 20.92% were past smokers. Likewise, more hypertensive (69.05%) than non-hypertensive participants (41.61%) report never smoking, while a greater percentage of non-hypertensive (32.85%) than hypertensive (17.86%) are current smokers and a higher proportion of non-hypertensive (25.55%) than hypertensive (13.10%) are past smokers.

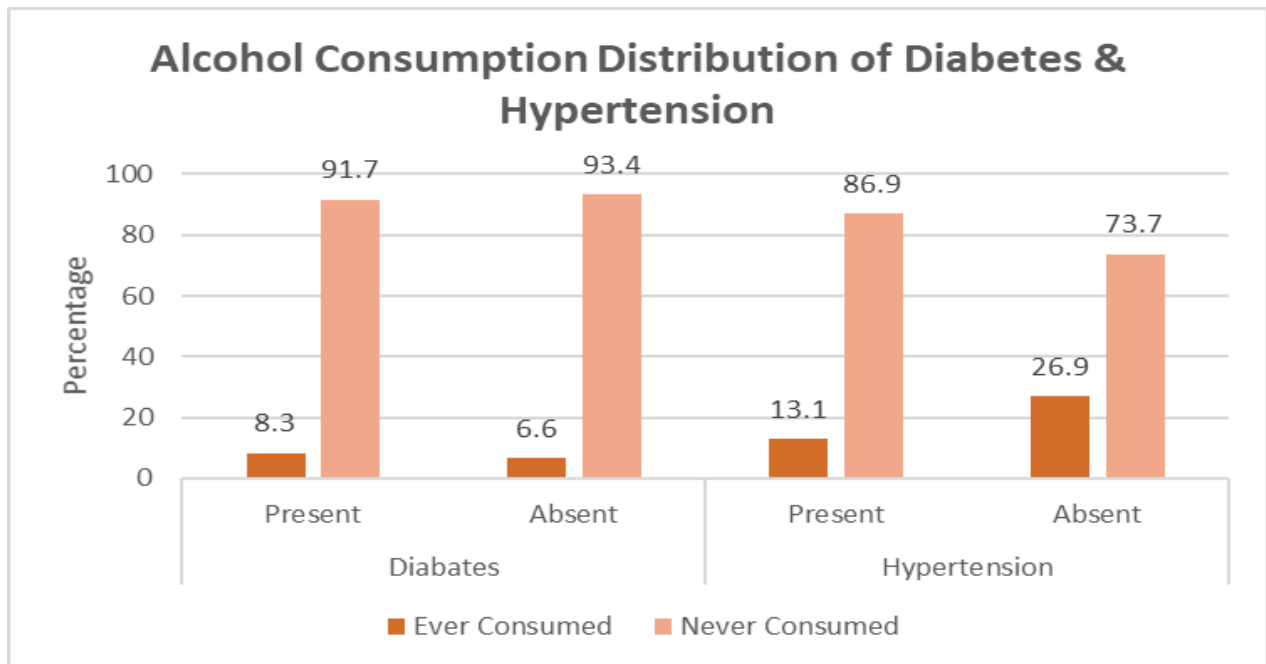


Figure 10: Distribution of Hypertensive and Diabetes by alcohol consumption

In Figure 10, it's the overall consumption of alcohol was very low with 91.7% of diabetic, 93.4% of non-diabetic, 86.9% of hypertensive and 73.7% of non-hypertensive subjects reporting that they never drank alcohol.

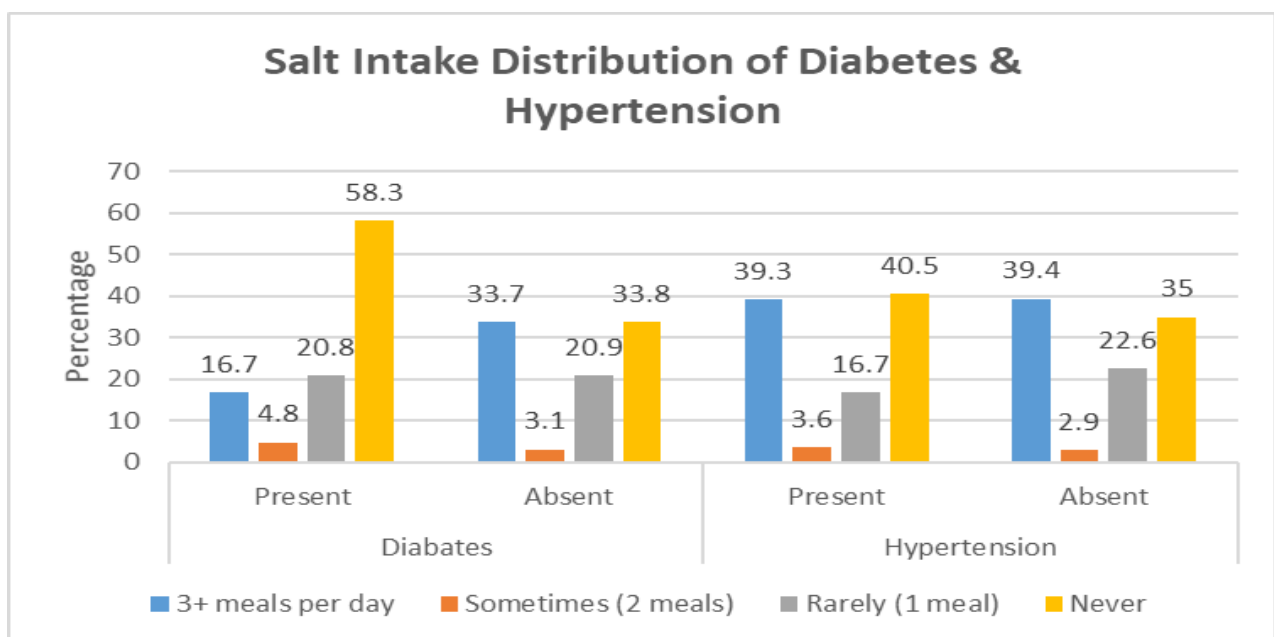


Figure 11: Distribution of Hypertensive and Diabetes by salt intake

Raw Salt consumption behaviors are shown to be unique after diagnosis. Diabetic persons are 58.33% never use salt to add to the food while non diabetic persons are 33.67% never use salt and 33.67% use salt 3 or more meals daily. The percentages of 39.29% added salt at 3 or more meals per day and 40.48% no added salt to meals are similar in the hypertensive group compared with the non-hypertensive control group (39.42% and 35.04%, respectively).

Table 5: Profile of Participants by Environmental Factors (N=225)

Variable	Diabetic n=24 (%)	Non-Diabetic n=196 (%)	Hypertensive n=84 (%)	Non-Hypertensive n=137 (%)
Kitchen PM2.5				
Good	7 (29.17)	61 (31.12)	27 (32.14)	40 (29.20)
Moderate	6 (25.00)	49 (25.00)	22 (26.19)	34 (24.82)
Unhealthy (Sensitive)	3 (12.50)	26 (13.27)	12 (14.29)	17 (12.41)
Unhealthy	8 (33.33)	60 (30.61)	23 (27.38)	46 (33.58)
Indoor PM2.5				
Good	5 (20.83)	61 (31.12)	28 (33.33)	49 (35.77)
Moderate	7 (29.17)	58 (29.59)	26 (30.95)	39 (28.47)
Unhealthy (Sensitive)	2 (8.33)	34 (17.35)	11 (13.10)	16 (11.68)
Unhealthy	10 (41.67)	43 (21.94)	19 (22.62)	33 (24.09)
Outdoor PM2.5				
Good	7 (29.17)	73 (37.24)	34 (40.48)	44 (32.12)
Moderate	8 (33.33)	61 (31.12)	26 (30.95)	43 (31.39)
Unhealthy (Sensitive)	2 (8.33)	24 (12.24)	11 (13.10)	15 (10.95)
Unhealthy	7 (29.17)	38 (19.39)	13 (15.48)	35 (25.55)
Kitchen PM10				
Good	20 (83.33)	168 (85.71)	69 (82.14)	119 (86.86)
Moderate	3 (12.50)	23 (11.73)	12 (14.29)	14 (10.22)
Unhealthy (Sensitive)	1 (4.17)	5 (2.55)	3 (3.57)	4 (2.92)

Variable	Diabetic n=24 (%)	Non-Diabetic n=196 (%)	Hypertensive n=84 (%)	Non-Hypertensive n=137 (%)
Indoor PM10				
Good	21 (87.50)	174 (88.78)	76 (90.48)	119 (86.86)
Moderate	3 (12.50)	22 (11.22)	8 (9.52)	17 (12.41)
Outdoor PM10				
Good	21 (87.50)	174 (88.78)	74 (88.10)	121 (88.32)
Moderate	3 (12.50)	21 (10.71)	10 (11.90)	15 (10.95)
Unhealthy (Sensitive)	0 (0.00)	1 (0.51)	0 (0.00)	1 (0.73)
Kitchen Temp				
Safe	11 (45.83)	101 (51.53)	41 (48.81)	71 (51.82)
Elevated	10 (41.67)	77 (39.29)	33 (39.29)	57 (41.61)
High	3 (12.50)	18 (9.18)	10 (11.90)	9 (6.57)
Indoor Temp				
Safe	16 (66.67)	143 (72.96)	56 (66.67)	100 (72.99)
Elevated	6 (25.00)	31 (15.82)	20 (23.81)	22 (16.06)
High	2 (8.33)	22 (11.22)	8 (9.52)	15 (10.95)
Outdoor Temp				
Safe	24 (100.00)	191 (97.45)	100 (100.00)	132 (96.35)
Elevated	0 (0.00)	5 (2.55)	0 (0.00)	5 (3.65)

From Table 5, across all air quality indices and microclimatic thermal stresses, there are high local exposures in households. When it comes to fine particulate matter (PM2.5), 41.67% of the diabetic households have unhealthy indoor PM2.5 exposures, which is almost twice that of non-diabetic households (21.94%). Unhealthy kitchen PM2.5 levels are pretty evenly distributed between the metabolic groups, with 33.33% of the diabetic households and 30.61% of the non-diabetic households having unhealthy levels. The distribution is slightly different for the hypertensive group, with an unhealthy concentration of kitchen PM2.5 present in 27.38% of the homes and an unhealthy concentration of indoor PM2.5 present in 22.62% of the homes. Baseline air quality is very stable and very clean throughout the community as shown in the coarse particulate matter (PM10) analysis. More than 80% of all households in both diagnostic stratifications have good baseline concentrations for all microenvironments. The PM10 concentration levels in the home kitchens are found to be in the good category (83.33% of the diabetic ones and 85.71% of the non-

diabetic ones) and (82.14% of the hypertensive and 86.86% of the non-hypertensive ones). Indoor room levels are equally as good, with 87.50% for diabetic homes vs 88.78% for non-diabetic homes, and 90.48% for hypertensive homes vs 86.86% for non-hypertensive homes. Similarly, 100% of the diabetic and 97.45% of the non-diabetic outdoor ambient spaces and 100% of the hypertensive and 96.35% of the non-hypertensive outdoor spaces have good status.

4.2 Qualitative Findings:

Table 6: Socio-demographic and Disease-related Characteristics of IDI Participants (N = 12)

Characteristics of the participants	Frequency	Percentage (%)
Age (in years)		
60–64	5	41.67
65–69	4	33.33
70–74	2	16.67
≥75	1	8.33
Gender		
Male	5	41.67
Female	7	58.33
Religion		
Islam	8	66.67
Hindu	4	33.33
Education Level		
No formal education	4	33.33
Primary education	3	25
Secondary education (SSC)	3	25
Higher education (Degree)	1	8.33
Occupational Status		
Agriculture	2	16.67
Household Duties	6	50
Retired	2	16.67
Imam & shop owner	1	8.33
Monthly Income (BDT)		
≤5,000	4	33.33

Characteristics of the participants	Frequency	Percentage (%)
5,001–10,000	3	25
10,001–15,000	2	16.67
>15,000	3	25
Family Members		
1–3 members	6	50
4–5 members	4	33.33
≥6 members	2	16.67
Disease Condition		
Hypertension only	5	41.67
Diabetes Mellitus only	4	33.33
Both HTN and DM	3	25

Table 7: KII Participants Information

KII	Designation
01	Assistant Surgeon (Upazila Health Complex)
02	CHCP (Community Health Care Provider)
03	Village Doctor & Owner of a Pharmacy

For the qualitative part of the study, a total of 12 IDI participants were included. The participants covered all age groups, males and females, education, profession and disease status.

The majority of the participants were in the younger elderly age group (60-64 years) with 41.67% followed by the age group 65-69 years with 33.33%. Only one participant was over the age of 75 years. The mean participant profile thus showed relatively active older adults who lived with chronic conditions.

Female participants (58.33%) outnumbered males (41.67%), which enabled the exploration of gendered experiences of chronic disease management and access to healthcare.

The majority of the participants were Muslims (66.67%) and 33.33% were Hindu showing religious diversity of the study area.

In terms of educational qualifications, one-third (33.33%) of the respondents were uneducated, 25.00% of them completed primary education and 25.00% completed secondary level (SSC). One participant was educated, with a higher degree. In general, educational levels of the elderly participants were not high.

Half of the participants were mainly involved in household chores and all are females. Other occupations were agriculture (16.67%), small business or religious service activities (16.67%) and retirement which is highlighting the largely rural and economically disadvantaged setting of participants.

Monthly income levels were found to be quite different but one-third of the participants had monthly income of less than or equal to 5,000 BDT. A significant number of participants had few financial opportunities as only 25.00% reported income levels above 15,000 BDT.

Analysis of family structure revealed that 50% and 33.3% of the participants lived in small (1-3) and medium (4-5) families, respectively. The elderly may have smaller family sizes, which might impact dependency, care provision and health care access and support.

As far as the disease condition goes, hypertension was reported to be the most common condition (41.67%) followed by diabetes mellitus (33.33%). Multi morbidity was also significant as one-quarter of the participants reported to suffer from both hypertension and diabetes.

In general, the profile of the participants shows that the study included the experiences of elderly people with different educational and disease backgrounds, who are economically vulnerable and live in a drought-stricken rural area.

Thematic Analysis

This results section organizes findings from the qualitative data into six core themes, highlighting the intersection of chronic illness, environmental stressors, and socioeconomic barriers among the geriatric population in rural northwestern Bangladesh.

1. Reliance on Physical Signals: Reading Symptoms and Reactive Care

Illness is primarily understood through a series of vivid physical warnings rather than clinical check-ups. Among male participants, a majority (3 out of 5) reported that they only recognize high blood pressure when they feel "head heaviness" or vertigo. For these men, medication is often a reactive choice rather than a preventive routine; they seek care when the physical "signal" becomes too loud to ignore. While head-spinning was the common thread, one male participant shared a unique story of discovering his diabetes after coworkers noticed ants gathering near his urine, and another noted that he first felt a persistent "feverish" feeling and sudden weight loss.

"During that time, my head felt very heavy and sometimes there was a tingling sensation. It didn't feel right to me so I went to the doctor with that heaviness, and he measured it and said my blood pressure was high." - (Male participant of IDI13)

Female participants described a different internal narrative, often centered on acute physical collapses and profound fear. Most women reported that their vision became affected or their hearts would pound so violently they felt as though they were dying. This acute distress is what finally drove them to seek diagnosis, often after years of neglecting minor symptoms.

"My head would spin, and I'd fall over. My heart would pound, and I'd feel like I was going to die. I couldn't stand up or eat. Even now, when it happens if I walk too much, my eyes go dark, and I have to sit down immediately." - (Female participant from IDI04)

Healthcare providers back these findings, observing that geriatric patients rarely understand the silent, asymptomatic nature of NCDs. They note that most patients are only caught when they present with a crisis such as a stroke or a non-healing infection confirming that the community generally views these diseases as intermittent episodes rather than lifelong conditions.

"They say the pain in the neck is more... dizziness and sometimes heart palpitations. For diabetes, mostly it's caught when an infection happens and doesn't heal for a long time." - (Assistant surgeon of UHC from KII01)

2. The Heat Factor: Climate Stress and Economic Burden

The Barind environment acts as a constant physical and psychological weight on health management. Most male participants (3 out of 5) described the intense summer heat as a sensation of the world being "on fire" or their bodies being "cooked". They linked this heat directly to blood pressure spikes, often driven by the anxiety of losing their daily income when it becomes too hot to labor in the fields or drive a van.

"During the drought, the heat was intense. In the months of Chaitra and Baishakh, it feels like the world is on fire. I feel like my body is being "cooked." My skin can't take it. When the heat is high, my pressure acts up." - (Male participant of IDI12)

Women described the heat as a domestic struggle, where brick houses trap heat and make breathing difficult. To cope with the "internal heat" they associate with their blood pressure, many (4 out of 7) reported pouring water on their heads multiple times a day or wearing wet clothes to find relief.

"The heat makes my heart pound. I sweat so much I have to bathe multiple times a day or wear wet clothes just to stay cool. Even in winter, I sometimes have to pour water on my head because of the internal heat from the blood pressure." - (Female participant from IDI08)

Providers highlighted a startling structural challenge. The facility wasn't built with any plan to adapt with intense heat strain in summer and the environment is so extreme at times that it physically degrades medical equipment such as blood pressure measuring machines. In rural community health clinics, the heat is often intense enough to melt the very tools used to monitor the patients' health.

"The building becomes very hot during summer time. The rubber pipes of our blood pressure machines melt in this heat. I have had 8 to 10 machines fail because the rubber literally melts and sticks together due to the intense heat accumulated in the building." - (CHCP from KII02)

3. The Preference for Familiar and Traditional Care

Faced with long distances and large queues in hospitals, patients often choose the familiarity of their local community. Male participants frequently adopt a pluralistic approach, combining modern pharmacy drugs with traditional herbal remedies. They value the local pharmacy not just for medicine, but as a place where they can get their condition checked and talk freely without worrying about time. One male participant who suffered from a stroke while working in the field on a hot summer day, had faced partial paralysis and then he sought out a *Kabiraj* specifically because he felt modern medicine hadn't provided quick relief.

"I took Kabiraj's medicine and the modern doctor's medicine at the same time. Kabiraj told me it's fine to take both together, no problem." - (Male participant of IDI12)

For women, the choice of local care is often rooted in a profound fear of the formal hospital system. Most women reported feeling safer with village doctors who come directly to their homes, avoiding the physical and emotional exhaustion of navigating a distant, crowded institution.

"Regarding Ghutu (a village doctor), I don't know if he passed any exams, but he gives medicine and goes from house to house, but after he went abroad a year ago, my treatments are in a halt. I have never been to UHC. It's far, and no one ever took me. I'm afraid to go to the hospital." - (Female participant from IDI08)

Rural providers acknowledge that this trust is a powerful force. They note that many patients return to them even after visiting specialized city centers, explicitly stating they prefer the familiarity of their local doctor for the remainder of their lives.

"Interestingly, many patients go to Rajshahi Medical College two or three times, and then they come back to me and say, "You give the same treatment as them, why would I go far then. I want to spend the rest of my life under your treatment."" - (Village doctor from KII03)

4. Challenges: Financial and Systemic Barriers

Poverty makes consistent care a luxury that few can maintain. Male participants (3 out of 5) identified the "financial crisis" as the primary reason for stopping their medication, often going days without pills until they can scrape together the money for the next strip. Some men also shared a unique frustration: being told by government doctors that hospital stock was "low power," forcing them to spend money for private pharmacy medicine.

"If I go to UHC, it takes about 100–150 Taka for a trip and the medicine. Sometimes even that small amount is a problem for me." - (Male participant of IDI03)

Women's barriers were often more structural and social. Many reported that the physical requirement to stand in long queues starting at dawn often referred to as the "Fajr line" was an impossibility for their aging bodies. They also noted a perceived lack of empathy from hospital staff, who they felt "shouted" at patients rather than listening to them.

"I know they give medicine there. But you have to stand in a line, and I can't stand for that long. You have to go at dawn (Fajr), that's why I don't go. I heard from people that you have to queue, so I never felt like going." - (Female participant from IDI07)

Providers admit that systemic pressures make high-quality care difficult. With hundreds of patients to see, they can often only spare two or three minutes per person, which they acknowledge is insufficient for the elderly who may have hearing or understanding difficulties. At primary care level providers also reported systemic delay for which they receive outdated equipment that are needed to measure blood sugar level such as outdated strips that only have a few weeks left until they expire.

"There are some linguistic differences... if you give an elderly person 2 to 3 minutes, they can't understand. In that case, if we could give 5 to 10 minutes or more, they would understand better. That is not possible at this level due to the patient pressure." - (Assistant surgeon of UHC from KII01)

5. Dependency on care: Forgetfulness, Memory Gaps and Support

At this stage of life, managing illness is a family effort rather than an individual one. In this age cognitive decline is an unavoidable part of life. Most male participants (3 out of 5) reported being

managed by wives or daughters-in-law who place medication directly into their hands. However, they also admitted that they are forgetful, often getting distracted by daily chores and missing their doses.

“Sometimes I can't follow the doctor's rules. Mostly due to mistakes or forgetfulness. I get busy with other work, like looking after the cattle, and I forget to take the medicine.” - (Male participant of IDI01)

Female participants often reported a more isolated form of dependency. Those without sons or with husbands who do not prioritize their health found themselves unable to access tests or medicine for months or even a year.

“I don't have a son or someone to take me to the city. My husband doesn't understand these things, and my daughters are married.” - (Female participant from IDI08)

Providers highlighted the life-threatening risks of this cognitive fragility. They shared a tragic narrative of an elderly patient who died after trying to compensate for several missed doses by taking multiple days' worth of pills all at once.

“He used to take medicine from here. He missed his doses for 3 or 4 consecutive days... he took 3 or 4 days' worth of pills all at once on the same day. This caused his blood pressure to crash... and he died.” - (CHCP from KII02)

6. Traditional Remedies and Seasonal Adaptive Practice

When the formal system is out of reach or undesired, the elderly turn to the natural world and seasonal adaptations for management of their condition. Women (3 out of 7) rely heavily on home remedies like tamarind for pressure or *Mahogany* seeds for diabetes, viewing them as accessible and "free" alternatives.

“I use home remedies. For pressure, I used to eat tamarind. For diabetes, I eat the fruit of the Mahogany plant or soak the seeds overnight and drink the water in the morning.” - (Female participant from IDI07)

Male diabetic participants similarly utilized local plants, such as *Telakucha* (Ivy Gourd) juice, specifically when they felt their condition worsening and suspected that sugar level in the body might not be in a healthy range. One participant uniquely noted that he used *Pippali* (Long Pepper) not for the disease itself, but to restore the physical strength he felt the illness had stolen.

Sometimes environmental conditions influence their management and dietary practice as well. One of the diabetic female participants mentioned that the doctor advised her to walk for an hour in the morning or evening, which she tries to follow but during hot summer days if she missed walking in the morning for any reason, she skips walking for that day due to the intense heat strain. And in winter many participants (7 out of 12) have reported skipping walks because of the knee pain, joint pain becoming more prominent. Also in the winter going near a stove is actually comforting so having rotis at night become common but in the summer, families switch from healthy wheat *rotis* to "Panta Bhat" (fermented rice) specifically to avoid the heat of the stove, prioritizing immediate physical comfort over long-term diabetic control.

“In summer, they don't like to make rotis... because of the heat from the stove. So, they... eat cold rice (panta bhat) more often. While wheat is better for diabetes, they switch to rice in summer because it's easier to manage in the heat.” - (CHCP from KII02)

And when they are in a habit of eating panta bhat, for some it becomes a necessity to add some raw salt in that otherwise the dish will be bland in taste. One of the male participant said,

“When i eat panta bhat i must add some raw salt in it, usually 2-3 pinches of salt because without adding the salt it will not taste as good.” - (Male participant of IDI01)

Chapter 5: Discussion

This section analyzes the results of this mixed methods study, clarifying the empirical significance of the results and their implications for public health practice. This chapter combines quantitative profile with qualitative findings, to give a fuller picture of the interaction between individual socio-demographic factors, clinical, behavioural and environmental microclimates in the management of hypertension and diabetes in older people.

5.1 Summary of key findings

The key findings from the survey are summarized in this section.

The main goal of this study was to assess the clinical prevalence, socio-demographic characteristics, clinical behaviors and micro environmental risk factors of older adults with and at risk for Diabetes Mellitus and Hypertension.

In terms of quantity, the study found that out of the total population ($N = 225$), the formal physician diagnosis prevalence of DM was 10.67% ($n = 24$) and HT was 37.33% ($n = 84$). One of the most important observations was the high percentage of diagnosed people who were not taking their prescribed drugs, 41.67% of the diabetic and 47.62% of the hypertensive individuals were not taking drugs. Moreover, there was a high prevalence of behavioral and environmental risk factors among all the participants, including more than half of the patients with diabetes (58.33%) and hypertensive patients (60.71%) who had sedentary lifestyle. Worryingly, considerable environmental vulnerabilities were recorded: 41.67% of the diabetic participants were exposed to unhealthy indoor fine particulate matter (PM (2.5)), while almost 25% of the hypertensive participants were exposed to high temperatures in their living area at home.

In order to put these figures into context, the thematic analysis uncovered severe structural and behavioural barriers to effective disease management. However, qualitative narratives indicated that financial distress, medical pluralism (accessing less expensive traditional healers or local pharmacies instead of doctors) and widespread structural access to medicines shortfalls at Community Clinics are strong drivers of clinical non-compliance. Crucially, the qualitative findings

exposed a profound vulnerability to shifting seasonal microclimates. On a hot summer day, older people have to stop their daily physical exercise due to heat strain and have to change the food habit, often from healthy wheat based food to cold fermented rice (panta bhat), which is less heat producing by indoor kitchen stoves. This is a seasonal dietary adjustment which poses a cumulative health problem, as it means adding several pinches of raw dietary salt for taste, thus directly increasing their cardiovascular risk.

5.2 Discussion of Findings

Clinical Prevalence, Treatment Gaps, and Socioeconomic Constraints.

The prevalence of hypertension (37.33%) and diabetes (10.67%) in this study is similar to recent epidemiological data reported in older adults in the country and elsewhere in the world. While 14 quantitative cases presented with both the condition, qualitative findings yielded no distinct insights; therefore, they were not analyzed as a separate group. Rapidly changing demographic trends and the growing pace of urbanization have consistently been identified as a growing problem of non-communicable diseases (NCDs) in the national surveys conducted in low- and middle-income countries (LMICs). The most alarming finding from the quantitative data, however, was the huge treatment gap: almost half of the people with hypertension were not on drug therapy and more than 40% of the people with diabetes were not on drug therapy.

The qualitative results help to explain this dramatic quantitative difference. Financial issues were reported as the main challenge for long term pharmacological adherence. Older adults who are living with HTN or DM, and who are facing economic constraints, cannot afford regular refills from a pharmacy, as these medications have to be taken on a recurring basis and require lifelong purchases. Instead they are relying on home remedies with the hope of managing their condition in safe levels and they are only using it when they face any visual or physical cues that they associate with high BP or Blood sugar level. While they deem it as an effective practice, the efficacy of those practices aren't scientifically reliable and relying on cues instead of measuring the BP or RBS level is even more concerning. This is in line with the already established knowledge, which

has shown that out-of-pocket healthcare expenditure is a significant barrier to adherence to medicines in limited resource environments.

In addition, structural weaknesses in primary healthcare delivery exacerbate this financial barrier. Qualitative narratives from participants and Community Health Care Providers (CHCPs) highlighted issues of periodic stock out of chronic medicines at the community-level facilities. Sometimes the most effective drug or dosage aren't available through govt. supply and once the free govt. allocated medicines are depleted, the patients are left with the choice to purchase the drugs from private pharmacies or to fall back on their drug regimens altogether. For the elderly population already suffering from aging issues such as cognitive decline or arthritis, going a long way and waiting in long queue is often not desirable. This trend particularly seen in female patients and they are preferring the local and traditional ways of management instead of taking institutional help and dependency and caregiving also plays a role in that. This structural failure sets the stage for medical pluralism – people switch to less expensive unqualified traditional healers or informal village healers, directly endangering their clinical safety and disease control.

The formal provider side is also not equipped with the right and sufficient tools. For the manpower shortage, providers can't allocate more time per patient, but elderly people need detailed instruction to follow their management routine properly. Community health clinic providers also emphasized that the health facility face challenges in extreme heat as the buildings were not made with the thought of climate resilience. When the rubber pipe of BP measuring machine melted in heat and no backups available, they have no choice but to release the patients without measuring their BP level. Also delay in supply chain often resulted in receiving strips for blood glucose measurement with few months of validity and become useless when they expire.

The behaviors, environmental microclimates, and seasonally vulnerabilities of a species are addressed. A key advantage of the mixed methods is that it helps to understand the reasons behind the continued high prevalence of sedentary lifestyle and unhealthy eating patterns, despite clinical counseling. Quantitatively, a high proportion of non-diabetic (49.49%) and non-hypertensive (44.53%) were found to have sedentary lifestyle, and more than one-third of the non-hypertensive consumed added salt in 3 or more meals in a day. The qualitative information helps to explain that

these behavioral patterns are not simply options, but are strongly influenced by exposure to their environment and microclimates. Although doctors often recommend walks for older adults, findings of the study reveal that the qualitative results show that extreme seasonal changes are interfering with these walks. During the winter, older adults have trouble with walking due to the pain and during the summer, the heat of the outdoors makes physical activity dangerous and uncomfortable.

One of the interesting results is environmental modification in dietary behaviour in extreme summer temperatures. Qualitative data indicated that the families avoid the use of wheat for making healthy wheat based flatbreads (roti) during the hot summer season because of the intolerable heat produced by the stoves used in their kitchens. They changed their dietary pattern to cook only once per day and eat 3 meals out of that. They move to fermented, cold rice called panta bhat to preserve the rice for a delayed eating. This climate driven dietary change creates an additional risk as panta bhat, compared to wheat rootis is a carbohydrate heavy food which isn't ideal for diabetes and also bland in taste so participants reported adding in several pinch of raw salt to make it taste better. The quantitative results of the investigation of dietary salt intake may be directly explained by this behavior. This winter effect is a critical hotspot in which repeated microclimatic exposure to heat directly prompts a switch toward higher sodium intake in the diet, leading to a further significant rise in blood pressure and cardiovascular risks – in both diagnosed and non-diagnosed groups. The latent risks in non-diagnosed group is also nothing to be neglected. An important thing to highlight is that people who are at present considered non-diabetic or non-hypertensive by no means are free from the risk of cardiovascular disease. The quantitative data clearly demonstrate that the non-disease cohorts are similarly exposed to the exact same predisposing risk factors as their diagnosed counterparts.

These clinical findings should be put in their proper context: the blood glucose and blood pressure measurements were taken at one point in time during the field assessment; these measurements alone are not definitive diagnostic tools. Chronic conditions are usually diagnosed by multiple elevations by independent readings. These figures, however, indicate that the percentage of individuals with levels outside the healthy range were highly vulnerable, potential cases. These

sub-cohorts need to be clinically assessed systematically and followed up longitudinally for confirmed diagnosis and timely intervention. These elevated one-time measurements are characteristic of an 'undiagnosed pool of chronic disease' which is often seen in resource-limited environments where screening is not easily available (Malcolm et al., 2019).

Notably, almost half of the non-diabetic population is sedentary, one fourth are active tobacco smokers and 33.67% consume high amounts of added salt. Almost one-third of non-diabetic people are exposed to high kitchen PM (2.5) and more than 16% of non-hypertensive people to high indoor temperatures.

Public health implications of these findings suggest that there is a substantial number of undiagnosed or latent chronic disease in the community. These individuals are not formally diagnosed and therefore are not clinically counseled for these behaviors and exposures, and thus persist with these high-risk behaviors and exposures. This constant exposure to high sodium, lack of activity, particulate air pollution, and extreme indoor heat will inevitably drive them from a non-disease state to clinical hypertension and diabetes in the future, and thus future NCD burdens in this population will continue to rise.

5.3 Strengths of the Study

The study has a number of strengths. The first is that the mixed-methods design enables for a comprehensive triangulation of data. The quantitative data set offers statistically valid prevalence data and helps to map out exposure trends at the large scale, whereas the qualitative narratives describe what it is like to be a participant, barriers to exposure, and the reasons for the behavior, thereby providing answers to the question of why.

Secondly, this study differs from the conventional lifestyle analysis, as it correlates the data of environmental monitoring (indoor PM (2.5), PM (10) and temperature) with clinical data, thereby creating a new connection between local environmental health and chronic disease management.

Also the study is designed not only to see the patient but also look at the potential exposures or behaviors that can contribute in increasing the number of the people affected.

Lastly, this study investigates the older adult population, an overlooked population in public health literature, in the context of climate change, environmental exposures, and geriatric non-communicable disease management in resource-poor communities.

5.4 Limitations of the Study

However, there are some drawbacks to this approach. First, clinical statuses of diabetes and hypertension were self-reported at the time of data collection and were not measured independently (e.g., HbA1c test or standardized blood pressure measurement). This might have added recall bias and probably affected the results of the disease prevalence as many undiagnosed patients in the community would have been missed.

Second, behavioral data for dietary salt consumption, smoking and physical activity were self-reported and thus vulnerable to social desirability and recall bias.

Third, a cross-sectional design of quantitative data does not allow for determining definite causality between micro environmental exposures and chronic disease progression. To overcome these restrictions, qualitative interviews were conducted to cross-validate behavioral consistency, and local health care providers were interviewed to validate structural and pharmaceutical obstacles of health care utilization reported by the community.

Also some relevant data such as specific family history not being present in the secondary data set resulted in not considering one of the predisposing factor in the analysis. Also time and resource shortage played as a barrier in the process.

5.5 Public Health Policy and Practice implications

The results of this study are of major implications for health strategies at the national level, environmental policies, and primary healthcare interventions.

Strengthening Primary Healthcare Supply Chains: There is a need for the Ministry of Health to optimize the supply chain to rural HCs and Community Clinics for the medicines for non-communicable diseases as there is a wide treatment gap due to medicines shortages. This is particularly important to maintain the uninterrupted supply of free anti-hypertensive and anti-diabetic drugs, thereby shielding low-income older persons from treatment drop-out and harmful medical pluralism.

Climate-Resilient and Seasonally Tailored Health Education: Public health counseling should be tailored to local environmental realities. Health workers should guide their patients towards lifestyle changes that can help them adapt to climate change rather than giving them specific behavioral instructions. For example, nutrition guidelines should clearly advise against adding raw salt to panta bhat in the summer, as well as recommending other low-sodium spices. Also, physical activity guidelines should provide adaptive season options, such as suggesting indoor activities when the outside weather is either very hot or very cold in the winter.

Targeted Screening for Non-Diagnosed Populations: There is a significant amount of exposure of risk factors for behavior and environment in non-diagnosed cohorts and so community wide mobile screening camps need to be implemented. Screening older people for high blood pressure and high blood sugar proactively, even before they have any symptoms, is important to detect these cases early and stop these chronic diseases in their tracks.

High prevalence of unhealthy indoor PM (2.5) and elevated living temperatures indicate a need for structural interventions. Policies should be targeted at improving household ventilation, cleaner cooking stoves and reducing particulate matter in kitchens, and the development of heat-resilient rural housing, which can help to protect older adults from the cumulative cardiovascular impacts of indoor thermal and air pollution.

Chapter 6: Conclusion and Recommendations

6.1 Conclusion

In conclusion it is evident that very relevant empirical evidence of the geriatric population of Barind Tract in Bangladesh, who face vulnerability in three domains – health, lifestyle behavior and climate change. The disease burden baseline shows a significant public health problem, with the high prevalence of Hypertension and the significant disease burden of Diabetes Mellitus. Socio-demographically, the sample was skewed towards the early geriatric phase, highlighting a critical opportunity for early public health intervention before the greater burden of advanced ageing results in a further overlap of these multi-morbidities.

However, the most alarming structural finding lies in the massive pharmacological treatment gaps. Many of the hypertension and diabetes patients are totally untreated. This unmediated gap was illustrated with qualitative data which showed that it rarely occurs by deliberate choice, but is instead due to serious financial limitations, significant out-of-pocket expenses for health services, and the absence of local, affordable diagnostic and therapeutic services in rural areas.

Furthermore, this physiological burden is actively exacerbated by distinct lifestyle and environmental hazards. Regarding behavioral risks, poor diets and sitting for long periods of time are prevalent in both disease and non-disease populations, along with high amounts of raw salt usage at mealtimes. In terms of climate and environmental exposure, geriatric population is actively exposed to household environmental hazards (toxic kitchen smoke and severe indoor ambient heat stress). Qualitative narratives also supported the fact that extreme summer heat waves significantly exacerbate the cardiovascular distress and impacts on the management practice in the Barind Tract.

To sum up, older adults in Barind Tract are facing a confluence of vulnerability at the interface of the challenges of physiological ageing, chronic metabolic diseases, behavioral risks, and harsh environmental stressors associated with climate change in a region with limited health care provision and lack of economic opportunity.

6.2 Recommendations

Multi-sectoral recommendations are provided based on the cumulative quantitative and qualitative insights synthesized in this study, for protecting the health, dignity and well-being of the geriatric population in Barind Tract.

The Ministry of Health and Family Welfare (MHFW) needs to introduce subsidized geriatric health services in Community Clinics and Upazila Health Complexes to establish links in primary healthcare in favour of geriatric care. The main goal of this should be to make the essential antihypertensive and antidiabetic drugs available to the people at free or highly subsidized prices to address the massive treatment gap largely caused by the limitation of out-of-pocket expenditure. In addition, mobile-based door-to-door metabolic screening camps are highly recommended for active detection of the cases who are asymptomatic or undiagnosed as early as possible in remote and peripheral villages.

To tackle lifestyle risks, local public health officials should create and execute context-specific Behavioral Change Communication campaigns that kick off community based health literacy programs that are specifically targeting low-literacy older adults. These interventions need to directly target their perception about the disease, implication of long term uncontrolled disease and their view of the disease as reactive management instead of regular management, the reduction of added raw salt consumption at mealtimes, as well as encourage safe, low-impact indoor physical activity to reduce sedentary behaviour. Public health messages can be optimized for community reach and adoption by systematically using local dialects and community networks based on trust such as local radio networks and religious announcements.

Union Parishad, other governmental and non-governmental bodies need to work together and undertake targeted rural housing adaptation programmes to address threats posed by climate change and environmental hazards. Such structural support should help deliver affordable, better cooking solution to significantly cut down biomass smoke in households, which adversely affects the health of older persons, in terms of their respiratory and cardiovascular systems. Additionally, housing schemes should encourage heat-resistant roofing solutions, natural shade structures and

local greening spaces that are directly adjacent to rural households, in order to combat extreme heat stress in the home.

Also for future studies like this, a longitudinal type of quantitative data would be better to draw any inference rather than cross-sectional, because of the progressive nature of these diseases. So any future studies on this matter may consider that for better analysis.

Lastly, social safety nets need to be directly linked with climate adaptation measures in relevant governance frameworks. The Ministry of Social Welfare should extend the Old Age Allowance to a specific climate-health medical allowance. This financial resilience should enable older people in vulnerable positions to access essential medicines and clean drinking water and be able to get to another out-of-town medical facility if they need to do so, without falling into catastrophic debt due to a climate catastrophe.

Declaration of GenAI Use

I, Kazi Maruf Quadir, declare that in preparing this assignment, I used ChatGPT & Deepseek as a support tool to assist with brainstorming ideas, organizing the structure of my writing, overcoming writer's block, and improving clarity and language in the text that I drafted myself. GenAI was not used to generate original arguments, interpret results, or produce final academic content. All substantive ideas, judgments, references, and conclusions are my own and have been independently verified in line with JPGSPH academic integrity guidelines.

References

- Akhtar, S., Nasir, J. A., Sarwar, A., Nasr, N., Javed, A., Majeed, R., Salam, M. A., & Billah, B. (2020). Prevalence of diabetes and pre-diabetes in Bangladesh: a systematic review and meta-analysis. *BMJ Open*, 10(9), e036086. <https://doi.org/10.1136/bmjopen-2019-036086>
- Alam, I., Otani, S., Majbauddin, A., Qing, Q., Ishizu, S. F., Masumoto, T., Amano, H., & Kurozawa, Y. (2021). The effects of drought severity and its aftereffects on mortality in Bangladesh. *Yonago Acta Medica*, 64(3), 292–302. <https://doi.org/10.33160/yam.2021.08.007>
- AR4 Climate Change 2007: Impacts, Adaptation, and Vulnerability — IPCC. (n.d.). IPCC. <https://www.ipcc.ch/report/ar4/wg2/>
- Boitchi, A. B., Naher, S., Pervez, S., & Anam, M. M. (2021). Patients' understanding, management practices, and challenges regarding hypertension: A qualitative study among hypertensive women in a rural Bangladesh. *Heliyon*, 7(7), e07679. <https://doi.org/10.1016/j.heliyon.2021.e07679>
- Chandrasekara, S. S., Kwon, H., Vithanage, M., Obeysekera, J., & Kim, T. (2021). Drought in South Asia: A review of drought assessment and prediction in South Asian countries. *Atmosphere*, 12(3), 369. <https://doi.org/10.3390/atmos12030369>
- Chowdhury, H. A., Joham, A. E., Kabir, A., Rahman, A. K. M. F., Ali, L., Harrison, C. L., & Billah, B. (2024). Exploring type 2 diabetes self-management practices in rural Bangladesh:

- facilitators, barriers and expectations—a qualitative study protocol. *BMJ Open*, 14(5), e081385. <https://doi.org/10.1136/bmjopen-2023-081385>
- Chowdhury, M. Z. I., Rahman, M., Akter, T., Akhter, T., Ahmed, A., Shovon, M. A., Farhana, Z., Chowdhury, N., & Turin, T. C. (2020). Hypertension prevalence and its trend in Bangladesh: evidence from a systematic review and meta-analysis. *Clinical Hypertension*, 26(1), 10. <https://doi.org/10.1186/s40885-020-00143-1>
- Della Corte, K. A., Bosler, T., McClure, C., Buyken, A. E., LeCheminant, J. D., Schwingshackl, L., & Della Corte, D. (2025). Dietary sugar intake and Incident Type 2 Diabetes Risk: A Systematic Review and Dose-Response Meta-Analysis of Prospective Cohort Studies. *Advances in Nutrition*, 16(5), 100413. <https://doi.org/10.1016/j.advnut.2025.100413>
- Dey, N., Alam, Sajjan, A., Bhuiyan, M., Ghose, L., Ibaraki, Y., & Karim, F. (2012). Assessing environmental and health impact of drought in the Northwest Bangladesh. *Journal of Environmental Science and Natural Resources*, 4(2), 89–97. <https://doi.org/10.3329/jesnr.v4i2.10141>
- Gao, D., Friedman, S., Hosler, A., Sheridan, S., Zhang, W., & Lin, S. (2022). Association between extreme ambient heat exposure and diabetes-related hospital admissions and emergency department visits: A systematic review. *Hygiene and Environmental Health Advances*, 4, 100031. <https://doi.org/10.1016/j.heha.2022.100031>
- Goudet, J., Arif, F. B., Owais, H., Ahmed, H. U., & Ridde, V. (2024). Climate change and women's mental health in two vulnerable communities of Bangladesh: An ethnographic study. *PLOS Global Public Health*, 4(6), e0002080. <https://doi.org/10.1371/journal.pgph.0002080>
- Haque, M. A., Budi, A., Malik, A. A., Yamamoto, S. S., Louis, V. R., & Sauerborn, R. (2013). Health coping strategies of the people vulnerable to climate change in a resource-poor rural setting in Bangladesh. *BMC Public Health*, 13(1), 565. <https://doi.org/10.1186/1471-2458-13-565>
- Hasan, M., Khan, M. S. A., Sutradhar, I., Hossain, M. M., Hossaine, M., Yoshimura, Y., Choudhury, S. R., Sarker, M., & Mridha, M. K. (2021). Prevalence and associated factors of hypertension in selected urban and rural areas of Dhaka, Bangladesh: findings from

- SHASTO baseline survey. *BMJ Open*, 11(1), e038975. <https://doi.org/10.1136/bmjopen-2020-038975>
- Hoq, M. I., Hossain, M., Jahan, S., Mahmud, H., Akter, F., Mahmud, F., Uddin, M., Siddiqui, S. A., & Jakaria, M. (2022). Trends in the Prevalence of Hypertension and Type 2 Diabetes in Bangladesh(2010-2020): A Systematic Review and Meta-Analysis. *Current Diabetes Reviews*, 19(6), e290422204250. <https://doi.org/10.2174/1573399818666220429092805>
- Hossain, A., Suhel, S. A., Islam, S., Dhor, N. R., Akther, N., Sanjoy, S. S., & Chowdhury, S. R. (2025). Prevalence and regional disparities of undiagnosed diabetes mellitus in Bangladesh: Results from the Bangladesh Demographic and Health Survey data. *PLoS ONE*, 20(4), e0321069. <https://doi.org/10.1371/journal.pone.0321069>
- Irwan, A. M., Potempa, K., Abikusno, N., & Syahrul, S. (2022). Self-Care Management for hypertension in Southeast Asia: A scoping review. *Journal of Multidisciplinary Healthcare*, Volume 15, 2015–2032. <https://doi.org/10.2147/jmdh.s367638>
- Kalra, S., Dhar, M., Afsana, F., Aggarwal, P., Aye, T. T., Bantwal, G., Barua, M., Bhattacharya, S., Das, A. K., Das, S., Dasgupta, A., Dhakal, G., Dhingra, A., Esfahanian, F., Gadve, S., Jacob, J., Kapoor, N., Latheef, A., Mahadeb, Y., . . . Jawdekar, A. (2022). Asian Best Practices for Care of Diabetes in Elderly (ABCDE). *The Review of Diabetic Studies*, 18(2), 100–134. <https://doi.org/10.1900/rds.2022.18.100>
- Kenney, W. L., Craighead, D. H., & Alexander, L. M. (2014). Heat waves, aging, and human cardiovascular health. *Medicine & Science in Sports & Exercise*, 46(10), 1891–1899. <https://doi.org/10.1249/mss.00000000000000325>
- Lilier, K., Dalglish, S. L., Reñosa, M. D. C., Selim, S. A., Raihan, S. T., Islam, R., Das, J., Danquah, I., Sauerborn, R., & Bärnighausen, K. (2025). The “most beautiful place” where “it’s not possible to live”: A qualitative study of relational well-being in an area of climate vulnerability, Bangladesh. *PLoS ONE*, 20(9), e0325972. <https://doi.org/10.1371/journal.pone.0325972>
- Malcolm, S., Cadet, J., Crompton, L., & DeGennaro, V. (2019). A model for point of care testing for non-communicable disease diagnosis in resource-limited countries. *Global Health*, 4, e7. <https://doi.org/10.1017/gh.2019.6>

- Meade, R. D., Akerman, A. P., Notley, S. R., McGinn, R., Poirier, P., Gosselin, P., & Kenny, G. P. (2020). Physiological factors characterizing heat-vulnerable older adults: A narrative review. *Environment International*, 144, 105909. <https://doi.org/10.1016/j.envint.2020.105909>
- Natur, S., Damri, O., & Agam, G. (2022). The effect of global warming on complex disorders (Mental disorders, primary hypertension, and type 2 diabetes). *International Journal of Environmental Research and Public Health*, 19(15), 9398. <https://doi.org/10.3390/ijerph19159398>
- Osborn, C. Y., Mayberry, L. S., Wagner, J. A., & Welch, G. W. (2014). Stressors may compromise medication adherence among adults with diabetes and low socioeconomic status. *Western Journal of Nursing Research*, 36(9), 1091–1110. <https://doi.org/10.1177/0193945914524639>
- Pius, M., Yelwa, S., & Adewuyi, T. (2025). From Deficit to Dysfunction: Rethinking Drought through a Multi-Index Functional Framework for Ecologically Vulnerable Systems. *International Journal of Research in Environmental Science*, 11(3), 1–15. <https://doi.org/10.20431/2454-9444.1103001>
- Resma, M. N. J., Karim, M. K. B., Zoha, S., Hasan, F., Saeed, A. S. M. A., & Kibria, M. K. (2026). Prevalence of hypertension and its associated risk factors among adults in Dinajpur District, Bangladesh: a Cross-Sectional study. *Health Science Reports*, 9(3). <https://doi.org/10.1002/hsr2.71957>
- Rummi, F. H., Khan, M. M., Tahsin, T., Rashad, I., Abrar, N., & Rawan, A. (2022). Pattern of geriatric health problems and health care seeking behavior among rural people in Bangladesh. *International Journal of Family & Community Medicine*, 6(2), 74–79. <https://doi.org/10.15406/ijfcm.2022.06.00268>
- Saquist, N., Saquist, J., Ahmed, T., Khanam, M. A., & Cullen, M. R. (2012). Cardiovascular diseases and Type 2 Diabetes in Bangladesh: A systematic review and meta-analysis of studies between 1995 and 2010. *BMC Public Health*, 12(1), 434. <https://doi.org/10.1186/1471-2458-12-434>

- Shanmugasundaram, S., Baskaran, P., Radhakrishnan, R. V., Raghav, P., & Gupta, A. K. (2025). Sociocultural and indigenous practices of rural India in adapting to heat stress: an exploratory descriptive qualitative study. *International Health*.
<https://doi.org/10.1093/inthealth/ihaf153>
- Sharma, I., Soni, B., Barik, M., Tyagi, J., Ingale, S., Singh, C., Menon, G. I., & Bhaumik, S. (2026). Climate change and health in South Asia: A systematic mapping. *The Journal of Climate Change and Health*, 27, 100645. <https://doi.org/10.1016/j.joclim.2025.100645>
- Sud, R., Mishra, A., Varma, N., & Bhadwal, S. (2015). Adaptation policy and practice in densely populated glacier-fed river basins of South Asia: a systematic review. *Regional Environmental Change*, 15(5), 825–836. <https://doi.org/10.1007/s10113-014-0711-z>
- Upamali, S., & Rathnayake, S. (2023). Perspectives of older people with uncontrolled type 2 diabetes mellitus towards medication adherence: A qualitative study. *PLoS ONE*, 18(8), e0289834. <https://doi.org/10.1371/journal.pone.0289834>
- Xie, W., Paul, R. R., Goon, I. Y., Anan, A., Rahim, A., Hossain, M. M., Hersch, F., Oldenburg, B., Chambers, J., & Mridha, M. K. (2023). Enhancing care quality and accessibility through digital technology-supported decentralisation of hypertension and diabetes management: a proof-of-concept study in rural Bangladesh. *BMJ Open*, 13(11), e073743.
<https://doi.org/10.1136/bmjopen-2023-073743>
- Xu, J., Zhao, M., Vrosgou, A., Yu, N. C. W., Liu, C., Zhang, H., Ding, C., Roth, N. W., Pan, Y., Liu, L., Wang, Y., Wang, Y., & Bettger, J. P. (2021). Barriers to medication adherence in a rural-urban dual economy: a multi-stakeholder qualitative study. *BMC Health Services Research*, 21(1), 799. <https://doi.org/10.1186/s12913-021-06789-3>

Appendices (Optional)

Appendix A: Data Collection Instrument

IDI GUIDELINE – ENGLISH

Title: Burden, Barriers, and Behavioral Adaptation: A Mixed-Method Study of Hypertension and Diabetes Management among the Geriatric Population in the Drought-Prone Barind Tract of Bangladesh

Date:

Interviewer name:

Note taker name:

Interview starting time:

Interview ending time:

Interview settings:

Unique ID:

Sociodemographic Profile

Variable	Categories	Response
Age	☐ 60 – 69 years ☐ 70 – 79 years ☐ 80 years and above	
Sex	☐ Male ☐ Female ☐ Other	
Education	☐ No formal education ☐ Primary education ☐ Secondary education ☐ Higher education	
Occupation	☐ Indoor/Sedentary ☐ Outdoor/Field-based ☐ Unemployed/Retired	
Income	☐ Low ☐ Middle ☐ High	
Family Size	☐ 1 – 2 members ☐ 3 – 5 members ☐ More than 5 members	

Component	Core Questions	Probes
1. Disease History & Awareness	1. When were you first diagnosed with hypertension and/or diabetes?	How did you get diagnosed?
	2. What were the problems you experienced initially?	How were you feeling after getting diagnosed?
	3. What do you understand about these diseases?	What complications do you know about?

	4. Did anyone in your family have similar diseases?	What do you know about the significance of a positive family history?
2. Daily Disease Self-Management	1. Can you describe what a usual day looks like for you in terms of food and drink?	Do these practices change in summer or drought? Who reminds or helps you? What happens when you feel unwell? If yes then how frequently , if irregular then ask why? do you face any challenges? if yes then what are those challenges?
	2. How do you usually decide how much water to drink each day?	
	3. What kinds of physical activities are part of your daily routine?	
	4. How do you keep track of your health or body changes related to your condition?	
	5. Do these routines remain the same throughout the year, or do they vary at different times?	
	6. Who, if anyone, supports you in managing these daily practices?	
	7. Do you monitor your blood pressure or blood sugar?	
3. Healthcare-Seeking Behavior	1. Where do you usually go when you need care for your condition?	Transport difficulties? Financial barriers? Drought or heat-related challenges?
	2. Can you describe how you usually travel to that place?	
	3. How often do you visit a healthcare provider for follow-up or check-ups?	
	4. What factors influence your decision to seek care or delay a visit?	
	5. Are there times when seeking care feels more difficult than others?	
4. Challenges, Coping & Adaptation	1. What are the main difficulties you experience in managing your condition?	Family or neighbor support? Community or NGO help? Any traditional practices?
	2. Can you describe situations when managing your condition feels particularly challenging?	
	3. What do you usually do when you feel unable to manage as you would like?	

	4. Who do you rely on for support during difficult times?	
	5. Are there any practices or resources in your community that you find helpful?	
5. Recommendations	1. What additional facilities would make it easier for you to manage diabetes or hypertension, which is not present now?	Government? non-government? ,BRAC , other ngo etc? why do you think so?
	2. Who should be involved in creating or running or managing those facilities/programs/ initiative?	

IDI GUIDELINE – বাংলা

শিরোনাম: বাংলাদেশের খরা-প্রবণ বরেন্দ্র অঞ্চলের প্রবীণ জনগোষ্ঠীর মধ্যে উচ্চ রক্তচাপ ও ডায়াবেটিস ব্যবস্থাপনা: রোগের ব্যাপকতা, প্রতিবন্ধকতা ও আচরণগত মোকাবিলা কৌশল বিষয়ক একটি মিশ্র-পদ্ধতির গবেষণা

তারিখ:

সাক্ষাৎকারগ্রহণকারীর নাম:

নোট গ্রহণকারীর নাম:

সাক্ষাৎকার শুরুর সময়:

সাক্ষাৎকার শেষ সময়:

সাক্ষাৎকারের পরিবেশ:

সাক্ষাৎকারদাতার নাম:

ভেরিয়েবল	বিভাগসমূহ	উত্তর
বয়সের গ্রুপ	☐ ৬০–৬৯ বছর ☐ ৭০–৭৯ বছর ☐ ৮০ বছর ও তদুর্ধ্ব	
লিঙ্গ	☐ পুরুষ ☐ মহিলা ☐ অন্যান্য	
শিক্ষাগত যোগ্যতা	☐ কোনো প্রাতিষ্ঠানিক শিক্ষা নেই ☐ প্রাথমিক ☐ মাধ্যমিক ☐ উচ্চশিক্ষা	
পেশা	☐ ইনডোর/স্থির কাজ ☐ আউটডোর/ক্ষেতভিত্তিক কাজ ☐ অবসরপ্রাপ্ত/বেকার	
মাসিক আয়	☐ নিম্ন ☐ মধ্যম ☐ উচ্চ	
পরিবারের সদস্য সংখ্যা	☐ ১–২ জন ☐ ৩–৫ জন ☐ ৫ জনের বেশি	
উপাদান	মূল প্রশ্নসমূহ	প্রোব

১. রোগ ইতিহাস ও সচেতনতা	১. প্রথম কবে আপনার উচ্চ রক্তচাপ এবং/অথবা ডায়াবেটিস শনাক্ত হয়েছিল? ২. শুরুতে আপনি কী ধরনের উপসর্গ বা সমস্যার সম্মুখীন হয়েছিলেন? ৩. এই রোগগুলো সম্পর্কে আপনার বর্তমান ধারণা কী? ৪. আপনার পরিবারের কারও কি একই ধরনের রোগ রয়েছে বা ছিল?	• রোগটি কীভাবে শনাক্ত হয়েছিল? • রোগ নির্ণয়ের পর আপনি কেমন অনুভব করেছিলেন? • সম্ভাব্য জটিলতা সম্পর্কে আপনি কী জানেন? • পারিবারিক ইতিহাস থাকলে ঝুঁকি বাড়ে—এ বিষয়ে আপনার ধারণা কী?
২. দৈনন্দিন রোগ স্ব-ব্যবস্থাপনা	১. খাদ্য ও পানীয়ের দিক থেকে আপনার একটি সাধারণ দিনের বর্ণনা দিন। ২. আপনি প্রতিদিন কতটা পানি পান করবেন তা কীভাবে নির্ধারণ করেন? ৩. আপনার দৈনন্দিন জীবনে কী ধরনের শারীরিক কার্যক্রম থাকে? ৪. আপনি কীভাবে আপনার উপসর্গ বা শারীরিক পরিবর্তন পর্যবেক্ষণ করেন? ৫. এসব রুটিন কি সারা বছর একই থাকে, নাকি ঋতুভেদে পরিবর্তিত হয়? ৬. এসব ব্যবস্থাপনায় কে আপনাকে সহায়তা করেন? ৭. আপনি কি নিয়মিত রক্তচাপ বা রক্তে শর্করা পরীক্ষা করেন?	• গ্রীষ্ম বা খরার সময় কোনো পরিবর্তন হয় কি? • কে আপনাকে মনে করিয়ে দেয়? • অসুস্থ বোধ করলে আপনি কী করেন? • অনিয়ম হলে তার কারণ কী? • কোনো বিশেষ চ্যালেঞ্জের সম্মুখীন হন কি?
৩. স্বাস্থ্যসেবা গ্রহণ আচরণ	১. আপনার রোগের চিকিৎসার জন্য আপনি সাধারণত কোথায় যান? ২. সেখানে যেতে কীভাবে যাতায়াত করেন? ৩. ফলো-আপের জন্য কত ঘন ঘন যান? ৪. চিকিৎসা নেওয়ার সিদ্ধান্তে কোন বিষয়গুলো প্রভাব ফেলে? ৫. বছরের কোনো সময় চিকিৎসা নেওয়া কি বেশি কঠিন হয়?	• যাতায়াত সমস্যা আছে কি? • আর্থিক সমস্যা আছে কি? • খরা বা তাপপ্রবাহের কারণে কোনো সমস্যা হয় কি?
৪. চ্যালেঞ্জ, মোকাবিলা ও অভিযোজন	১. আপনার রোগ নিয়ন্ত্রণে প্রধান অসুবিধাগুলো কী? ২. কোন পরিস্থিতিতে নিয়ন্ত্রণ সবচেয়ে কঠিন হয়? ৩. নিয়ন্ত্রণে ব্যর্থ হলে আপনি কী করেন? ৪. কঠিন সময়ে কার ওপর নির্ভর করেন? ৫. কমিউনিটিতে কোনো সহায়ক সম্পদ আছে কি?	• পরিবার/প্রতিবেশীর সহায়তা • কমিউনিটি বা এনজিও সহায়তা • লোকজ বা ঐতিহ্যবাহী চিকিৎসা

৫. সুপারিশ	১. কোন অতিরিক্ত সুবিধা থাকলে আপনার রোগ ব্যবস্থাপনা সহজ হতো? ২. এসব কর্মসূচি কারা পরিচালনা করা উচিত বলে আপনি মনে করেন?	• সরকার • বেসরকারি সংস্থা • ব্র্যাক বা অন্যান্য এনজিও
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KII GUIDELINE – ENGLISH

Title: Burden, Barriers, and Behavioral Adaptation: A Mixed-Method Study of Hypertension and Diabetes Management among the Geriatric Population in the Drought-Prone Barind Tract of Bangladesh

Date:

Interviewer name:

Note taker name:

Interview starting time:

Interview ending time:

Interview settings:

Name of interviewee:

Age of interviewee:

Unique ID:

Component	Core Questions	Probes
1. Provider Background	Can you describe your current professional role and responsibilities?	Training on hypertension and diabetes? Experience with geriatric patients?
	How long have you been working in this area?	
	Approximately how many older patients with hypertension and/or diabetes do you see in a typical week?	
2. Perceived Burden of Hypertension and Diabetes	How would you describe the occurrence of hypertension and diabetes among older adults in this area?	Gender differences? Socioeconomic patterns?
	Have you noticed any changes in these conditions over time? Any seasonal patterns?	
	Are there particular times of the year when these conditions present differently?	
3. Predisposing and Environmental Factors	What factors do you think influence the control of hypertension and diabetes among older adults here?	

	How do environmental conditions influence daily routines related to this health condition?	daily dietary pattern, work life, physical exercises
4. Self-Care and Disease Management Practices	How do older adults typically manage hypertension or diabetes in their daily lives? How often do they attend follow-up for these conditions?	Challenges (both patient and provider side), why? Role of extreme heat and drought in those challenges ?
	What kinds of activities do older adults usually engage in for maintaining their health?	
	How do they monitor symptoms or changes in their condition?	
	Where do they usually go for follow-up visits?	
	What factors influence decisions around self-care practices?	
5. Health-Seeking Behavior and Access to Care	How do older adults usually seek healthcare for HTN and DM?	Transport issues? Caregiver availability? Patient beliefs?
	What challenges affect access to healthcare services?	
	What factors influence their decisions?	
6. Medication Use and Health System Factors	Do the patients typically adhere to the prescribed medications for hypertension or diabetes routinely?	Stock-outs? Human resource constraints? Referral issues?
	What health system factors affect continuity of care? From patients perspective, what do you think that affects the adherence/non adherence?	
7. Coping and Adaptation Practices	How well do geriatric patients adjust their health management practices? Please explain.	Climate-resilient services? Policy-level changes
	What forms of support are available at the family or community level?	
	How do healthcare services respond during periods of increased demand or stress?	
	What practices appear to help or hinder disease management?	
8. Recommendations and Future Directions	What changes could improve care for older adults with hypertension or diabetes in this area?	

	What types of services would better support care under difficult environmental conditions?	
	What approaches seem feasible within existing resources?	

KII GUIDELINE – বাংলা

শিরোনাম: বাংলাদেশের খরা-প্রবণ বরেন্দ্র অঞ্চলের প্রবীণ জনগোষ্ঠীর মধ্যে উচ্চ রক্তচাপ ও ডায়াবেটিস ব্যবস্থাপনা: রোগের ব্যাপকতা, প্রতিবন্ধকতা ও আচরণগত মোকাবিলা কৌশল বিষয়ক একটি মিশ্র-পদ্ধতির গবেষণা

তারিখ:

সাক্ষাৎকারগ্রহণকারীর নাম:

নোট গ্রহণকারীর নাম:

সাক্ষাৎকার শুরুর সময়:

সাক্ষাৎকার শেষ সময়:

সাক্ষাৎকারের পরিবেশ:

সাক্ষাৎকারদাতার নাম:

সাক্ষাৎকারদাতার বয়স:

ইউনিক আইডি:

উপাদান	মূল প্রশ্নসমূহ	প্রোব
১. সেবাদানকারীর পটভূমি	১. আপনি কি আপনার বর্তমান পেশাগত ভূমিকা ও দায়িত্ব সম্পর্কে বিস্তারিত বর্ণনা করতে পারেন? ২. আপনি কত বছর ধরে এই এলাকায় কাজ করছেন? ৩. আপনি কোন ধরনের স্বাস্থ্য প্রতিষ্ঠানে কর্মরত আছেন? ৪. একটি সাধারণ সপ্তাহে আনুমানিক কতজন বয়স্ক উচ্চ রক্তচাপ এবং/অথবা ডায়াবেটিস রোগী আপনি সেবা প্রদান করেন?	• এনসিডি (NCDs) সম্পর্কিত কোনো প্রশিক্ষণ পেয়েছেন কি? • বয়স্ক রোগীদের সঙ্গে কাজ করার বিশেষ অভিজ্ঞতা আছে কি?
২. উচ্চ রক্তচাপ ও ডায়াবেটিসের অনুভূত বোঝা	১. আপনার দৃষ্টিতে এই এলাকায় বয়স্ক জনগোষ্ঠীর মধ্যে উচ্চ রক্তচাপ ও ডায়াবেটিসের প্রকোপ কেমন? ২. সময়ের সাথে সাথে এই রোগগুলোর ক্ষেত্রে কোনো বৃদ্ধি বা পরিবর্তন লক্ষ্য করেছেন কি? ৩. বছরের নির্দিষ্ট কোনো সময়ে রোগের উপসর্গ বা জটিলতার পরিবর্তন দেখা যায় কি?	• লিঙ্গভিত্তিক কোনো পার্থক্য আছে কি? • সামাজিক-অর্থনৈতিক অবস্থাভেদে কোনো পার্থক্য লক্ষ্য করেন কি?
৩. পূর্বপ্রবণ ও পরিবেশগত কারণসমূহ	১. আপনার মতে, এই এলাকায় বয়স্কদের উচ্চ রক্তচাপ ও ডায়াবেটিস নিয়ন্ত্রণে প্রধান কোন কোন বিষয় প্রভাব ফেলে?	• দৈনন্দিন খাদ্যাভ্যাসে কী পরিবর্তন হয়? • কর্মজীবন বা জীবিকায় কী প্রভাব পড়ে?

	২. পরিবেশগত অবস্থা (যেমন খরা বা তাপপ্রবাহ) কীভাবে তাদের দৈনন্দিন রোগ ব্যবস্থাপনার রুটিনকে প্রভাবিত করে?	শারীরিক পরিশ্রম বা ব্যায়ামের ক্ষেত্রে কী পরিবর্তন হয়?
৪. স্ব-যত্ন ও রোগ ব্যবস্থাপনা চর্চা	১. বয়স্করা কীভাবে তাদের দৈনন্দিন জীবনে উচ্চ রক্তচাপ বা ডায়াবেটিস নিয়ন্ত্রণের চেষ্টা করেন? ২. তারা কত ঘন ঘন নিয়মিত ফলো-আপে আসেন? ৩. স্বাস্থ্য বজায় রাখতে তারা কী ধরনের কার্যক্রমে অংশগ্রহণ করেন? ৪. তারা কীভাবে তাদের উপসর্গ বা শারীরিক পরিবর্তন পর্যবেক্ষণ করেন? ৫. ফলো-আপের জন্য তারা সাধারণত কোন স্বাস্থ্য প্রতিষ্ঠানে যান? ৬. স্ব-যত্ন সংক্রান্ত সিদ্ধান্ত গ্রহণে কোন বিষয়গুলো সবচেয়ে বেশি প্রভাব ফেলে?	- রোগী ও সেবাদাতার দৃষ্টিকোণ থেকে প্রধান চ্যালেঞ্জগুলো কী? - চরম তাপ ও খরার পরিস্থিতি এসব চ্যালেঞ্জকে কীভাবে প্রভাবিত করে?
৫. স্বাস্থ্যসেবা গ্রহণ আচরণ ও প্রবেশাধিকার	১. বয়স্ক রোগীরা সাধারণত উচ্চ রক্তচাপ ও ডায়াবেটিসের চিকিৎসার জন্য কোথায় যান? ২. স্বাস্থ্যসেবায় প্রবেশের ক্ষেত্রে তারা কী ধরনের প্রতিবন্ধকতার সম্মুখীন হন? ৩. চিকিৎসা নেওয়ার সিদ্ধান্তে কোন বিষয়গুলো প্রভাব ফেলে?	- যাতায়াতের সমস্যা আছে কি? - পরিচর্যাকারীর প্রাপ্যতা কেমন? - রোগীর ব্যক্তিগত বিশ্বাস বা ধারণা কি ভূমিকা রাখে?
৬. ওষুধ ব্যবহার ও স্বাস্থ্যব্যবস্থাগত বিষয়	১. রোগীরা কি নিয়মিতভাবে নির্ধারিত উচ্চ রক্তচাপ বা ডায়াবেটিসের ওষুধ সেবন করেন? ২. ওষুধের প্রাপ্যতা বা অনিয়মিত সেবনের কোনো সমস্যা রয়েছে কি? ৩. ধারাবাহিক সেবাপ্রদানে কোন স্বাস্থ্যব্যবস্থাগত সীমাবদ্ধতা রয়েছে? ৪. রোগীর দৃষ্টিকোণ থেকে ওষুধ সেবনে অনুগত্য বা অননুগত্যের পেছনে কী কারণ রয়েছে বলে আপনি মনে করেন?	- ওষুধের ঘাটতি (স্টক-আউট) - মানবসম্পদের সীমাবদ্ধতা - রেফারেল ব্যবস্থার সমস্যা
৭. মোকাবিলা ও অভিযোজন চর্চা	১. বয়স্ক রোগীরা কীভাবে তাদের স্বাস্থ্য ব্যবস্থাপনায় অভিযোজন করেন? ২. পরিবার বা কমিউনিটি পর্যায়ে কী ধরনের সহায়তা পাওয়া যায়? ৩. অতিরিক্ত চাহিদার সময় স্বাস্থ্যসেবা ব্যবস্থা কীভাবে সাড়া দেয়? ৪. কোন চর্চাগুলো রোগ ব্যবস্থাপনায় সহায়ক বা প্রতিবন্ধক হিসেবে কাজ করে?	- জলবায়ু-সহনশীল সেবা আছে কি? - নীতিগত কোনো পরিবর্তন হয়েছে কি?

৮. সুপারিশ ও ভবিষ্যৎ করণীয়	১. এই এলাকায় বয়স্ক উচ্চ রক্তচাপ ও ডায়াবেটিস রোগীদের সেবা উন্নত করতে কী ধরনের পরিবর্তন প্রয়োজন বলে আপনি মনে করেন? ২. কঠিন পরিবেশগত পরিস্থিতিতে কোন ধরনের সেবা অধিক কার্যকর হতে পারে? ৩. বিদ্যমান সম্পদের মধ্যে কোন উদ্যোগগুলো বাস্তবায়নযোগ্য বলে আপনি মনে করেন?	
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Appendix B: Informed Consent Form

Consent Form

Title of the study: Burden, Barriers, and Behavioural Adaptation: A Mixed-Method Study of Hypertension and Diabetes Management among the Geriatric Population in the Drought-Prone Barind Tract of Bangladesh

If you agree to participate in this study, please confirm by putting your signature/thumbprint.

Thank you for your cordial cooperation.

Do you give permission for the interview to be audio recorded?	Yes	No
Do you give permission to share your findings?	Yes	No
Do you give permission to take photos?	Yes	No
Do you give permission to share the photos?	Yes	No
Do you have any question?	Yes	No

Interviewer name:	Respondent's name:
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Interviewer signature:	Respondent's signature/ thumbprint:
Date:	Date:

সম্মতি ফরম

গবেষণার শিরোনাম: বাংলাদেশের খরা-প্রবণ বরেন্দ্র অঞ্চলের প্রবীণ জনগোষ্ঠীর মধ্যে উচ্চ রক্তচাপ ও ডায়াবেটিস ব্যবস্থাপনা: রোগের ব্যাপকতা, প্রতিবন্ধকতা ও আচরণগত মোকাবিলা কৌশল বিষয়ক একটি মিশ্র-পদ্ধতির গবেষণা

আপনি যদি এই গবেষণায় অংশগ্রহণ করতে সম্মত হন, অনুগ্রহ করে আপনার স্বাক্ষর/বুড়ো আঙুলের ছাপ দিয়ে নিশ্চিত করুন। আপনার আন্তরিক সহযোগিতার জন্য ধন্যবাদ।

আপনি কি সাক্ষাৎকারটি
অডিও রেকর্ড করার অনুমতি
দিচ্ছেন?

हाँ ना

আপনি কি আপনার তথ্য
শেয়ার করার অনুমতি
দিচ্ছেন?

हाँ ना

আপনি কি ছবি তোলার
অনমতি দিচ্ছেন?

हाँ ना

আপনি কি ছবি শেয়ার করার
অনুমতি দিচ্ছেন?

हाँ ना

আপনার কি কোনো প্রশ্ন
আছে?

श्री ना

সাক্ষাৎকারগ্রহণকারীর নাম:

উত্তরদাতার নাম:

সাক্ষাৎকারগ্রহণকারীর স্বাক্ষর:

উত্তরদাতার স্বাক্ষর/বুড়ো আঙুলের ছাপ:

তারিখ:

তারিখ: