

Assessment of Vitality and Locomotor Capacity among Older Adults in Rural Bangladesh: A Cross-Sectional Study

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Declaration

I, Saima Ahmed Arni, declare that this thesis, titled “Assessment of Vitality and Locomotor Capacity among Older Adults in Rural Bangladesh: A Cross-Sectional Study,” is an original work submitted in partial fulfilment of the requirements for the Master of Public Health (MPH) degree at the BRAC James P. Grant School of Public Health (JPGSPH), BRAC University, Dhaka, Bangladesh.

This work has not been submitted elsewhere for any other degree or examination. All sources used have been duly acknowledged and cited. Any assistance received is mentioned in the acknowledgements.

I have included a separate declaration on the use of Generative AI at the end of this thesis.

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Approval

The thesis/project titled “[Assessment of Vitality and Locomotor Capacity among Older Adults in Rural Bangladesh: A Cross-Sectional Study]” submitted by

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Ethical approval for this study was obtained from the Institutional Review Board of BRAC James P Grant School of Public Health, BRAC University (IRB Ref: **MPH-2025-011**). Written informed consent was obtained from all participants prior to data collection. All procedures conducted in this study involving human participants were in accordance with the ethical standards of the Institutional Review Board and the 1975 Helsinki Declaration.

Abstract

Background: Population ageing is accelerating in Bangladesh, with 9.5% of people now aged 60 years or above, and this proportion is expected to rise to 22% by 2050. The WHO Integrated Care for Older People (ICOPE) framework identifies vitality and locomotor capacity as two foundational domains of intrinsic capacity (IC) in older adults. Impairment in these domains leads to loss of independence, increased disability, and a heavier burden on health systems. Community-level evidence on these domains from rural Bangladesh is almost completely absent.

Objectives: To assess the status of vitality and locomotor capacity among community-dwelling older adults aged ≥ 60 years in rural Bangladesh and identify associated factors with impairments.

Methods: A community-based cross-sectional study was conducted from January to May 2026 among 402 older adults in Sujalpur Union, Birganj, Dinajpur, Bangladesh. Simple random sampling was employed. Vitality was assessed using the Mini Nutritional Assessment Short Form (MNA-SF); a score of ≤ 11 indicated impairment. Locomotor capacity was assessed using the Short Physical Performance Battery (SPPB) chair stand test; a time of ≥ 12 s (AWGS 2019 cut-off) indicated impairment. Data on sociodemographic, behavioral, dietary, clinical, and functional characteristics were also collected. Chi-square tests were used for bivariate analysis and binary logistic regression was used to identify associated factors.

Results: The mean age of the surveyed older adults was 68.3 (± 6.0) years, and 54% were male. The prevalence of impaired vitality was 75.1% ($n=302$), and that of impaired locomotor capacity was 35.3% ($n=142$). In the multivariable analysis, older age (aOR: 1.07, 95% confidence interval [CI], 1.02–1.12) and female sex (aOR, 2.60; 95% CI, 1.44–4.68) were associated with higher odds of impaired vitality, whereas food security (aOR, 0.27; 95% CI, 0.14–0.51) and highest wealth tertile (aOR, 0.50; 95% CI, 0.27–0.91) were protective. For locomotor capacity, older age (aOR: 1.08, 95% CI: 1.04–1.13), female sex (aOR: 2.40, 95% CI: 1.31–4.42), and cognitive decline (aOR: 1.89, 95% CI: 1.17–3.04) increased the odds of impairment, whereas adequate physical activity (aOR: 0.43, 95% CI: 0.26–0.73) was protective.

Conclusions: Three in four rural older adults had impaired vitality, and more than one in three had impaired locomotor capacity, with older women at the greatest risk. Food insecurity, poverty, physical inactivity, and cognitive decline were the most important modifiable factors. Integrating ICOPE-based screening into primary healthcare in Bangladesh can enable early detection and targeted interventions to preserve the functional independence of older adults.

Keywords: Intrinsic capacity; ICOPE; vitality; locomotor capacity; older adults; malnutrition; Bangladesh

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List of Acronyms

Acronym	Full Form
AAI	Active Ageing Index
ADL	Activities of Daily Living
aOR	Adjusted Odds Ratio
AWGS	Asian Working Group for Sarcopenia
BAMSE	Brief Assessment for Mental Status in the Elderly
BBS	Bangladesh Bureau of Statistics
BMI	Body Mass Index
CC	Calf Circumference
CI	Confidence Interval
CRD	Chronic Respiratory Disease
DGHS	Directorate General of Health Services
DQQ	Diet Quality Questionnaire
DDS	Dietary Diversity Score
FEV1	Forced Expiratory Volume in 1 Second
FVC	Forced Vital Capacity
GAD-7	Generalised Anxiety Disorder-7 Scale
HGS	Hand Grip Strength
IADL	Instrumental Activities of Daily Living
IC	Intrinsic Capacity
ICOPE	Integrated Care for Older People
IRB	Institutional Review Board
JPGSPH	James P. Grant School of Public Health
LMIC	Low- and Middle-Income Country
MNA-SF	Mini Nutritional Assessment – Short Form
MUAC	Mid-Upper Arm Circumference
NCD	Non-Communicable Disease
NPRS	Numeric Pain Rating Scale
OR	Odds Ratio

Acronym	Full Form
PEFR	Peak Expiratory Flow Rate
PHC	Primary Healthcare
PHQ-9	Patient Health Questionnaire-9
SD	Standard Deviation
SPPB	Short Physical Performance Battery
UHC	Universal Health Coverage
UHFPO	Upazila Health and Family Planning Officer
VIF	Variance Inflation Factor
WHO	World Health Organization

Chapter 1: Introduction

1.1 Background

The world is undergoing a major shift in its age structure. People are living longer, and the proportion of older adults is increasing in nearly every country. In 2015, an estimated 900 million people were aged ≥ 60 years worldwide, and this number is expected to reach 2.1 billion by 2050 (United Nations, 2023). While population ageing was once considered a phenomenon of high-income countries, the most rapid increases are now occurring in low- and middle-income countries (LMICs), where health systems are often least prepared to respond (WHO, 2021).

Bangladesh is facing the same challenges. In 2015, older adults aged 60 years and above accounted for approximately 7.7% of the total population of the country. By 2023, this figure had risen to approximately 9.5%, and it is projected to reach 22% by 2050 (BBS, 2023). The median age of the Bangladeshi population is expected to increase by 15 y between 2000 and 2050 (United Nations, 2023). This is particularly challenging for a country with a large rural population, limited healthcare infrastructure at the community level, and poor coverage of geriatric health services (Afrin et al., 2025).

As populations age, the primary aim of public health shifts from preventing early death to preserving function and quality of life in older age groups. The United Nations, through its “Decade of Healthy Ageing (2021–2030),” has called on all countries to support the functional independence of older people (United Nations, 2020). The WHO defines healthy ageing as “the process of developing and maintaining the functional ability that enables wellbeing in older age” (WHO, 2015). Bangladesh has responded with the National Healthy Ageing Strategy and Action Plan 2024–2030, which provides a policy framework for improving care for the elderly population (Directorate General of Health Services, 2024).

To support this work, the WHO developed an integrated care framework for older people (ICOPE). This framework focuses on a concept called “intrinsic capacity” (IC), which refers to the combination of all physical and mental abilities that a person can draw on at any point in their lives. The ICOPE framework identifies six key domains of IC: locomotor capacity, vitality, cognition, psychological well-being, sensory function, and continence (WHO, 2024).

Among these, vitality and locomotor capacity are especially important for physical independence in daily life activities.

Vitality, as defined by the WHO ICOPE framework, refers to the underlying physiological energy state of an individual, which is largely determined by their nutritional status (WHO, 2017). An older adult who is malnourished or at risk of malnutrition lacks the energy reserves needed to carry out daily activities, recover from illness, and maintain body function. In Bangladesh, a nationally representative survey found that 89% of older people were either malnourished (20%) or at risk of malnutrition (69%), making it one of the most widespread health problems in this age group (Mridha et al., 2021).

Locomotor capacity refers to the ability to move the body effectively, involving muscle strength, walking speed, and balance (WHO, 2017). When this capacity declines, older adults struggle with basic tasks, such as walking, getting up from a chair, or climbing stairs. This increases the risk of falls, fractures, and permanent disability. In rural Bangladesh, nearly half (45%) of older adults have been reported to experience mobility-related difficulties (Sarker, 2021). These two domains are closely linked; poor nutrition leads to muscle wasting, which in turn reduces physical performance and increases the risk of falls and dependency, a “biological cascade” as described by the WHO (2019).

The ICOPE framework provides practical screening tools that can be used at the primary healthcare level to detect early declines in these domains before they become irreversible (WHO, 2024). Studies from China and several European countries have shown that applying the ICOPE protocol in community settings is feasible and effective for identifying those at risk (Wang et al., 2024). However, such evidence is almost entirely absent in Bangladesh’s literature.

In Bangladesh, the Active Ageing Index (AAI) has shown that 48.1% of older adults score poorly on the health dimension and 34.4% are considered poorly active (Haque & Afrin, 2022). Despite this burden, there has been no comprehensive community-based assessment of vitality and locomotor capacity using the WHO ICOPE framework in rural Bangladesh. The few existing studies are mostly hospital-based or focused on urban populations, and they tend to look at individual conditions rather than taking the integrated approach recommended by the WHO.

1.2 Rationale

The growing number of older adults in Bangladesh, especially in rural areas, makes it urgent to understand the extent of functional decline at the community level. Rural older adults face particular challenges because of greater poverty, poorer access to healthcare, physically demanding livelihoods, and limited awareness of their geriatric health needs. In agricultural communities like Birganj in Dinajpur, where many older adults continue to work in the fields, the ability to move and maintain adequate nutrition is not only a health issue but also a matter of livelihood for them.

Despite the importance of vitality and locomotor capacity for older adults' independence, no study in Bangladesh has used the WHO ICOPE framework to assess these two domains in a community-based setting. Most existing research has focused on individual conditions, such as hypertension, diabetes, and malnutrition, in isolation.

This study addresses these gaps by providing the first community-based evidence of the prevalence of impaired vitality and impaired locomotor capacity using the ICOPE framework in rural Bangladesh. By identifying the factors associated with these impairments, the findings will support the development of targeted interventions, inform the implementation of the National Healthy Ageing Strategy 2024–2030, and contribute to the goal of achieving Universal Health Coverage for older adults.

1.3 Research Questions

1. What is the prevalence of impaired vitality and impaired locomotor capacity among older adults (aged ≥ 60 years) in rural Bangladesh?
2. What are the factors associated with impaired vitality and locomotor capacity in this population?

1.4 Study Objectives

General Objective

To assess vitality and locomotor capacity among community-dwelling older adults in rural Bangladesh and to identify factors associated with their decline.

Specific Objectives

1. To estimate the prevalence of impaired vitality (assessed by MNA-SF) and impaired locomotor capacity (assessed by SPPB with AWGS chair stand cut-off) among older adults aged 60 years and above in Sujalpur Union, Birganj, Dinajpur.
2. To identify sociodemographic, behavioural, dietary, clinical, and psychological factors associated with impaired vitality and impaired locomotor capacity in this population.

Chapter 2: Literature Review

2.1 Global Burden of Population Ageing

The global population of older adults aged 60 years and above is growing faster than that of any other age group. According to the United Nations World Population Ageing Report (2023), the number of people in this age group reached 1.05 billion in 2022 and is projected to reach 2.1 billion by 2050. This growth is most rapid in LMICs, where healthcare systems are often underprepared to meet the complex needs of an ageing population (Klenk et al., 2016). Population ageing raises the demand for long-term care, increases healthcare expenditure, and reduces the working-age population available to support dependents (Gianfredi et al., 2025).

The WHO South-East Asia Regional Office (SEARO) region, which includes Bangladesh, faces some of the sharpest projected increases in the proportion of older adults over the next three decades (WHO SEARO 2024). Within this region, Bangladesh is notable for the speed of its demographic transition. Life expectancy has improved substantially, from approximately 46 years in 1960 to over 73 years by 2023, and fertility rates have declined rapidly (BBS, 2023). This has created a large cohort of older adults emerging at a time when the healthcare system is still largely organised around infectious diseases and maternal and child health (Kabir et al., 2013).

2.2 Intrinsic Capacity and the WHO ICOPE Framework

In response to the challenge of population ageing, the WHO introduced the concept of “healthy ageing” as “the process of developing and maintaining the functional ability that enables wellbeing in older age” (WHO, 2015). Functional ability is shaped by the interaction between a person’s intrinsic capacity (IC) and their environment. IC is defined as a composite of all physical and mental capacities that an individual can draw upon at any point in time (WHO, 2017).

Building on this concept, the WHO developed the ICOPE framework, which was first published in 2017 and updated in 2024 (WHO, 2024). The framework identifies six key domains of IC: locomotor capacity, vitality, cognition, psychological well-being, hearing, and vision. It provides a stepwise protocol for screening and in-depth assessment at the primary care level, making it practical for use in low-resource settings (Chhetri et al., 2022). Studies have validated the feasibility and effectiveness of the ICOPE screening in diverse contexts.

Wang et al. (2024) demonstrated high acceptance rates and improved functional outcomes in older adults who were screened using the ICOPE protocol in China. European studies have similarly shown that IC screening can be embedded into routine primary care consultations with minimal additional resources (Cesari et al., 2022).

2.3 Vitality in Older Adults

Vitality, as a domain of IC, captures the physiological and nutritional state of an individual. The Mini Nutritional Assessment (MNA) and its short form (MNA-SF) are among the most widely validated tools for assessing nutritional risk in older adults (Kaiser et al., 2009). The MNA-SF covers six dimensions: recent food intake, weight loss, mobility status, acute illness or psychological stress, neuropsychological problems, and body mass index (or calf circumference). Each item is scored from 0 to 2 or 0 to 3, yielding a total score of 0–14. A score of 11 or less indicates impaired vitality (malnutrition or risk of malnutrition).

Globally, malnutrition affects between 5% and 30% of community-dwelling older adults, with much higher rates in low-income countries (Cederholm et al. 2019). This problem is particularly severe in Bangladesh. Mridha et al. (2021) conducted a nationally representative survey and found that 89% of older adults were either malnourished (20%) or at risk of malnutrition (69%) using MNA screening. This remains the most comprehensive national estimate of the nutritional status of older Bangladeshis, and the research group that produced it supervised the current thesis.

Food insecurity is a critical driver of vitality impairment. Food-insecure households cannot reliably access adequate, safe, and nutritious food, which directly limits dietary intake and nutritional status in older members (FAO, 2022). In rural Bangladesh, food insecurity is closely linked to the seasonal agricultural cycles and poverty. Older adults, particularly widowed women, are disproportionately affected (Akter et al., 2026). Low dietary diversity, characterised by dependence on a small number of food groups (usually staple grains and potatoes), is widespread and contributes to micronutrient deficiencies that accelerate functional decline (Herforth et al., 2024).

2.4 Locomotor Capacity in Older Adults

Locomotor capacity encompasses the ability to perform physical movements involving the lower limbs, including walking, maintaining balance, and rising from a seated position. This reflects integrated musculoskeletal and neuromuscular function. A decline in locomotor capacity is a hallmark of physical ageing and is closely linked to the risk of falls, fractures, hospitalisation, and loss of independence (Guralnik et al., 1994).

The Short Physical Performance Battery (SPPB) is the most widely used and validated tool for assessing locomotor capacity in older adults (Guralnik et al., 1994). It comprises three components: a standing balance test (side-by-side, semi-tandem, and tandem positions), a 4-metre gait speed test, and a five-repetition chair stand test. Each component is scored from 0 to 4, yielding a total score between 0 and 12. A total SPPB score of 9 or less is traditionally used to indicate limited locomotor capacity in the ICOPE framework (WHO, 2017). The chair stand component specifically measures the lower limb strength and power. The Asian Working Group for Sarcopenia (AWGS) 2019 consensus recommends a time of 12 s or more for five chair stands as the cut-off for muscle weakness in older Asian adults, accounting for the generally lower body mass and different muscle composition of this population compared to Western cohorts (Chen et al., 2020).

Estimates of impaired locomotor capacity in South Asia are limited. Sarker (2021) estimated that nearly 45% of rural older adults in Bangladesh experience mobility-related difficulties, although not using the SPPB. Factors consistently associated with impaired locomotor capacity in the literature include advancing age, female sex, low BMI, physical inactivity, cognitive decline, depression, comorbidities, and low socioeconomic status (Chen et al., 2020).

The relationship between locomotor capacity and cognitive function has been well established. Cognitive decline in older adults is associated with slower gait, poorer balance, and increased fall risk, suggesting that brain-muscle pathways are important determinants of physical performance (Montero-Odasso et al., 2020). In this study, cognitive status was assessed using the Brief Assessment for Mental Status in the Elderly (BAMSE), a validated cognitive screening tool adapted for use in Bangladesh. A BAMSE score below 24 (out of 30) was used to define cognitive decline in this study.

2.5 Interrelationship between Vitality and Locomotor Capacity

Vitality and locomotor capacity are closely related and mutually reinforcing domains of the IC. Malnutrition leads to muscle wasting (sarcopenia), which impairs physical performance and increases the risk of falls and fractures (WHO, 2019). Conversely, reduced locomotor capacity can limit an individual's ability to obtain food, prepare meals, or engage in physical activities that support nutritional health. The WHO describes this bidirectional process as a “biological cascade” in which a decline in one domain accelerates the decline in the other (WHO, 2019).

In Bangladesh, the coexistence of malnutrition and mobility limitations in older adults has not been systematically studied using an integrated framework. However, the nationally representative data from Mridha et al. (2021) and the rural mobility data from Sarker (2021) suggest that a large proportion of rural older adults may experience simultaneous impairment across both domains, placing them at a particularly high risk of rapid functional decline and dependency.

2.6 Associated Factors in LMICs

A large body of literature has identified key factors associated with impaired vitality and locomotor capacity in LMICs. Advanced age is consistently associated with both impaired nutritional status and poor physical performance across all settings (Cederholm et al., 2019; Guralnik et al., 1994). Female sex is often associated with worse nutritional outcomes in South Asia, partly because of lower household decision-making power, smaller meal portions, higher widowhood rates, and greater social isolation (Akter et al., 2026). Women also tend to have lower absolute muscle mass, which predisposes them to impaired locomotor capacity (Chen et al. 2020).

Physical inactivity is a major modifiable risk factor for impaired locomotor capacity in older adults. The WHO recommends at least 150–300 min of moderate-intensity physical activity per week for older adults (WHO, 2020). Studies from Bangladesh have found high rates of inadequate physical activity, particularly among older women and those with pre-existing health conditions (Islam et al., 2021).

Socioeconomic factors, including household wealth, income, and food security, are strongly associated with nutritional status and locomotor capacity in LMICs (Hossain et al. 2021). In

Bangladesh, poverty is more prevalent in the northern districts, including Dinajpur, making this population especially vulnerable. Among clinical factors, comorbidities such as chronic respiratory disease, hypertension, diabetes, and depression have been linked to both an impaired nutritional status and reduced physical performance (Cesari et al., 2022).

2.7 Evidence Gaps and Justification for This Study

While the global literature on intrinsic capacity in older adults is growing, evidence from rural Bangladesh is extremely limited. Existing studies tend to focus on individual outcomes, such as malnutrition or falls, rather than assessing integrated functional status using validated tools. Hospital-based studies may overestimate the disease burden due to selection bias, whereas urban studies may not capture the unique challenges faced by older adults in rural areas. No community-based study in Bangladesh has used both the MNA-SF and SPPB simultaneously within the WHO ICOPE framework.

This study addresses these gaps by providing the first community-based domain assessment of intrinsic capacity in a rural Bangladeshi population using internationally validated tools and a comprehensive set of explanatory variables. The findings will provide a baseline for monitoring and intervention evaluation under the National Healthy Ageing Strategy 2024–2030.

Chapter 3: Methods

3.1 Study Design

This was a community-based cross-sectional study. A cross-sectional design was chosen because it's efficient for estimating prevalence and identifying associations at a single point in time, which aligns with the study objectives.

3.2 Study Area and Setting

This study was conducted in the Sujalpur Union, Birganj Sub-district, Dinajpur District, in the northern region of Bangladesh. Three wards (Ward Nos. 7, 8, and 9) were selected as study sites. Birganj is predominantly rural and agricultural, with a large proportion of the population engaged in crop farming, including the cultivation of potatoes. This setting is representative of rural Bangladesh. Data were collected from households and a makeshift clinic established at Jogdol High School.

3.3 Study Period

The overall study period was from January to May 2026. Protocol development and ethical clearance were completed in January–February 2026. Training and household listing were conducted in March of 2026. Primary data collection was conducted from March to April 2026. Data cleaning, analysis, and thesis writing were completed between April and May 2026.

3.4 Study Population

The study recruited community-dwelling older adults who were permanent residents of the selected wards.

Inclusion Criteria:

- Adults aged 60 years or above
- Permanent resident of the study area (residing for at least 12 months)
- Capable of providing informed consent

Exclusion Criteria:

- Individuals with severe disabilities (inability to speak, walk, sudden loss of vision or hearing, or terminal illness) that would prevent effective participation

- Acute illness requiring immediate hospitalisation
- Unwillingness to participate

3.5 Sample Size Calculation

The sample size was calculated using Cochran's formula, with $z = 1.96$ (95% confidence level), p = estimated prevalence, and $d = 0.05$ (margin of error). Because the study assessed two primary outcomes with different estimated prevalence rates, the calculation was performed separately for each, with a 15% non-response allowance. For locomotor capacity, using a prevalence estimate of 0.45 (Sarker 2021), the required sample size was 448. For vitality, using a prevalence of 0.89 (Mridha et al., 2021), the required sample size was 177 participants. A larger figure of 448 was selected as the final target sample. After exclusions and refusals, 402 participants completed all assessments and were included in the study.

3.6 Sampling Technique

Simple random sampling was employed. A complete household listing was conducted in Wards 7, 8, and 9 of Sujalpur Union to create a sampling frame of all older adults aged 60 years and above. From this frame, participants were randomly selected and recruited directly from their households. A maximum of one participant was selected from each household to maintain the independence of observations. Age was verified using national ID cards, and a locally adapted event calendar anchored to the 1971 Liberation War was used to confirm age, an approach found to be effective in previous community-based studies in rural Bangladesh.

3.7 Study Variables and Measurement

Outcome Variables

Vitality (Nutritional Status):

Vitality was assessed using the Mini Nutritional Assessment Short Form (MNA-SF), a validated and widely used screening tool for malnutrition risk in older adults (Kaiser et al., 2009). The MNA-SF comprises six items: (i) food intake decline over the past three months, (ii) unintentional weight loss, (iii) mobility status, (iv) presence of psychological stress or acute illness, (v) neuropsychological problems, and (vi) body mass index or calf circumference. The total score ranged from 0 to 14. A score of 12–14 indicates a normal nutritional status, and a

score of 11 or below indicates impaired vitality (at risk of malnutrition or malnourished). In this study, participants with an MNA-SF score of ≤ 11 were classified as having impaired vitality.

Locomotor Capacity:

Locomotor capacity was assessed using the Short Physical Performance Battery (SPPB) (Guralnik et al., 1994). The SPPB comprises three components: (i) standing balance (side-by-side, semi-tandem, and full-tandem positions held for up to 10 s each); (ii) 4-metre gait speed at the participant's usual pace (best of two trials); and (iii) five-times chair stand test (time to rise from a chair five times without arm support). Each component was scored from 0 to 4, with a total score of 0 to 12. For the primary outcome, the chair stand cutoff recommended by the Asian Working Group for Sarcopenia (AWGS) 2019 was used: ≥ 12 seconds was classified as indicating impaired locomotor capacity (Chen et al., 2020). This AWGS cutoff was chosen because it is specifically validated for Asian older adults and is more appropriate for this setting than the standard ICOPE threshold of 14 s, which was derived from a more general global dataset. The basic ICOPE screening (using the 14-second cut-off) was also performed to determine eligibility for in-depth assessment according to the ICOPE protocol.

CONCEPTUAL FRAMEWORK

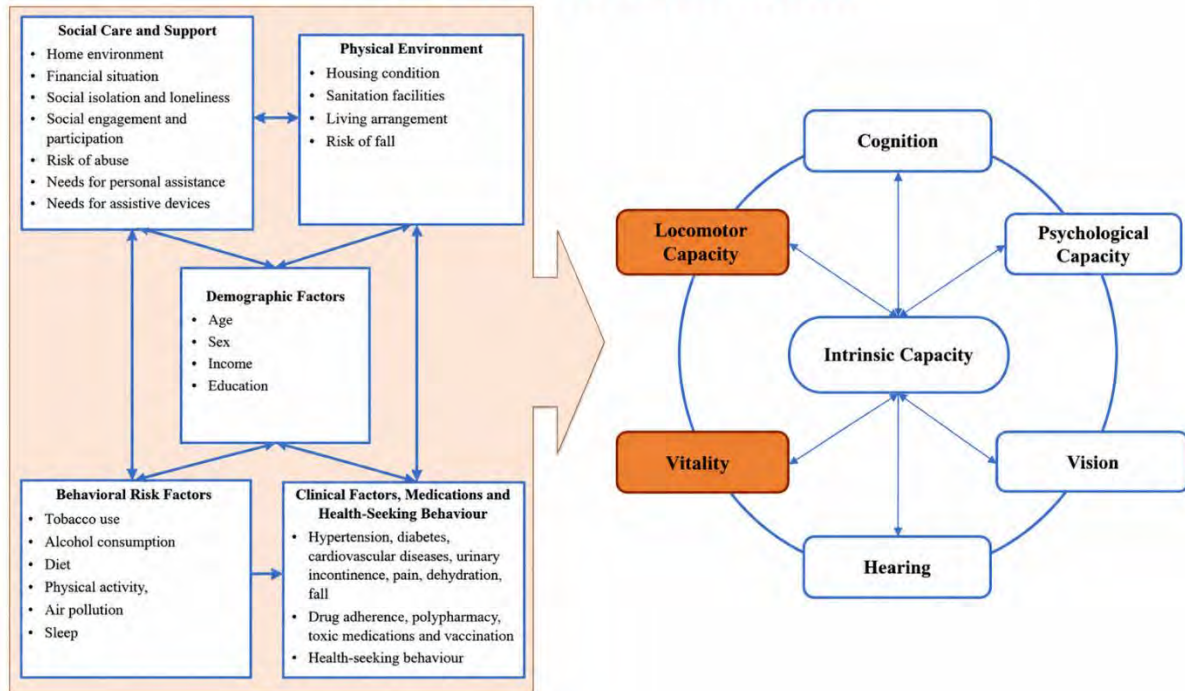


Figure 1: Conceptual framework

Explanatory Variables

The explanatory variables were collected across the following:

Sociodemographic variables included age (continuous), sex, marital status, religion, education (years and categories), occupation, household monthly income, household wealth tertile (derived from household assets, construction materials, and utilities), and involvement in income-generating activity.

Behavioral variables were collected using a modified WHO STEP survey approach (Riley et al., 2016), including tobacco use (smoking and smokeless), alcohol consumption, physical activity (adequate: ≥ 600 MET-min/week or inadequate: < 600 MET-min/week), sedentary time (≤ 7 hours or > 7 hours/day), sleep duration (adequate: ≥ 7 hours or inadequate: < 7 hours), and cooking fuel type (clean or unclean).

Dietary variables: Dietary intake was assessed using the Diet Quality Questionnaire (DQQ), which evaluates the consumption of 10 food groups based on a 24-hour non-quantitative dietary recall (Herforth et al., 2024). A Dietary Diversity Score (DDS) of < 5 groups out of 10

food groups was classified as inadequate. Food security status was categorized as food secure or food insecure.

Clinical variables included BMI (weight divided by height squared; arm span used as an alternative for participants with spinal deformities), blood pressure, fasting blood glucose, MUAC, calf circumference (CC), and hand grip strength (measured using a CAMRY EH101 hydraulic dynamometer; low grip strength defined as <28 kg for men and <18 kg for women, according to the AWGS 2019). Comorbidities, including hypertension (diagnosed or measured BP $\geq$ 140/90 mmHg), diabetes (fasting blood glucose $\geq$ 7.0 mmol/L), and chronic respiratory disease (by PEF/spirometry), were recorded.

Psychological variables: Anxiety was assessed using the GAD-7 (score $\geq$ 10 = moderate to severe anxiety); depression was assessed using the PHQ-9.

Cognitive status: assessed using the Brief Assessment for Mental Status in the Elderly (BAMSE), a validated cognitive screening tool adapted for Bangladesh. A BAMSE score <24 (out of 30) was used to define cognitive decline.

Functional ability: Katz Index for ADL and Lawton Scale for IADL.

3.8 Data Collection Procedure

Data were collected by six trained data collectors: three MPH student researchers (including the principal investigator) and three research assistants with at least a Bachelor's degree in a relevant discipline. All completed seven days of standardised training covering research ethics, informed consent, questionnaire administration (including MNA-SF), anthropometric measurements, and participant safety.

Formal administrative clearance was obtained from the Civil Surgeon of Dinajpur and the UHFPO before commencing the data collection. Union Council members were also formally notified of the study.

Data were collected in two stages. In the first stage, data collectors visited randomly selected households in the villages. Participants' ages were verified using their national ID cards or an event calendar. Written informed consent was obtained from all the participants. A face-to-face structured interview was conducted along with an observational checklist for the physical

environment and risk of abuse. Data were entered in real-time using the KoboToolbox application on mobile tablets.

In the second stage, participants were invited to the makeshift clinic at Jogdol High School the following morning for clinical assessment. The ICOPE basic assessment (SPPB) was performed first. Participants who did not pass the basic screening (SPPB chair stand time ≥ 14 s) underwent an in-depth ICOPE assessment. All clinical measurements (blood pressure, fasting blood glucose, anthropometry, handgrip strength, and respiratory function) were taken from all participants, regardless of the screening results. Participants with significant clinical abnormalities were sensitively informed and referred to the nearest health facility.

3.9 Clinical Measurements

3.9.1 SPPB Assessment

The SPPB was conducted on a flat surface using a stopwatch in a phone, marking tape, and a standard armless chair (seat height 43 cm). The participants were allowed to use their usual walking aids. The test was stopped immediately in case of pain or discomfort. Balance was tested in three progressive positions: side-by-side, semi-tandem, and full-tandem. Gait speed was assessed over 4 m (faster of two trials). The five-times chair stand test was timed from “Stand” until the participant stood fully upright for the fifth time.

3.9.2 Hand Grip Strength

Grip strength was measured using a calibrated CAMRY EH101 hydraulic dynamometer. The participants sat upright with their feet flat on the floor, elbow flexed at 90°, and forearm neutral. Three trials were performed with 60-second rest intervals using both dominant and non-dominant hand. The maximum value was recorded for all trials.

3.9.3 Anthropometric Measurements

Weight was measured using Omron BF511 digital scales. Height was measured using a portable measuring board; arm span was used as a validated alternative for participants with spinal deformities (a practical adaptation made in consultation with supervisors and supported by the literature). Calf circumference was measured at the widest point of the left calf while the participant was seated and the knee flexed at 90°. MUAC was measured at the midpoint of the non-dominant arm using an AnthroFlex MUAC tape.

3.9.4 Blood Pressure and Blood Glucose

Blood pressure was measured using an Omron HEM-7120 digital sphygmomanometer after 30 min of rest, with two readings at three-minute intervals. Fasting blood glucose levels were measured using an ACCU-CHECK Instant glucometer following standard biosafety procedures.

3.9.5 Respiratory Function

The peak expiratory flow rate (PEFR) was measured using a Mini-Wright peak flow meter (best of three readings). For participants with PEFR below the expected values, a reversibility test was performed following salbutamol administration (>20% improvement = positive). Spirometry was performed in those with a negative reversibility test using a NuvoAir device (recording FEV1 and FVC).

3.10 Data Management and Analysis

All questionnaires were assigned unique numerical identifiers. Paper data were entered into the ODK platform and transferred to STATA version 17.0 (StataCorp, TX, USA) for analysis. Data cleaning involved range and logic checks for outliers and entry errors. Three participants had missing values for chronic respiratory disease (CRD), representing less than 1% of the sample. These were handled through complete case analysis, which is the standard practice for such small amounts of missing data; the regression analyses therefore used $n = 399$ observations.

Descriptive analysis: Continuous variables were summarised as mean $\pm$ standard deviation (SD). Categorical variables were reported as frequencies and percentages.

Bivariate analysis: Associations between independent variables and each outcome were tested using the Pearson chi-square test for categorical variables and the independent samples t-test or one-way ANOVA for continuous variables.

Multivariable analysis: Binary logistic regression with backward stepwise selection (removal criterion: $p > 0.05$) was used to identify independent predictors of impaired vitality and impaired locomotor capacity. Variables selected based on $p < 0.20$ in the bivariate analysis,

combined with those identified as biologically important in the literature, were entered into the initial models. The final models retained variables with p-values ≤ 0.05 . Results were expressed as adjusted odds ratios (aOR) with 95% confidence intervals (CI). Multicollinearity was assessed using the Variance Inflation Factor (VIF); all VIF values were below 5, indicating no significant collinearity. A p-value of ≤ 0.05 was considered statistically significant.

3.11 Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of the BRAC James P. Grant School of Public Health. Written informed consent was obtained from all participants prior to data collection. Participation was entirely voluntary, and the participants were informed of their right to withdraw at any time without consequences. All data were anonymised using unique numeric identifiers. Access was restricted to authorised research team members. Participants with clinical abnormalities were referred to the nearest health facility. Minimal incentives (light snacks after fasting blood glucose collection) were provided to the participants.

Chapter 4: Results

4.1 Participant Recruitment

A total of 457 older adults were approached for this study. Of these, 12 refused screening, and 43 were not reached after the initial approach. Among the remaining 402 participants who completed both the household interview and all clinical assessments, this constituted the final analytical sample. Of the 43 who did not complete the study, eight households refused to participate, 12 individuals were found to be outside the study area after initial listing, three did not meet the age inclusion criterion (below 60 years), one had died before data collection, 11 were not available at the household during repeated visits due to agricultural work, and eight were unable to travel to the makeshift clinic due to age-related limitations or illness.

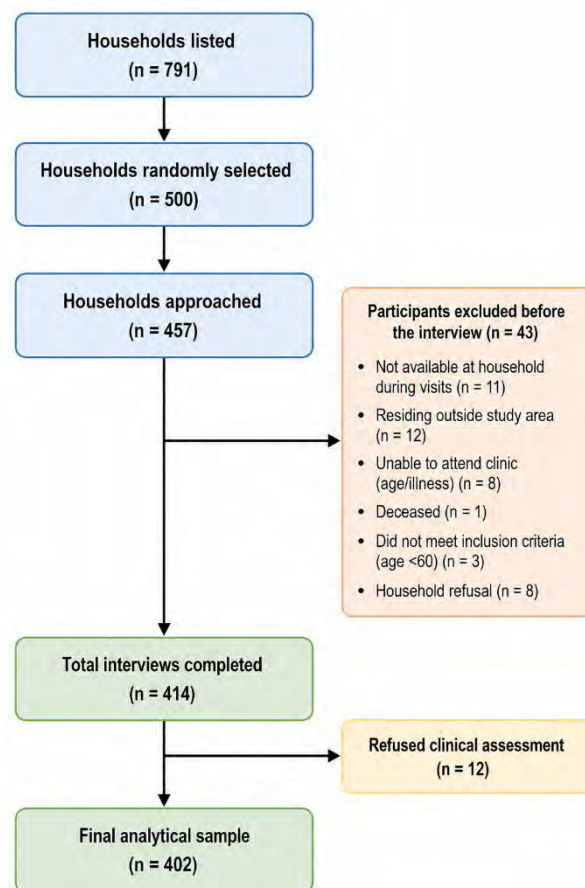


Figure 2: Participant recruitment flowchart

4.2 Background Characteristics of Study Participants

The background characteristics of the 402 participants are shown in Table 1. The mean age of the patients was 68.3 (± 6.0) years. The largest proportion of participants (39.1%) fell in the 65–69 year age group, followed by those aged 70 years and above (35.8%). More than half of the patients were men (54.0%). Among all participants, 60.2% were married and 48.0% were Muslim. The majority (67.4%) had no formal education. Just over half (53.0%) had some form of occupation or employment, with a mean monthly household income of 19,100 ($\pm 17,200$) Taka. In terms of household wealth, 41.3% were in the lowest tertile of household wealth.

Regarding behavioral and lifestyle characteristics, 27.9% were current smokers, 47.8% used smokeless tobacco, and 64.7% reported tobacco use. More than two-fifths (41.3%) of the participants had inadequate physical activity, and 68.7% had inadequate sleep. Nearly all participants (95.5%) used unclean cooking fuel (solid biomass), and 89.6% consumed less than the recommended amount of fruits and vegetables. Inadequate dietary diversity (DDS < 5) was found in 65.9% of the participants, and food insecurity was found in 38.6%.

The mean BMI was 20.8 (± 3.5) kg/m². Underweight (BMI < 18.5 kg/m²) was observed in 27.9% of the participants. Hypertension was found in 39.8%, diabetes in 8.5%, and chronic respiratory disease in 21.6%. Low hand-grip strength was observed in 41.8% of the participants.

Table 1: Background characteristics of the study participants (n = 402)

Characteristics	Mean $\pm$ SD	Frequency (n)	Percentage (%)
Age (years)	68.3 $\pm$ 6.0 years		
60–64		101	25.1%
65–69		157	39.1%
70 and above		144	35.8%
Sex			
Male		217	54.0%
Female		185	46.0%
Marital status			
Currently married		242	60.2%
Others*		160	39.8%
Religion			
Islam		193	48.0%

Characteristics	Mean $\pm$ SD	Frequency (n)	Percentage (%)
Others*		209	52.0%
Education			
No formal schooling		271	67.4%
Formal schooling		131	32.6%
Occupation			
Employed		213	53.0%
Others*		189	47.0%
Monthly household income	19.1 $\pm$ 17.2 thousands		
Household wealth tertile			
Lowest		166	41.3%
Middle		106	26.4%
Highest		130	32.3%
Involvement with income generating activity			
Yes		238	59.2%
No		164	40.8%
Behavioral risk factors			
Tobacco (smoking) consumption			
Yes		112	27.9%
No		290	72.1%
Tobacco (smokeless) consumption			
Yes		192	47.8%
No		210	52.2%
Tobacco (smokeless/smoking) consumption			
Yes		260	64.7%
No		142	35.3%
Physical activity	7.4 $\pm$ 2.8 hours/day		
Inadequate (<600 MET)		166	41.3%
Adequate ($\geq$ 600 MET)		236	58.7%
Sedentary time category	5.9 $\pm$ 1.3 hours		
$\leq$ 7 hours/day		192	47.8%
>7 hours/day		210	52.2%
Sleep			
Inadequate (<7 hours)		276	68.7%
Adequate ($\geq$ 7 hours)		126	31.3%

Characteristics	Mean $\pm$ SD	Frequency (n)	Percentage (%)
Alcohol consumption			
Yes		17	4.2%
No		385	95.8%
Cooking fuel			
Unclean		384	95.5%
Clean		18	4.5%
Fruits and vegetables consumption			
Inadequate (<5 servings)		360	89.6%
Adequate ($\geq$ 5 servings)		42	10.4%
Composite salt behavior score	7.0 ± 2.0		
Dietary diversity score	3.9 ± 1.7		
NCD-protect score	2.1 ± 1.3		
NCD-risk score	0.6 ± 0.8		
Global dietary recommendations score	10.5 ± 1.4		
Dietary diversity			
Inadequate (score <5)		265	65.9%
Adequate (score $\geq$ 5)		137	34.1%
Nutritional status			
Normal (12–14 points)		100	24.9%
At risk of malnutrition (8–11 points)		216	53.7%
Malnourished (0–7 points)		86	21.4%
Food security			
Food insecure		155	38.6%
Food secure		247	61.4%
Depression status			
No depression		214	53.2%
Mild depression		105	26.1%
Moderate to severe depression		83	20.6%
Anxiety			
No anxiety		295	73.4%
Mild anxiety		86	21.4%
Moderate to severe anxiety		21	5.2%
Any mental health disease			
Absent		204	50.7%
Present		198	49.3%

Characteristics	Mean ± SD	Frequency (n)	Percentage (%)
Activity of daily living			
Dependent		99	24.6%
Independent		303	75.4%
Instrumental activity of daily living			
Dependent		339	84.3%
Independent		63	15.7%
Meal companionship			
Alone		158	39.3%
With others		102	25.4%
With spouse		142	35.3%
Clinical parameters			
BMI	20.8 ± 3.5 kg/m ²		
Underweight (<18.5)		112	27.9%
Normal (18.5–24.9)		187	46.5%
Overweight/Obese (≥25.0)		103	25.6%
Hypertension			
Yes		160	39.8%
No		242	60.2%
Diabetes			
Yes		34	8.5%
No		368	91.5%
Hypertension or diabetes			
Yes		175	43.5%
No		227	56.5%
Chronic respiratory disease			
Yes		86	21.6%
No		313	78.4%
Hand grip strength (AWGS)			
Low muscle strength		168	41.8%
Normal muscle strength		234	58.2%
Locomotor capacity (AWGS ≥12s)			
Impaired		142	35.3%
Not impaired		260	64.7%

*Other marital status: widowed, divorced, separated, or never married. DDS, Dietary Diversity Score; MNA-SF, Mini Nutritional Assessment – Short Form; AWGS, Asian Working Group for Sarcopenia; BAMSE, Brief Assessment for Mental Status in the Elderly.

4.3 Prevalence of Impaired Vitality and Impaired Locomotor Capacity

The overall prevalence of impaired vitality was 75.1% (n = 302; 95% CI: 70.8–79.1). Among them, 53.7% were at risk of malnutrition (MNA-SF score 8–11), and 21.4% were malnourished (MNA-SF score 0–7). Only 24.9% of the patients had a normal nutritional status.

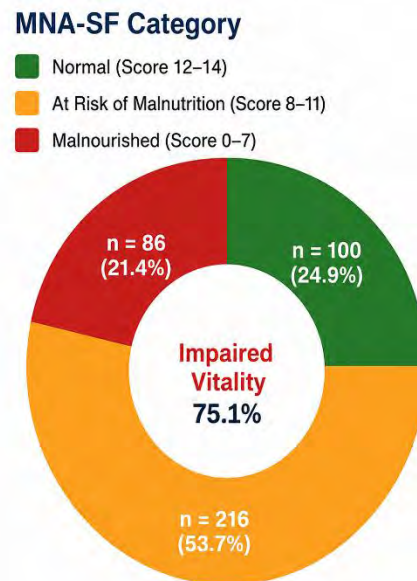


Figure 3: **Distribution of MNA-SF nutritional status categories**

The overall prevalence of impaired locomotor capacity using the AWGS chair stand cutoff (≥ 12 s) was 35.3% (n = 142; 95% CI: 30.7–40.2).

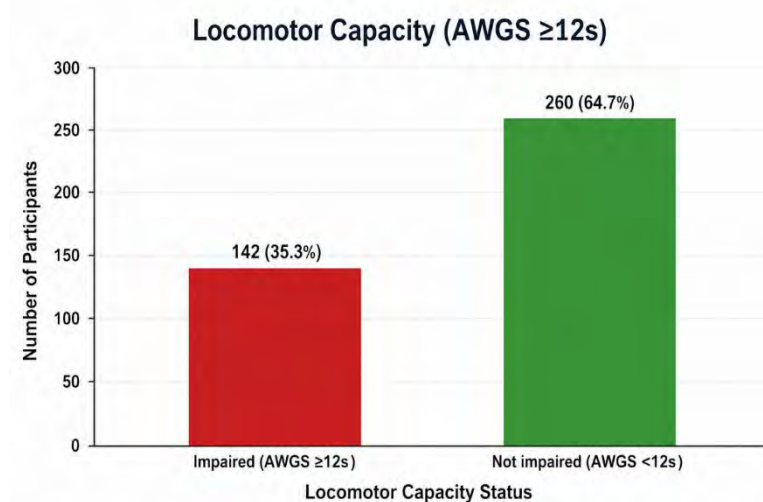


Figure 4: **Prevalence of Impaired Locomotor Capacity**

4.4 Bivariate Analysis

Table 2 presents the prevalence of impaired vitality and locomotor capacity according to background characteristics.

significantly higher prevalence of impaired vitality was found among participants aged ≥ 70 years (83.3% vs. 70.3% in those aged 60–64 years, $p = 0.017$), females (86.5% vs. 65.4%, $p < 0.001$), those not currently married (86.9% vs. 67.4%, $p < 0.001$), those with no formal schooling (81.5% vs. 61.8%, $p < 0.001$), those not employed (85.7% vs. 65.7%, $p < 0.001$), those in the lowest wealth tertile (82.5%, $p < 0.001$), those not involved in income-generating activity (87.2% vs. 66.8%, $p < 0.001$), those with inadequate dietary diversity (78.9% vs. 67.9%, $p = 0.016$), food-insecure participants (90.3% vs. 65.6%, $p < 0.001$), underweight participants (96.4%, $p < 0.001$), and those with IADL dependence (79.1% vs. 54.0%, $p < 0.001$).

A significantly higher prevalence of impaired locomotor capacity was observed among those aged ≥ 70 years (44.4% vs. 22.8% in the 60–64 group, $p = 0.002$), females (50.3% vs. 22.6%, $p < 0.001$), those not currently married (51.9% vs. 24.4%, $p < 0.001$), those with no formal schooling (38.7% vs. 28.2%, $p = 0.039$), those unemployed (52.4% vs. 20.2%, $p < 0.001$), those with inadequate physical activity (49.4% vs. 25.4%, $p < 0.001$), inadequate dietary diversity (39.2% vs. 27.7%, $p = 0.022$), low hand grip strength (44.6% vs. 28.6%, $p < 0.001$), and cognitive decline (52.0% vs. 24.7%, $p < 0.001$).

Table 2: Prevalence of impaired vitality and impaired locomotor capacity by background characteristics

Characteristics	Impaired Vitality n = 302		Impaired Locomotor Capacity n = 142	
	Frequency (%)	p-value	Frequency (%)	p-value
Age categories (years)		0.017		0.002
60–64	71 (70.3)		23 (22.8)	
65–69	111 (70.7)		55 (35.0)	
70 and above	120 (83.3)		64 (44.4)	
Sex		<0.001		<0.001
Male	142 (65.4)		49 (22.6)	
Female	160 (86.5)		93 (50.3)	
Marital status		<0.001		<0.001
Currently married	163 (67.4)		59 (24.4)	

Characteristics	Impaired Vitality n = 302		Impaired Locomotor Capacity n = 142	
	Frequency (%)	p-value	Frequency (%)	p-value
Other than currently married	139 (86.9)		83 (51.9)	
Religion		0.64		0.31
Islam	147 (76.2)		73 (37.8)	
Other than Islam	155 (74.2)		69 (33.0)	
Education		<0.001		0.039
No formal schooling	221 (81.5)		105 (38.7)	
Formal schooling	81 (61.8)		37 (28.2)	
Occupation		<0.001		<0.001
Employed	140 (65.7)		43 (20.2)	
Other than employed	162 (85.7)		99 (52.4)	
Household wealth tertile		<0.001		0.27
Low	137 (82.5)		61 (36.7)	
Middle	87 (82.1)		42 (39.6)	
High	78 (60.0)		39 (30.0)	
Involvement with income generating activity		<0.001		<0.001
No	143 (87.2)		85 (51.8)	
Yes	159 (66.8)		57 (23.9)	
Meal companionship		<0.001		<0.001
Alone	122 (77.2)		63 (39.9)	
With others	88 (86.3)		47 (46.1)	
With spouse	92 (64.8)		32 (22.5)	
Smoking status		0.19		<0.001
Yes	79 (70.5)		22 (19.6)	
No	223 (76.9)		120 (41.4)	
Smokeless tobacco use status		0.033		0.15
Yes	135 (70.3)		61 (31.8)	
No	167 (79.5)		81 (38.6)	
Any tobacco use status		0.003		<0.001
Yes	183 (70.4)		76 (29.2)	
No	119 (83.8)		66 (46.5)	
Physical activity		0.14		<0.001
Inadequate (<600 MET)	131 (78.9)		82 (49.4)	
Adequate (≥600 MET)	171 (72.5)		60 (25.4)	
Sedentary time category		0.68		0.51

Characteristics	Impaired Vitality n = 302		Impaired Locomotor Capacity n = 142	
	Frequency (%)	p-value	Frequency (%)	p-value
≤7 hours/day	146 (76.0)		71 (37.0)	
>7 hours/day	156 (74.3)		71 (33.8)	
Sleep		0.87		0.22
Inadequate (<7 hours)	208 (75.4)		92 (33.3)	
Adequate (≥7 hours)	94 (74.6)		50 (39.7)	
Alcohol consumption		0.66		0.30
Yes	12 (70.6)		8 (47.1)	
No	290 (75.3)		134 (34.8)	
Cooking fuel		0.16		0.066
Unclean	291 (75.8)		132 (34.4)	
Clean	11 (61.1)		10 (55.6)	
Fruits and vegetables consumption		0.036		0.53
Inadequate (<5 servings)	276 (76.7)		129 (35.8)	
Adequate (≥5 servings)	26 (61.9)		13 (31.0)	
Dietary diversity		0.016		0.022
Inadequate (score <5)	209 (78.9)		104 (39.2)	
Adequate (score ≥5)	93 (67.9)		38 (27.7)	
Food security		<0.001		0.18
Food insecure	140 (90.3)		61 (39.4)	
Food secure	162 (65.6)		81 (32.8)	
Anxiety levels		0.095		0.78
No to mild anxiety	283 (74.3)		134 (35.2)	
Moderate to severe anxiety	19 (90.5)		8 (38.1)	
Activity of daily living		0.66		0.008
Dependent	76 (76.8)		46 (46.5)	
Independent	226 (74.6)		96 (31.7)	
Instrumental activity of daily living		<0.001		<0.001
Dependent	268 (79.1)		134 (39.5)	
Independent	34 (54.0)		8 (12.7)	
Hand grip strength		<0.001		<0.001
Low muscle strength	142 (84.5)		75 (44.6)	
Normal muscle strength	160 (68.4)		67 (28.6)	
BMI category		<0.001		0.95
Underweight (<18.5)	108 (96.4)		40 (35.7)	

Characteristics	Impaired Vitality n = 302		Impaired Locomotor Capacity n = 142	
	Frequency (%)	p-value	Frequency (%)	p-value
Normal (18.5–24.9)	139 (74.3)		67 (35.8)	
Overweight/Obese (≥ 25.0)	55 (53.4)		35 (34.0)	
Hypertension		0.60		0.92
Yes	118 (73.8)		57 (35.6)	
No	184 (76.0)		85 (35.1)	
Diabetes		0.82		0.45
Yes	25 (73.5)		10 (29.4)	
No	277 (75.3)		132 (35.9)	
Chronic respiratory disease		0.20		0.88
Yes	69 (80.2)		31 (36.0)	
No	230 (73.5)		110 (35.1)	

Chi-square test used for all comparisons. IADL: Instrumental Activities of Daily Living; DDS: Dietary Diversity Score.

4.5 Multivariable Analysis: Factors Associated with Impaired Vitality

Table 3 presents the results of the multivariable logistic regression analysis for impaired vitality (n = 399, complete case analysis). Each additional year of age was associated with a 7% higher odds of impaired vitality (aOR: 1.07, 95% CI: 1.02–1.12, p = 0.008). Female sex was associated with 2.6 times higher odds of impaired vitality compared to males (aOR: 2.60, 95% CI: 1.44–4.68, p = 0.001). Being food secure was associated with 73% lower odds of impaired vitality (aOR: 0.27, 95% CI: 0.14–0.51, p < 0.001). Belonging to the highest wealth tertile was associated with 50% lower odds compared to the lowest tertile (aOR: 0.50, 95% CI: 0.27–0.91, p = 0.023). Education, mental health status, hypertension, diabetes, and CRD were not associated with impaired vitality in the final model.

Table 3: Multivariable logistic regression analysis of factors associated with impaired vitality (n = 399)

Variable	Category	aOR	95% CI	p-value
Age	In years	1.07	1.02 – 1.12	0.008
Sex	Male	Reference		

Variable	Category	aOR	95% CI	p-value
	Female	2.60	1.44 – 4.68	0.001
Education	No formal schooling	<i>Reference</i>		
	Formal schooling	0.63	0.37 – 1.09	0.099
Food security	Food insecure	<i>Reference</i>		
	Food secure	0.27	0.14 – 0.51	<0.001
Household wealth tertile	Low	<i>Reference</i>		
	Middle	1.07	0.54 – 2.14	0.837
	High	0.50	0.27 – 0.91	0.023
Any mental health disease	Absent	<i>Reference</i>		
	Present	1.15	0.66 – 2.01	0.616
Hypertension	No	<i>Reference</i>		
	Yes	1.04	0.61 – 1.77	0.885
Diabetes	No	<i>Reference</i>		
	Yes	1.28	0.53 – 3.14	0.582
Chronic respiratory disease	Yes	<i>Reference</i>		
	No	0.71	0.37 – 1.37	0.311

aOR = Adjusted Odds Ratio; CI = Confidence Interval; CRD = Chronic Respiratory Disease.

4.6 Multivariable Analysis: Factors Associated with Impaired Locomotor Capacity

Table 4 presents the results for impaired locomotor capacity (n = 399). Each additional year of age was associated with an 8% higher odds of locomotor capacity impairment (aOR: 1.08, 95% CI: 1.04–1.13, p < 0.001). Female participants had more than twice the odds of impaired locomotor capacity compared with males (aOR: 2.40, 95% CI: 1.31–4.42, p = 0.005). Adequate physical activity was associated with 57% lower odds of impairment than inadequate activity (aOR: 0.43, 95% CI: 0.26–0.73, p = 0.002). Cognitive decline was associated with 89% higher odds of impaired locomotor capacity (aOR: 1.89, 95% CI: 1.17–3.04, p = 0.009). Sedentary time, marital status, hypertension, diabetes, and CRD were not significant risk factors.

Table 4: Multivariable logistic regression analysis of factors associated with impaired locomotor capacity (n = 399)

Variable	Category	aOR	95% CI	p-value
Age (per year increase)	Continuous	1.08	1.04 – 1.13	<0.001

Variable	Category	aOR	95% CI	p-value
Sex	Male	Reference		
	Female	2.40	1.31 – 4.42	0.005
Marital status	Currently married	Reference		
	Other than currently married	1.44	0.79 – 2.60	0.231
Physical activity	Inadequate (<600 MET)	Reference		
	Adequate ($\geq$ 600 MET)	0.43	0.26 – 0.73	0.002
Sedentary time	$\leq$ 7 hours/day	Reference		
	>7 hours/day	0.47	0.28 – 0.79	0.004
Cognitive status	Not declined	Reference		
	Declined	1.89	1.17 – 3.04	0.009
Hypertension	No	Reference		
	Yes	0.82	0.51 – 1.33	0.425
Diabetes	No	Reference		
	Yes	1.00	0.42 – 2.39	0.999
Chronic respiratory disease	Yes	Reference		
	No	1.10	0.61 – 1.99	0.740

OR = Odds Ratio; CI = Confidence Interval; Ref = Reference category

Chapter 5: Discussion

5.1 Principal Findings

This study provides the first community-based assessment of vitality and locomotor capacity using the WHO ICOPE framework in older adults in rural Bangladesh. The findings revealed a high burden of impairment in both domains. Three out of four older adults (75.1%) had impaired vitality, and more than one in three (35.3%) had impaired locomotor capacity. Older age, female sex, food insecurity, and lower household wealth were the main independent factors associated with impaired vitality in older adults. Older age, female sex, physical inactivity, and cognitive decline were independently associated with impaired locomotor capacity in older adults.

5.2 Prevalence of Impaired Vitality

The prevalence of impaired vitality (75.1%) found in this study is broadly consistent with the national estimate of 89% reported by Mridha et al. (2021) in a nationally representative survey. The somewhat lower figure in this study may reflect differences in seasonal food availability during the data collection period, slightly different characteristics of this sub-district sample, or variations in the distribution of MNA-SF item scores. Nevertheless, this finding is alarming: three in four community-dwelling older adults in this rural setting lack adequate nutritional reserves to support healthy ageing.

This level of nutritional impairment is substantially higher than estimates from high-income countries, where community-based MNA-SF studies typically report a malnutrition risk in 20–40% of older adults (Cederholm et al., 2019). It also exceeds estimates from urban South Asian settings, reinforcing the particular vulnerability of rural older populations in LMICs. The extremely high proportion of underweight participants (27.9%, BMI <18.5 kg/m²), combined with widespread food insecurity (38.6%) and inadequate dietary diversity (65.9%), reflects a food environment that is fundamentally inadequate for meeting the nutritional needs of an ageing body.

5.3 Factors Associated with Impaired Vitality

The independent association between advancing age and impaired vitality is consistent with the global evidence. As people age, their appetite declines, nutrient absorption becomes less

efficient, and their physical capacity to obtain and prepare food diminishes (Cederholm et al., 2019). The higher odds of impaired vitality among women align with the findings of Mridha et al. (2021) national survey and the recent nationally representative analysis by Akter et al. (2026), which found that older women in Bangladesh had significantly worse dietary diversity and nutritional status than men of the same age. The mechanisms are multiple and interacting smaller household food allocations, higher rates of widowhood, greater social isolation, and lower participation in income-generating activities all contribute to this phenomenon.

The strong protective effect of food security is one of the most important findings of this study. Participants who were food secure had 73% lower odds of having impaired vitality. Food insecurity directly limits dietary intake and reflects poverty and seasonal agricultural vulnerability, both of which are highly prevalent in Dinajpur. Similarly, belonging to the highest wealth tertile was associated with 50% lower odds of impaired vitality, highlighting the fundamental link between poverty and malnutrition in older age groups. Taken together, these findings point to food-based safety net programmes and poverty alleviation strategies as critical policy interventions to improve vitality in rural older adults.

5.4 Prevalence of Impaired Locomotor Capacity

The prevalence of impaired locomotor capacity was 35.3% using the AWGS 2019 chair stand cutoff of ≥ 12 seconds. This is somewhat lower than the approximately 45% estimated by Sarker (2021), although the measurement approaches differ. The AWGS cutoff was chosen for this study because it has been specifically validated for older Asian adults, accounting for the generally lower body mass and different muscle compositions of this population compared to Western cohorts (Chen et al., 2020). Using the standard ICOPE cutoff of 14 s would have classified a larger proportion as impaired, and the difference between these two cutoffs is an important methodological point when comparing results across studies.

Impaired locomotor capacity was most prevalent among those aged ≥ 70 years (44.4%) and among women (50.3%), reflecting the well-established patterns of musculoskeletal decline with age and lower muscle mass in women in this setting.

5.5 Factors Associated with Impaired Locomotor Capacity

The association between advancing age and impaired locomotor capacity reflects the universal biological process of musculoskeletal aging: muscle mass, strength, and neuromuscular function all decline progressively, regardless of the setting (Guralnik et al., 1994). The more than twofold higher odds of locomotor impairment in women is broadly consistent with findings from other Asian studies, in which women have lower absolute muscle mass and, in most contexts, lower habitual physical activity levels than men (Chen et al., 2020).

The protective effect of adequate physical activity (aOR: 0.43) was one of the most clinically important findings of this study. Participants who met the WHO recommendation of at least 600 MET-minutes of physical activity per week had 57% lower odds of having impaired locomotor capacity. This underscores the critical role of maintaining physical activity in preserving muscle function and mobility in older adults. Many participants in this agricultural community engaged in physically demanding work during the planting and harvesting seasons, which may partly explain why the majority (58.7%) met the physical activity threshold.

The finding regarding sedentary time (aOR: 0.47 for >7 h of sedentary time) is counterintuitive and requires careful interpretation. This likely reflects that participants who were physically well were more likely to be actively farming or working throughout the day and thus reported lower sedentary time, while those with impaired locomotor capacity spent more time seated. This pattern, sometimes called the ‘healthy worker effect,’ is a recognised challenge in cross-sectional studies of physical function in occupationally active older populations.

The association between cognitive decline and impaired locomotor capacity (aOR: 1.89) was an important finding. The relationship between cognition and physical function is well established; slower gait, reduced balance, and impaired motor learning are all features of cognitive decline, even before a formal dementia diagnosis (Montero-Odasso et al., 2020). In the ICOPE framework, cognitive and locomotor domains are assessed together precisely because of this close interaction. The finding that cognitive decline nearly doubled the odds of locomotor impairment suggests that interventions targeting locomotor capacity should also consider cognitive health and vice versa.

5.6 Implications for Policy and Practice

First, the extremely high burden of impaired vitality demands immediate and sustained policy actions. Food-based safety net programmes targeting older adults, nutritional supplementation, and community-level food security interventions should be prioritised, especially for older women and those in the lowest wealth tertile. The integration of routine MNA-SF screening into existing community health worker visits is feasible and low-cost and would enable the early detection of nutritional risk.

Second, the high prevalence of impaired locomotor capacity and its strong association with physical inactivity and cognitive decline highlight the need for structured physical activity programmes at the community level. Simple, low-cost group exercise sessions and walking programmes adapted for older adults have been effective in improving SPPB scores in LMIC settings. These could be delivered through community clinics, religious gathering spaces, or family welfare centres.

Third, this study demonstrates that the WHO ICOPE dual-stage protocol (household interview followed by clinic assessment) is feasible even in a resource-limited rural Bangladeshi setting. This supports the argument for integrating ICOPE-based screening into Bangladesh's community clinic system, consistent with the priorities of the National Healthy Ageing Strategy 2024–2030 (DGHS, 2024).

5.7 Strengths and Limitations

This study had several important strengths. This is the first community-based assessment of vitality and locomotor capacity using the WHO ICOPE framework in rural Bangladesh. The use of validated, internationally recognised tools (MNA-SF and SPPB) enhances comparability with the global literature. Comprehensive data collection across sociodemographic, behavioural, dietary, clinical, and psychological domains allowed for a robust multivariable analysis. The simple random sampling approach reduces the selection bias.

However, this study has several limitations. The cross-sectional design does not allow causal inferences, and the associations identified cannot be interpreted as causes without longitudinal evidence. The study was conducted in a single union in Birganj, limiting its generalizability to other regions. Although the BAMSE cognitive screen was adapted for Bangladesh, it has not

been specifically validated in rural northern Bangladesh. Self-reported physical activity data are prone to recall bias. The study was conducted during April–May 2026, a period of intense agricultural activity and extreme heat that affected participant availability and assessment conditions.

Chapter 6: Conclusion and Recommendations

6.1 Conclusion

This community-based cross-sectional study assessed vitality and locomotor capacity among 402 older adults in Sujalpur Union, Birganj, Dinajpur using the WHO ICOPE framework. The findings reveal a heavy burden of functional impairment in this rural community. Three in four older adults (75.1%) had impaired vitality, and more than one in three (35.3%) had impaired locomotor capacity. Older women, those living in poverty, food-insecure individuals, those who were physically inactive, and those with cognitive decline were at the greatest risk.

These findings demonstrate the urgent need for integrated geriatric care services at the primary healthcare level in rural areas of Bangladesh. The study also showed that community-based assessment using the WHO ICOPE framework is feasible in a low-resource rural setting, which has important implications for scaling up such approaches nationally.

6.2 Recommendations

For Health Policy and Programmes:

3. Integrate ICOPE-based nutritional screening (MNA-SF) into the routine service package of community health workers (Health Assistants and Family Welfare Assistants) in Bangladesh's community clinic programme, with a referral pathway for those found to be at nutritional risk.
4. Develop and scale up nutrition safety net programmes specifically targeting older adults in food-insecure and low-wealth households, with particular attention to older women, who face the greatest risk of impaired vitality.
5. Incorporate structured physical activity promotion and falls prevention programmes into the implementation of the National Healthy Ageing Strategy 2024–2030 at the sub-district level, using community clinics, religious gathering spaces, and family welfare centres as delivery platforms.
6. Develop clinical guidelines for primary care providers to identify and manage cognitive decline in older adults, with specific reference to its association with impaired locomotor capacity and the risk of falls.

For Future Research:

7. Longitudinal studies are needed to establish the causal pathways between nutritional status, physical inactivity, cognitive decline, and locomotor impairment in older Bangladeshis.
8. Intervention studies that test the effectiveness of community-level ICOPE implementation within Bangladesh's primary healthcare system are a priority.
9. Future studies should explore sex-disaggregated analyses in greater depth to understand the mechanisms driving higher risks among older women and design gender-responsive interventions.

Declaration of Generative AI Use

In preparing this thesis, I used an AI-assisted writing tool to support language editing and structuring of certain sections. All intellectual content, including study design, data collection, statistical analysis, interpretation of findings, and conclusions, represents my own original work. The final thesis represents my own judgment.

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Appendices

Appendix A: Data Collection Instrument

Assessment of *vitality* and *locomotor* capacity of older adults: A cross-sectional study

Conducted by: BRAC James P Grant School of Public Health

Questionnaire administration		
Be completed by the Researcher administering the questionnaire after participant consented		
Admin0	Questionnaire version	1.0
Admin1	Interviewer name	
Admin2	Interviewer ID	
Admin3	Date	DD / MM / YYYY
Admin4	Time interview started	HH : MM
Admin15	Household number	
Admin14	Do you agree to participate in this study?	1. Yes 2. No
STUDYID	Participant ID <i>Instructions: 10 digits</i>	_____
Admin5	Participant name	
Admin6	Participant NID	
Admin7	Participant's father's name	
Admin8	Participant's spouse's name	
Address and contact of the participant		
Admin 9	Ward	
Admin10	Village	
Admin10	Contact number	
Sociodemographic characteristics		
<i>Hello, my name is X. I have some questions to go through with you. This questionnaire will take about 2 hours to complete. First, I would like to ask you about your background and personal circumstances</i>		
Demo1	What is your date of birth? <i>[Check participant ID if available. If the participants cannot recall their birthday, probe, and try to make a best guess using anchoring historical events, or other approaches as appropriate]</i>	DD / MM / YYYY

Demo2	Age [PROGRAM: calculate age based on the interview date and DOB]	_____ Years
Demo3	Gender	☐ 1. Male ☐ 2. Female ☐ 3. Other
Demo4	The division you were born	[PROGRAM: Pre-specified list of all states in Bangladesh], Others _____
Demo5	The district you were born	[PROGRAM: Pre-specified list of districts in Bangladesh], Others _____
Demo6	In total, how many years have you spent at school in full- time study (excluding pre-school)?	_____ Years [PROGRAM: Trigger <u>hard check</u> if Demo8 > age, show warning message: “The number of years spent at school is greater than current age, please check if this is correct”] [PROGRAM: Trigger <u>soft check</u> if Demo8 > (age - 4) & Demo8 < age, show warning message: “Based on the reported number of years spent at school, you started primary school before age 4, please check if this is correct”]
Demo7	What is the highest level of education you have completed? [chose <u>one</u> that apply]	☐ 1. No formal schooling ☐ 2. Less than primary school ☐ 3. Primary school completed ☐ 4. Secondary school completed ☐ 5. High school completed ☐ 6. College/University completed ☐ 7. Postgraduate degree
Demo8	What is your current marital status? [chose <u>one</u> that apply]	☐ 1. Never married ☐ 2. Currently married ☐ 3. Divorced ☐ 4. Widowed ☐ 5. Separated (without getting divorced) ☐ 6. Cohabiting
Demo9	What is your religion? [chose <u>one</u> that apply]	☐ 1. Muslim ☐ 2. Hindu ☐ 3. Buddhist ☐ 4. Christian ☐ 5. Other → specify _____

Demo10	Which of the following best describes your main work status over the past 12 months? <i>[chose one that apply]</i>	☐ 1. Government employee ☐ 2. Non-government employee ☐ 3. Self-employed ☐ 4. Non-paid ☐ 5. Student ☐ 6. Homemaker ☐ 7. Retired ☐ 8. Unemployed (able to work) ☐ 9. Unemployed (unable to work) ☐ 99. Refused to answer	
Demo11	Where do people cook in your living space? <i>[chose one that apply]</i>	☐ 1. In a room use for living or sleeping ☐ 2. In a separate room ☐ 3. In a separate building ☐ 4. Outdoors ☐ 5. Not cooking at home ☐ 4. Not known	
Demo12	What ventilation is there in the area where the cooking is done? <i>[chose one that apply]</i>	☐ 1. Stove has chimney or exhaust fan ☐ 2. Window used for ventilation ☐ 3. No ventilation ☐ 4. Not known ☐ 5. Other → Specify _____	
Demo13	What is the primary fuel used for cooking in your household? <i>[chose one that apply, use showcard]</i>	☐ 1. Electricity ☐ 2. Natural gas ☐ 3. Liquified petroleum gas (LPG) ☐ 4. Cow dung ☐ 5. Coal/Lignite ☐ 6. Charcoal ☐ 7. Wood ☐ 8. Straw/shrubs/grass ☐ 9. Agricultural crop ☐ 10. Biogas ☐ 11. Other, specify_____	
Demo14	Does your household have the following items?	Demo14a. Electricity Demo14b. Television Demo14c. Electric fan Demo14d. Wardrobe/Amirah Demo14e. Refrigerator	☐ 1. Yes ☐ 2. No ☐ 1. Yes ☐ 2. No ☐ 1. Yes ☐ 2. No ☐ 1. Yes ☐ 2. No ☐ 1. Yes ☐ 2. No
Demo15	Does any of member of the household own the following items?	Demo15a. Watch Demo15b. Mobile phone Demo15c. Bicycle Demo15d. Motorcycle Demo15e. Car/truck	☐ 1. Yes ☐ 2. No ☐ 1. Yes ☐ 2. No ☐ 1. Yes ☐ 2. No ☐ 1. Yes ☐ 2. No ☐ 1. Yes ☐ 2. No

Demo16	With whom do you live?	☐ 1. Living alone ☐ 2. Living with spouse/family	
Demo17	How many people live in your household	☐ 1. Less than 1year _____ ☐ 2. 1–3-year _____ ☐ 3. 4–6-year _____ ☐ 4. 7–10-year _____ ☐ 5. 11 years or more _____	
Demo18	What is the monthly income of your household? (Reflecting the past 12 months) This question aims to understand the monthly income of your household/household members. The total monthly income of all earning members of the household should be recorded. Additionally, you should ask whether there is any other source of income.	_____ Taka	
Tobacco use <i>Now I am going to ask you some questions about tobacco use.</i>			
Tob1	Do you currently smoke any tobacco products, such as cigarettes, cigars, or pipes? [use showcard]	☐ 1. Yes ☐ 2. No [go to Tob6]	
Tob2	How old were you when you first started smoking?	_____ Years ☐ 99. Don't know [PROGRAM: Trigger <u>hard check</u> if Tob2 > Demo2 (age), show warning message: "Age first started smoking is greater than current age, please check if this is correct"]	
Tob3	Do you currently smoke tobacco products daily ?	☐ 1. Yes ☐ 2. No	
On average, how many of the following products do you smoke each day? [If products are smoked less than daily by daily smokers, enter weekly consumption.]			
Tob4		☐ 1. Daily users [PROGRAM: Tob1=1 & Tob3=1]	☐ 2. Non-daily users [PROGRAM: Tob1=1 & Tob3=2]
Tob4a	Manufactured cigarettes	_____ per day	_____ per week

Tob4b	Hand-rolled cigarettes	_____ per day	_____ per week
Tob4c	Pipes full of tobacco	_____ per day	_____ per week
Tob4d	Cigars, cheroots, cigarillos	_____ per day	_____ per week
Tob4e	Number of Shisha sessions	_____ per day	_____ per week
Tob4f	Others (please specify_____)	_____ per day	_____ per week
Tob5	During the past 12 months, have you tried to stop smoking?	☐ 1. Yes ☐ 2. No	
Tob5a	During the past 12 months, how many times did you try to quit smoking?	_____ times <i>[go to Tob9 – regardless of the answer to this question]</i>	
Tob6	In the past, did you ever smoke any tobacco products?	☐ 1. Yes ☐ 2. No <i>[go to Tob9]</i>	
Tob6a	In the past, did you ever smoke any tobacco products daily ?	☐ 1. Yes ☐ 2. No	
Tob7	How old were you when you first started smoking?	_____ Years ☐ 99. Don't know [PROGRAM: Trigger hard check if Tob7 > age, show warning message: "Age first started smoking is greater than current age, please check if this is correct"]	
Tob8	How old were you when you stopped smoking?	_____ Years ☐ 99. Don't know [PROGRAM: Trigger hard check if Tob8 > age, show warning message: "Age stopped smoking is greater than current age, please check if this is correct"] [PROGRAM: Trigger hard check if Tob8 < Tob7, show warning message: "Age stopped smoking is younger than age first started smoking, please check if this is correct"]	
Smokeless tobacco use			
Tob9	Do you currently use any smokeless tobacco products, such as snuff, chewing tobacco, or betel with tobacco? <i>[use showcard]</i>	☐ 1. Yes ☐ 2. No <i>[go to Tob13]</i>	
Tob10	How old were you when you first started using these?	_____ Years ☐ 99. Don't know [PROGRAM: Trigger hard check if Tob2 > age, show warning message: "Age first started smoking is greater than current age, please check if this is correct"]	

Tob11	Do you currently use any smokeless tobacco products <u>daily</u> ?	☐ 1. Yes ☐ 2. No	
On average, how many of the following products do you use each day?			
Tob12		☐ 1. Daily users [PROGRAM: Tob9=1 & Tob11=1]	☐ 2. Non-daily users [PROGRAM: Tob9=1 & Tob11=2]
Tob12a	Snuff (Nossi), by mouth	_____ per day	_____ per week
Tob12b	Snuff (Nossi), by nose	_____ per day	_____ per week
Tob12c	Chewing tobacco / Gul	_____ per day	_____ per week
Tob12d	Betel with <i>Zorda</i> or other forms of tobacco	_____ per day	_____ per week
Tob12e	Other	_____ per day	_____ per week
Tob12f	Other, specify	_____ [Specify smokeless tobacco not listed above]	
Tob13b	During the past 12 months, have you tried to stop smokeless tobacco?	☐ 1. Yes ☐ 2. No	
Tob13c	During the past 12 months, how many times did you try to quit smokeless tobacco?	_____ times [go to Tob15b – regardless of the answer to this question]	
Tob13	In the past, did you ever use smokeless tobacco products?	☐ 1. Yes ☐ 2. No [go to Tob16, regardless of the answer to this question]	
Tob13a	In the past, did you ever use smokeless tobacco products <u>daily</u> ?	☐ 1. Yes ☐ 2. No [go to Tob15b]	
Tob14	How old were you when you first started using smokeless tobacco?	Tob14a. _____ Years ☐ 99. Don't know [PROGRAM: Trigger <u>hard check</u> if Tob7 > age, show warning message: "Age first started smoking is greater than current age, please check if this is correct"]	
Tob15	How old were you when you stopped using smokeless tobacco?	Tob15a. _____ Years ☐ 99. Don't know [PROGRAM: Trigger <u>hard check</u> if Tob8 > age, show warning message: "Age stopped smoking is greater than current age, please check if this is correct"] [PROGRAM: Trigger <u>hard check</u> if Tob8 < Tob7, show warning message:	

		“Age stopped smoking is younger than age first started smoking, please check if this is correct”]
Tob15b	On the scale of 10 where 0 is no motivation and 10 is full motivation, at this time how motivated are you to quit tobacco?	0-1-2-3-4-5-6-7-8-9-10
Second-hand smoke exposure		
Tob16	During the past 30 days, did someone smoke tobacco near you, in a <u>closed area</u> of your home?	☐ 1. Yes ☐ 2. No
Tob17	During the last 30 days, did someone smoke near you, in a <u>closed area</u> of your workplace (e.g., in the office)?	☐ 1. Yes ☐ 2. No
Alcohol consumption <i>The next questions ask about consumption of alcohol</i>		
Alc1	Do you consume any alcoholic products (such as beer, wine, whisky, brandy, rum, vodka or locally prepared alcoholic drinks)?	☐ 1. Yes, within the last 12 months ☐ 2. Yes, not in the last 12 months <i>[go to Diet1]</i> ☐ 3. Never <i>[go to Diet1]</i>
Alc2	How frequently have you had at least one standard drink? <i>[use showcard]</i>	☐ 1. Less than once / month ☐ 2. 1-3 days per month ☐ 3. 1-4 days per week ☐ 4. 5-7 days per week
Alc3	Have you consumed any alcohol <u>within the past 30 days?</u>	☐ 1. Yes ☐ 2. No <i>[go to Diet1]</i>
Alc4	During past 30 days, when you drink alcohol, on average, how many standard drinks do you have during one occasion?	_____ Drinks
Dietary intake <i>The next questions ask about the fruits and vegetables that you usually eat. I have a nutrition card here that shows you some examples of local fruits and vegetables. Each picture represents the size of a serving. As you answer these questions please think of a typical week in the last year.</i>		
Diet1	In a typical week, on how many days do you eat fruit? <i>[use showcard]</i>	_____ Days [If 0 → go to Diet3]

Diet2	How many servings of fruit do you eat on one of those days?	_____ Servings
Diet3	In a typical week, on how many days do you eat vegetables? [use showcard]	_____ Days [If 0 → go to Diet5]
Diet4	How many servings of vegetables do you eat on one of those days	_____ Servings
Diet5	Do you have sugary drinks (for example, soda/coke/sprite/fanta etc. or other carbonated drink, juice (not pure fruit juice but juice drink or flavoured juice drinks, sweetened milk, sweetened tea or coffee) on most days.	☐ 1. Yes ☐ 2. No
Diet6	How often do you eat foods high in sugar (e.g., sweets, desserts) ?	☐ 1. Always ☐ 2. Often ☐ 3. Sometimes ☐ 4. Rarely ☐ 5. Never ☐ 99. Don't know
Diet7	How often do you eat oily foods or deep fried snacks (e.g., Paratha, Luchi, Singara, Samucha, Piyaju, Beguni) ?	☐ 1. Always ☐ 2. Often ☐ 3. Sometimes ☐ 4. Rarely ☐ 5. Never ☐ 99. Don't know
Dietary salt <i>With the next questions, we would like to learn more about salt in your diet. Dietary salt includes ordinary table salt, unrefined salt such as sea salt, iodized salt, salty stock cubes and powders, and salty sauces such as soy sauce or fish sauce (see showcard). The following questions are on adding salt to the food right before you eat it, on how food is prepared in your home, on eating processed foods that are high in salt such as [insert country specific examples], and questions on controlling your salt intake. Please answer the questions even if you consider yourself to eat a diet low in salt. [Read this opening statement out loud. Don't forget to use the showcard which will help the respondent when answering to the questions.]</i>		
Salt1	How often do you add salt or a salty sauce such as soy sauce to your food right before you eat it or as you are eating it? [select only one, use showcard]	☐ 1. Always ☐ 2. Often ☐ 3. Sometimes ☐ 4. Rarely ☐ 5. Never ☐ 99. Don't know
Salt2	How often is salt, salty seasoning or a salty sauce added in cooking or preparing foods in your household?	☐ 1. Always ☐ 2. Often ☐ 3. Sometimes ☐ 4. Rarely ☐ 5. Never ☐ 99. Don't know

Salt3	How often do you eat <u>processed food high in salt</u> ? By processed food high in salt, I mean foods that have been altered from their natural state, such as packaged salty snacks, canned salty food including pickles and preserves, salty food prepared at a fast-food restaurant, cheese, bacon, and processed meat [add country specific examples, use showcard].	☐ 1. Always ☐ 2. Often ☐ 3. Sometimes ☐ 4. Rarely ☐ 5. Never ☐ 99. Don't know
Salt4	<u>How much salt or salty sauce</u> do you think you consume?	☐ 1. Always ☐ 2. Often ☐ 3. Sometimes ☐ 4. Rarely ☐ 5. Never ☐ 99. Don't know
Salt5	<u>How much salt you need in your household</u> for food or food preparation in one week?	_____ spoon Or _____ gram
Physical activity Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. <i>[Insert other examples if needed]</i>. In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate. <i>Read this opening statement out loud. It should not be omitted. The respondent will have to think first about the time he/she spends doing work (paid or unpaid work, household chores, harvesting food, fishing or hunting for food, seeking employment [Insert other examples if needed]), then about the time he/she travels from place to place, and finally about the time spent in vigorous as well as moderate physical activity during leisure time.</i> <i>Remind the respondent when he/she answers the following questions that 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate. Don't forget to use the showcard which will help the respondent when answering to the questions.</i>		
PA1	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like <i>[carrying or lifting heavy loads, digging or construction work]</i> ? <i>[INSERT EXAMPLES] (USE SHOWCARD)</i> Ask the participant to think about vigorous-intensity activities at work only.	☐ 1. Yes ☐ 2. No <i>[go to PA4]</i>

	<i>Activities are regarded as vigorous intensity if they cause large increases in breathing and/or heart rate.</i>	
PA2	In a typical week, on how many days do you do vigorous-intensity activities as part of your work? <i>“Typical week” means a week when the participant is engaged in his/her usual activities. Valid responses range from 1-7.</i>	_____Days [PROGRAM: Range 0 - 7]
PA3	How much time do you spend doing vigorous-intensity activities at work on a typical day? <i>Ask the participant to think of a typical day he/she can recall easily in which he/she engaged in vigorous-intensity activities at work. The participant should only consider those activities undertaken continuously. Probe very high responses (over 4 hrs) to verify.</i>	_____Minutes [PROGRAM: Range 0 - 1440]
PA4	Does your work involve moderate-intensity activity, that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads]? <i>[INSERT EXAMPLES] (USE SHOWCARD)</i> <i>Ask the participant to think about moderate-intensity activities at work only. Activities are regarded as moderate intensity if they cause small increases in breathing and/or heart rate.</i>	☐ 1. Yes ☐ 2. No [go to PA4]
PA5	In a typical week, on how many days do you do moderate-intensity activities as part of your work? <i>“Typical week” means a week when the participant is engaged in his/her usual activities. Valid responses range from 1-7.</i>	_____Days [PROGRAM: Range 0 - 7]
PA6	How much time do you spend doing moderate-intensity activities at work on a typical day? <i>Ask the participant to think of a typical day he/she can recall easily in which he/she engaged in moderate-intensity activities at work. The participant should only consider those activities undertaken continuously. Probe very high responses (over 4 hrs) to verify.</i>	_____Minutes [PROGRAM: Range 0 - 1440]

The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship. <i>[Insert other examples if needed]</i> <i>The introductory statement to the following questions on transport-related physical activity is very important. It asks and helps the participant to now think about how they travel around getting from place-to-place. This statement should not be omitted.</i>		
PA7	Do you walk or use a bicycle (<i>pedal cycle</i>) to get to and from places? Select the appropriate response.	☐ 1. Yes ☐ 2. No <i>[go to PA10]</i>
PA8	In a typical week, on how many days do you walk or bicycle to get to and from places? <i>“Typical week” means a week when the participant is engaged in his/her usual activities. Valid responses range from 1-7.</i>	_____ Days [PROGRAM: Range 0 - 7]
PA9	How much time do you spend walking or bicycling for travel on a typical day? <i>Ask the participant to think of a typical day he/she can recall easily in which he/she engaged in transport-related activities. The participant should only consider those activities undertaken continuously. Probe very high responses (over 4 hrs) to verify.</i>	_____ Minutes [PROGRAM: Range 0 - 1440]
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure) <i>[Insert relevant terms]</i>. This introductory statement directs the participant to think about recreational activities. This can also be called discretionary or leisure time. It includes sports and exercise but is not limited to participation in competitions. Activities reported should be done regularly and not just occasionally. It is important to focus on only recreational activities and not to include any activities already mentioned. This statement should not be omitted.		
PA10	Do you do any vigorous-intensity sports, fitness or recreational (<i>leisure</i>) activities that cause large increases in breathing or heart rate like <i>[running or football]</i>? <i>[INSERT EXAMPLES] (USE SHOWCARD)</i> <i>Ask the participant to think about recreational vigorous-intensity activities only. Activities are regarded as vigorous intensity if they cause large increases in breathing and/or heart rate.</i>	☐ 1. Yes ☐ 2. No <i>[go to PA13]</i>
PA11	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (<i>leisure</i>) activities? <i>“Typical week” means a week when the participant is engaged in his/her usual activities. Valid responses range from 1-7.</i>	_____ Days [PROGRAM: Range 0 - 7]

PA12	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day? <i>Ask the participant to think of a typical day he/she can recall easily in which he/she engaged in recreational vigorous-intensity activities. The participant should only consider those activities undertaken continuously. Probe very high responses (over 4 hrs) to verify.</i>	_____ Minutes [PROGRAM: Range 0 - 1440]
PA13	Do you do any moderate-intensity sports, fitness or recreational (<i>leisure</i>) activities that cause a small increase in breathing or heart rate such as brisk walking, [<i>cycling, swimming, volleyball</i>]? <i>[INSERT EXAMPLES] (USE SHOWCARD)</i> <i>Ask the participant to think about recreational moderate-intensity activities only. Activities are regarded as moderate intensity if they cause small increases in breathing and/or heart rate.</i>	☐ 1. Yes ☐ 2. No [<i>go to PA16</i>]
PA14	In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (<i>leisure</i>) activities? <i>“Typical week” means a week when the participant is engaged in his/her usual activities. Valid responses range from 1-7.</i>	_____ Days [PROGRAM: Range 0 - 7]
PA15	How much time do you spend doing moderate-intensity sports, fitness or recreational (<i>leisure</i>) activities on a typical day? <i>Ask the participant to think of a typical day he/she can recall easily in which he/she engaged in recreational moderate-intensity activities. The participant should only consider those activities undertaken continuously. Probe very high responses (over 4 hrs) to verify.</i>	_____ Minutes [PROGRAM: Range 0 - 1440]
This section is about your sleep. Please consider typical days in the previous 30 days. Do not consider nights when sleep is disrupted by special events (e.g., attending funeral, marriage, etc.)		
Sleep1	During past month, what time have you usually gone to bed at night?	_____:____ Hr : mm [use 24 hr format]
Sleep2	During past month, what time have you usually gotten up in the morning?	_____:____ Hr : mm [use 24 hr format]
Sleep3	During past month, how long (in minutes) has it usually taken you to fall asleep each night?	_____ minutes

Sleep4	During past month, how many hours of actual sleep did you get at night?	_____ hours
Sleep5	During past month, how would you rate your sleep quality overall?	☐ 1. Very good ☐ 2. Fairly good ☐ 3. Fairly bad ☐ 4. Very bad
Sleep6	How often do you feel sleepy or drowsy during the daytime?	☐ 1. Always ☐ 2. Often ☐ 3. Sometimes ☐ 4. Rarely ☐ 5. Never ☐ 99. Don't know
Sleep7	Are you using any sleep medication or sleeping pills?	☐ 1. Yes ☐ 2. No

DIET QUALITY QUESTIONNAIRE (DQQ)

Read: Now I'd like to ask you some yes-or-no questions about foods and drinks that you consumed yesterday during the day or night, whether you had it at home or somewhere else.

First, I would like you to think about yesterday, from the time you woke up through the night. Think to yourself about the first thing you ate or drank after you woke up in the morning ... Think about where you were when you had any food or drink in the middle of the day ... Think about where you were when you had any evening meal ... and any food or drink you may have had in the evening or late-night... and any other snacks or drinks you may have had between meals throughout the day or night.

I am interested in whether you had the food items I will mention even if they were combined with other foods. Please listen to the list of foods and drinks, and if you ate or drank ANY ONE OF THEM, say yes.

	Yesterday, did you eat any of the following foods:	
DQQ1	Rice, paratha, or pa ruti?	YES or NO
DQQ2	Roti, corn, or popcorn?	YES or NO
DQQ3	Potato, plantain, arum, or sweet potato?	YES or NO
DQQ4	Daal, chickpeas, or khichuri	YES or NO
	Yesterday, did you eat any of the following vegetables:	

DQQ5	Carrots or pumpkin?	YES or NO
DQQ6.1	Lal shak, pui shak, amaranth, spinach, or any other shak?	YES or NO
DQQ7.1	Eggplant, lady finger, cauliflower, cabbage, long beans, green beans, or tomatoes?	YES or NO
DQQ7.2	Bottle gourd, pointed gourd, bitter gourd, bitter melon,	YES or NO
DQQ7.3	White radish, kohlrabi, taro shoots, or green papaya?	
	Yesterday, did you eat any of the following fruits:	YES or NO
DQQ8	Ripe mango, ripe papaya, or orange musk melon?	YES or NO
DQQ9	Orange, malta, or pomelo?	YES or NO
DQQ10.1	Guava, pineapple, ripe banana, watermelon, jackfruit, custard apple, or apple?	YES or NO
DQQ10.2	Jamrul, star fruit, koromcha, jujube, Java plum, litchi, or amra?	YES or NO
	Yesterday, did you eat any of the following sweets:	
DQQ11	Sweet biscuits, cakes, misti pitha, halwa, or jilapi?	YES or NO
DQQ12	Mishti, chocolate, or ice cream?	YES or NO
	Yesterday, did you eat any of the following foods of animal origin:	
DQQ13	Eggs?	YES or NO

DQQ14	Paneer or cheese?	YES or NO
DQQ15	Yogurt or lassi?	YES or NO
DQQ16	Sausages?	YES or NO
DQQ17	Beef or goat meat?	YES or NO
DQQ18	N/A	YES or NO
DQQ19	Chicken, chicken liver, pigeon, duck, or quail?	YES or NO
DQQ20	Fish or dried fish?	YES or NO
	Yesterday, did you eat any of the following other foods:	
DQQ21	Peanuts or jackfruit seeds?	YES or NO
DQQ22	Chips or chanachur?	YES or NO
DQQ23	Instant noodles such as Maggi noodles or Pran's Mr. Noodles?	YES or NO
DQQ24	Puri, singara, samucha, pakora, piaju, beguni, fried chicken, or chop?	YES or NO
	Yesterday, did you have any of the following beverages:	
DQQ25	Milk?	YES or NO
DQQ26	Tea with sugar, coffee with sugar, chocolate milk, Horlicks, Milo, Complan or Ovaltine?	YES or NO

	HTN2	Do you seek care for hypertension?	1 = Yes 2 = No	[If 'No' please go to next section]
	HTN3	Where do you usually seek treatment for your high blood pressure/ hypertension?	1 = At home 2 = At nearby dispensary 3 = Physician chamber 4 = Private Clinic 5 = Community Clinic 6 = Union health and family planning center 7 = Upazila Health Complex (UHC) 8 = District hospital 9 = Diabetic hospital 10 = Government Medical College Hospital 99 = Others (specify)	
	HTN4	If yes, from whom did you seek care for your hypertension?	1 = Doctor 2 = SACMO 3 = Nurse 4 = Kabiraj 5 = Health assistant/CHW 6 = Pharmacist/Drug seller 7 = Rural medical practitioner 8 = Homeopathy 9 = Ayurveda 10 = CHCP 99 = Others (Specify)	
	HTN5	How often do you usually visit a health facility for follow-up?	1 = Monthly 2 = Every 3 months 3 = Every 6–12 months 4 = Only when symptoms worsen	
	HTN6	Are you currently taking any medicine according to the prescription of doctor or other health care provider to control hypertension/ raised blood pressure? <i>Instruction: Record correct answer</i>	1 = Yes 2 = Stopped medication as per doctor's advice 3 = No	[If '2' or '3' please go to next section]
	HTN7	In the last 30 days, have you missed taking your prescribed medicine? <i>Instruction: Medicine should be taken according to doctor's prescription or advice of registered health care provider only.</i>	1 = Yes, frequently 2 = Yes, occasionally 3 = I was able to take regularly	[If '1' or '2' please go to 'HTN8']
	HTN8	What was the reason behind not taking the medications? <i>Instruction: Multiple responses possible.</i>	1 = Don't think taking drug is necessary 2 = Expensive 3 = Got side-effect or afraid of side-effect 4 = Blood pressure is now normal 5 = Medicine is not available 6 = Medicine not advised 7 = Distance of healthcare facility	

			99 = Others (specify)	
Diabetes [if COM 2 =1]				
	DM1	How old were you when a doctor first told you that you have Diabetes?	_____ years	
	DM2	Do you seek care for Diabetes?	1 = Yes 2 = No	[If 'No' please go to next section]
	DM3	Where do you usually seek treatment for your Diabetes?	1 = At home 2 = At nearby dispensary 3 = Physician chamber 4 = Private Clinic 5= Community Clinic 6= Union health and family planning center 7= Upazila Health Complex (UHC) 8= District hospital 9= Diabetic hospital 10= Government Medical College Hospital 99 = Others (specify)	
	DM4	If yes, from whom did you seek care for your Diabetes?	1 = Doctor 2 = SACMO 3 = Nurse 4 = Kabiraj 5 = Health assistant/CHW 6 = Pharmacist/Drug seller 7 = Rural medical practitioner 8 = Homeopathy 9 = Ayurveda 10 = CHCP 99 = Others (Specify)	
	DM5	How often do you usually visit a health facility for follow-up?	1= Monthly 2= Every 3 months 3= Every 6–12 months 4= Only when symptoms worsen	
	DM6	Are you currently taking any medicine according to the prescription of doctor or other health care provider to control Diabetes? <i>Instruction: Record correct answer</i>	1 =Yes 2= Stopped medication as per doctor's advice 3= No	[If '2' or '3' please go to next section]
	DM7	In the last 30 days, have you missed taking your prescribed medicine? <i>Instruction: Medicine should be taken according to doctor's</i>	1 = Yes, frequently 2 = Yes, occasionally 3= I was able to take regularly	[If '1' or '2' please go to 'DM8']

		<i>prescription or advice of registered health care provider only.</i>		
	DM8	What was the reason behind not taking the medications? <i>Instruction: Multiple responses possible.</i>	1 = Don't think taking drug is necessary 2 = Expensive 3 = Got side-effect or afraid of side-effect 4 = Blood pressure is now normal 5 = Medicine is not available 6 = Medicine not advised 7 = Distance of healthcare facility 99 = Others (specify)	
Asthma [if COM 3 =1]				
	Asthm1	How old were you when a doctor first told you that you have asthma?	_____ years	
	Asthm2	Do you seek care for asthma?	1 = Yes 2 = No	[If 'No' please go to next section]
	Asthm3	Where do you usually seek treatment for your asthma?	1 = At home 2 = At nearby dispensary 3 = Physician chamber 4 = Private Clinic 5 = Community Clinic 6 = Union health and family planning center 7 = Upazila Health Complex (UHC) 8 = District hospital 9 = Diabetic hospital 10 = Government Medical College Hospital 99 = Others (specify)	
	Asthm4	If yes, from whom did you seek care for your asthma?	1 = Doctor 2 = SACMO 3 = Nurse 4 = Kabiraj 5 = Health assistant/CHW 6 = Pharmacist/Drug seller 7 = Rural medical practitioner 8 = Homeopathy 9 = Ayurveda 10 = CHCP 99 = Others (Specify)	
	Asthm5	How often do you usually visit a health facility for follow-up?	1 = Monthly 2 = Every 3 months 3 = Every 6–12 months 4 = Only when symptoms worsen	

	Asthm6	Are you currently taking any medicine according to the prescription of doctor or other health care provider to control asthma? <i>Instruction: Record correct answer</i>	1 =Yes 2= Stopped medication as per doctor's advice 3= No	[If '2' or '3' please go to next section]
	Asthm7	In the last 30 days, have you missed taking your prescribed medicine? <i>Instruction: Medicine should be taken according to doctor's prescription or advice of registered health care provider only.</i>	1 = Yes, frequently 2 = Yes, occasionally 3= I was able to take regularly	[If '1' or '2' please go to 'Asthm8']
	Asthm8	What was the reason behind not taking the medications? <i>Instruction: Multiple responses possible.</i>	1 = Don't think taking drug is necessary 2 = Expensive 3 = Got side-effect or afraid of side-effect 4 = Blood pressure is now normal 5 = Medicine is not available 6 = Medicine not advised 7= Distance of healthcare facility 99 = Others (specify)	
Chronic Obstructive Pulmonary Disease (COPD) [if COM 4 =1]				
	COPD1	How old were you when a doctor first told you that you have COPD?	_____ years	
	COPD2	Do you seek care for COPD?	1 = Yes 2 = No	[If 'No' please go to next section]
	COPD3	Where do you usually seek treatment for your COPD?	1 = At home 2 = At nearby dispensary 3 = Physician chamber 4 = Private Clinic 5= Community Clinic 6= Union health and family planning center 7= Upazila Health Complex (UHC) 8= District hospital 9= Diabetic hospital 10= Government Medical College Hospital 99 = Others (specify)	
	COPD4	If yes, from whom did you seek care for your COPD?	1 = Doctor 2 = SACMO 3 = Nurse 4 = Kabiraj 5 = Health assistant/CHW 6 = Pharmacist/Drug seller 7 = Rural medical practitioner 8 = Homeopathy 9 = Ayurveda 10 = CHCP 99 = Others (Specify)	

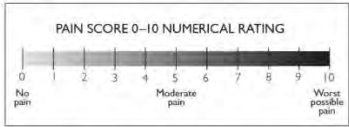
	COPD5	How often do you usually visit a health facility for follow-up?	1= Monthly 2= Every 3 months 3= Every 6–12 months 4= Only when symptoms worsen	
	COPD6	Are you currently taking any medicine according to the prescription of doctor or other health care provider to control COPD? <i>Instruction: Record correct answer</i>	1 =Yes 2= Stopped medication as per doctor's advice 3= No	[If '2' or '3' please go to next section]
	COPD7	In the last 30 days, have you missed taking your prescribed medicine? <i>Instruction: Medicine should be taken according to doctor's prescription or advice of registered health care provider only.</i>	1 = Yes, frequently 2 = Yes, occasionally 3= I was able to take regularly	[If '1' or '2' please go to 'COPD8']
	COPD8	What was the reason behind not taking the medications? <i>Instruction: Multiple responses possible.</i>	1 = Don't think taking drug is necessary 2 = Expensive 3 = Got side-effect or afraid of side-effect 4 = Blood pressure is now normal 5 = Medicine is not available 6 = Medicine not advised 7= Distance of healthcare facility 99 = Others (specify)	
Cancer [if COM 5 =1]				
	Cancer1	How old were you when a doctor first told you that you have cancer?	_____ years	
	Cancer2	What was the cancer?	Select all the correct answers: 1 = Bladder 2 =Breast 3 = Brain 4 = Uterus / Fallopian tubes / Ovaries 5 = Intestines 6 = Esophagus 7 = Head and neck 8 = Liver 9 = lungs 10 = Face 11 = Pancreas 12 = Prostate 13 = Stomach 14 = Testicles 99=Other (please specify)	
	Cancer3	Do you seek care for cancer?	1 = Yes 2 = No	[If 'No' please go to next section]

	Cancer4	Where do you usually seek treatment for your cancer?	1 = At home 2 = At nearby dispensary 3 = Physician chamber 4 = Private Clinic 5 = Community Clinic 6 = Union health and family planning center 7 = Upazila Health Complex (UHC) 8 = District hospital 9 = Diabetic hospital 10 = Government Medical College Hospital 99 = Others (specify)	
	Cancer5	If yes, from whom did you seek care for your cancer?	1 = Doctor 2 = SACMO 3 = Nurse 4 = Kabiraj 5 = Health assistant/CHW 6 = Pharmacist/Drug seller 7 = Rural medical practitioner 8 = Homeopathy 9 = Ayurveda 10 = CHCP 99 = Others (Specify)	
	Cancer6	How often do you usually visit a health facility for follow-up?	1 = Monthly 2 = Every 3 months 3 = Every 6–12 months 4 = Only when symptoms worsen	
	Cancer7	Are you currently taking any medicine according to the prescription of doctor or other health care provider to control cancer? <i>Instruction: Record correct answer</i>	1 = Yes 2 = Stopped medication as per doctor's advice 3 = No	[If '2' or '3' please go to next section]
	Cancer8	In the last 30 days, have you missed taking your prescribed medicine? <i>Instruction: Medicine should be taken according to doctor's prescription or advice of registered health care provider only.</i>	1 = Yes, frequently 2 = Yes, occasionally 3 = I was able to take regularly	[If '1' or '2' please go to 'Cancer9']
	Cancer9	What was the reason behind not taking the medications? <i>Instruction: Multiple responses possible.</i>	1 = Don't think taking drug is necessary 2 = Expensive 3 = Got side-effect or afraid of side-effect 4 = Blood pressure is now normal 5 = Medicine is not available 6 = Medicine not advised 7 = Distance of healthcare facility 99 = Others (specify)	
Mental Health [if COM 8 =1or COM 9 =1 or COM 10 =1 or COM 11 =1]				

	MHD1	How old were you when a doctor first told you that you have mental health disorder?	_____ years	
	MHD2	Do you seek care for mental health disorder?	1 = Yes 2 = No	[If 'No' please go to next section]
	MHD3	Where do you usually seek treatment for your mental health disorder?	1 = At home 2 = At nearby dispensary 3 = Physician chamber 4 = Private Clinic 5 = Community Clinic 6 = Union health and family planning center 7 = Upazila Health Complex (UHC) 8 = District hospital 9 = Diabetic hospital 10 = Government Medical College Hospital 99 = Others (specify)	
	MHD4	If yes, from whom did you seek care for your mental health disorder?	1 = Doctor 2 = SACMO 3 = Nurse 4 = Kabiraj 5 = Health assistant/CHW 6 = Pharmacist/Drug seller 7 = Rural medical practitioner 8 = Homeopathy 9 = Ayurveda 10 = CHCP 99 = Others (Specify)	
	MHD5	How often do you usually visit a health facility for follow-up?	1 = Monthly 2 = Every 3 months 3 = Every 6–12 months 4 = Only when symptoms worsen	
	MHD6	Are you currently taking any medicine according to the prescription of doctor or other health care provider to control mental health disorder? <i>Instruction: Record correct answer</i>	1 = Yes 2 = Stopped medication as per doctor's advice 3 = No	[If '2' or '3' please go to next section]
	MHD7	In the last 30 days, have you missed taking your prescribed medicine? <i>Instruction: Medicine should be taken according to doctor's prescription or advice of registered health care provider only.</i>	1 = Yes, frequently 2 = Yes, occasionally 3 = I was able to take regularly	[If '1' or '2' please go to 'MHD8']
	MHD8	What was the reason behind not taking the medications? <i>Instruction: Multiple responses possible.</i>	1 = Don't think taking drug is necessary 2 = Expensive 3 = Got side-effect or afraid of side-effect	

			4 = Blood pressure is now normal 5 = Medicine is not available 6 = Medicine not advised 7= Distance of healthcare facility 99 = Others (specify)	
Geriatric illness				
	GRI1	Are you undergoing treatment for any geriatric disorders (such as general cognitive impairment, reduced mobility, malnutrition, vision or hearing impairment, mental health disorder, etc.)?	1 = Yes 2 = No	[If 'No' please go to next section]
	GRI2	Where do you usually seek treatment for geriatric disorders?	1 = At home 2 = At nearby dispensary 3 = Physician chamber 4 = Private Clinic 5= Community Clinic 6= Union health and family planning center 7= Upazila Health Complex (UHC) 8= District hospital 9= Diabetic hospital 10= Government Medical College Hospital 99 = Others (specify)	
	GRI3	If yes, from whom did you seek care for your geriatric disorders?	1 = Doctor 2 = SACMO 3 = Nurse/ Physiotherapist 4 = Kabiraj 5 = Health assistant/CHW 6 = Pharmacist/Drug seller 7 = Rural medical practitioner 8 = Homeopathy 9 = Ayurveda 10 = CHCP 99 = Others (Specify)	
	GRI4	How soon do you usually seek care after noticing a health problem?	1= Immediately (within 24–48 hours) 2= Within 1 week 3= After symptoms worsen 4= Do not seek care	
	GRI5	Have you ever received any of the following services? <i>Instruction: Multiple responses possible.</i>	1= Blood pressure check 2= Blood sugar test 3= Assessment of cognition 4= Assessment of mobility 5= Nutritional assessment 6= Vision check 7= Hearing check 8= Mental health assessment 9= None	
	GRI6	How often do you usually visit a health facility for follow-up of geriatric illness?	1= Monthly 2= Every 3 months 3= Every 6–12 months 4= Only when symptoms worsen	

	GRI7	Are you currently taking any medicine according to the prescription of doctor or other health care provider to control geriatric disorder? <i>Instruction: Record correct answer</i>	1 =Yes 2= Stopped medication as per doctor's advice 3= No	[If '2' or '3' please go to next section]
	GRI8	In the last 30 days, have you missed taking your prescribed medicine? <i>Instruction: Medicine should be taken according to doctor's prescription or advice of registered health care provider only.</i>	1 = Yes, frequently 2 = Yes, occasionally 3= I was able to take regularly	[If '1' or '2' please go to 'GRI9']
	GRI9	What was the reason behind not taking the medications? <i>Instruction: Multiple responses possible.</i>	1 = Don't think taking drug is necessary 2 = Expensive 3 = Got side-effect or afraid of side-effect 4 = Blood pressure is now normal 5 = Medicine is not available 6 = Medicine not advised 7= Distance of healthcare facility 99 = Others (specify)	

Numerical Pain Rating Scale (NPRS) Now I will ask you about your pain .		
NPRS	Please rate your pain right now (on a scale from 0 to 10, where 0 means 'no pain at all' and 10 means 'the worst pain you can imagine'.	_____ / 10 

Medications for chronic conditions Now I am going to ask you again about the medications that you take regularly (at least once a week)? Please don't forget to tell me about drugs that you inject (like insulin) or that you inhale (eg for asthma). There is no need to tell me about ointments or creams.		
MED1	Do you take any medications regularly (at least once a week)?	☐ 1. Yes ☐ 0. No [go to VAC1]

MED2	Add medication list <i>[please remind participant to bring the regularly used medication and/or prescription to examination. Please record the information carefully – an example was given]</i>	MED2a. Name & type 1. <i>Metformin</i> 2. 3. 4. 5. [add rows needed]	MED2b. Strength 1. <i>5 mg</i> 2. 3. 4. 5. [add rows needed]	MED2c. Dosage 1. <i>2 pills / time</i> 2. 3. 4. 5. [add rows needed]	MED3d. Frequency 1. <i>2 times / day</i> 2. 3. 4. 5. [add rows needed]
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Medication adherence (for chronic disease like HTN/DM patients who are currently on Tx)

This section of questions is only applicable to those ever diagnosed with chronic and currently taken medication. [MED1=1]

MMAS1	Do you ever forget to take your medication?	☐ 1. Yes ☐ 2. No
MMAS2	Do you ever have problems remembering to take your medication?	☐ 1. Yes ☐ 2. No
MMAS3	When you feel better, do you sometimes stop taking your medicine?	☐ 1. Yes ☐ 2. No
MMAS4	Sometimes if you feel worse when you take your medicine, do you stop taking it/them?	☐ 1. Yes ☐ 2. No

Vaccination

VAC1	Have you taken these vaccines? [Select multiple options that apply]	☐ Influenza (flu) vaccine ☐ Pneumonia vaccine ☐ COVID-19 vaccine
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History of fall

FALL1	How many times have you fallen during the last 12 months?	_____ Times
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Social care and support		
PCG1	Do you have a primary caregiver? (Explain: Someone who provides regular assistance with your daily activities, health needs, or financial management.) [if PCG1=1 go for PCG2 and PCG3]	☐ 1. Yes ☐ 2. No
PCG2	If yes , who is your primary caregiver?	1. Spouse 2. Son 3. Daughter 4. Daughter-in-law 5. Son-in-law 6. Grandchild 7. Sibling 8. Other relative 9. Paid help 10. Friend/Neighbor
PCG3	Does your primary caregiver live in the same household with you?	1. Yes, lives in the same house 2. No, lives nearby/outside the house
SCS1	Do you have problems with your home, for example housing condition, location, or safety? (If YES, supplementary questions)	☐ 1. Yes ☐ 2. No
SCS1.1	What concerns do you have?	☐ Safety and security ☐ Housing condition including maintenance (repair, sanitation) ☐ Location (distance from services/family) ☐ Difficulty living independently ☐ Size of home (House too small/unsuitable)
SCS2	Do you often have insufficient money to pay for food, housing, or health care costs? (If YES, supplementary questions)	☐ 1. Yes ☐ 2. No
SCS2.1	☐ Are you able to manage your money yourself?	☐ 1. Yes ☐ 2. No
SCS2.2	☐ Would you like advice about financial support/benefits?	☐ 1. Yes ☐ 2. No
SCS3	Do you have difficulty in pursuing leisure interests and other activities that are important to you? (If YES, supplementary questions)	☐ 1. Yes ☐ 2. No
SCS3.1	You are unable to participate because of:	☐ Cost ☐ Transport problems ☐ Distance ☐ Lack of opportunities

Use/practice of Assistive Products and Supports		
Cognition		
APS1	Do you use written notes to help you remember daily tasks or appointments?	☐ Yes ☐ No
APS2	Do you use written reminders to help you remember daily tasks or appointments?	☐ Yes ☐ No
APS3	Do you use calendars to help you remember daily tasks or appointments?	☐ Yes ☐ No
APS4	Do you need signs or labels inside your home to help you find places such as the toilet, bedroom, or exit?	☐ Yes ☐ No
APS5	Do you use pill box or organizer for remembering medication intake?	☐ Yes ☐ No
Psychological Capacity		
APS6	Do you have educational materials (leaflets, pictures, or visual aids) to better understand depressive symptoms?	☐ Yes ☐ No
APS7	Do you use any symptom monitoring sheets to help you tracking your mood or emotional changes over time?	☐ Yes ☐ No
Functional ability Now I will ask you some questions about your daily activities, such as bathing, dressing, cooking, or managing money. Please answer based on what you usually do by yourself, not what you could do on a very good day or with help. If you use any assistive device (like a stick, glasses, or help from someone), please answer based on your usual situation.		
ADL1	Do you need help to take a bath (sponge, shower, or tub)?	1. Bathes self completely or needs help cleaning only a single part of the body (e.g., back). 0. Needs help with more than one part of the body, getting in/out, or cannot bathe self.

ADL2	Can you pick out your clothes and put them on by yourself?	1. Gets clothes and dresses without assistance (may use cane/walker for support). 0. Needs help with buttons, zippers, shoelaces, or stays partly undressed.
ADL3	Can you go to the toilet, clean yourself, and arrange your clothes afterwards?	1. Goes to toilet, cleans self, and arranges clothes independently. 0. Needs help transferring to the toilet, cleaning self, or uses bedpan/commode.
ADL4	Can you move from the bed to a chair and back without help?	1. Moves in and out of bed/chair independently (mechanical aids acceptable). 0. Needs help to move or cannot get out of bed.
ADL5	Can you control your urination and bowel movements completely?	1. Controls bowels and bladder completely (no accidents). 0. Has occasional or frequent accidents, or needs supervision (catheter/incontinence pads).
ADL6	Can you feed yourself food from a plate without help?	1. Feeds self without assistance (food may be prepared by others). 0. Needs assistance in feeding or is fed intravenously/by tube.
IADL1	Ability to Use Telephone	1. Operates telephone on own initiative; looks up and dials numbers. 2. Dials a few well-known numbers. 3. Answers telephone, but does not dial. 4. Does not use telephone at all.
IADL2	Shopping	1. Takes care of all shopping needs independently. 2. Shops independently for small purchases. 3. Needs to be accompanied on any shopping trip. 4. Completely unable to shop.
IADL3	Food Preparation	1. Plans, prepares, and serves adequate meals independently. 2. Prepares adequate meals if supplied with ingredients. 3. Heats and serves prepared meals, or prepares meals but does not maintain adequate diet. 4. Needs to have meals prepared and served.

IADL4	Housekeeping	1. Maintains house alone or with occasional assistance (e.g., heavy work). 2. Performs light daily tasks such as dishwashing, bed making. 3. Performs light daily tasks, but cannot maintain acceptable level of cleanliness. 4. Needs help with all home maintenance tasks. 5. Does not participate in any housekeeping tasks.
IADL5	Laundry	1. Does personal laundry completely. 2. Launders small items (rinses socks, stockings, etc.). 3. All laundry must be done by others.
IADL6	Mode of Transportation	1. Travels independently on public transportation or drives own car. 2. Arranges own travel via taxi, but does not otherwise use public transportation. 3. Travels on public transportation when assisted or accompanied by another. 4. Travel limited to taxi or automobile with assistance of another. 5. Does not travel at all.
IADL7	Responsibility for Own Medications	1. Is responsible for taking medication in correct dosages at the correct time. 2. Takes responsibility if medication is prepared in advance in separate dosages. 3. Is not capable of dispensing their own medication.
IADL8	Ability to Handle Finances	1. Manages financial matters independently (budgets, writes checks, pays rent/bills, goes to bank), collects and keeps track of income. 2. Manages day-to-day purchases, but needs help with banking, major purchases, etc.

		3. Incapable of handling money.
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Health-related quality of life		
Finally for each of the following questions, choose the one option that best describes your health TODAY?		
EQ5D5L1	Problems with your mobility (ability to walk about)	☐ 1. None ☐ 2. Slight ☐ 3. Moderate ☐ 4. Severe ☐ 5. Unable
EQ5D5L2	Problems with your ability to self-care (wash and dress)	☐ 1. None ☐ 2. Slight ☐ 3. Moderate ☐ 4. Severe ☐ 5. Unable
EQ5D5L3	Problems with your ability to do usual activities (work, study, family or leisure activities)	☐ 1. None ☐ 2. Slight ☐ 3. Moderate ☐ 4. Severe ☐ 5. Unable
EQ5D5L4	Feelings of pain or discomfort	☐ 1. None ☐ 2. Slight ☐ 3. Moderate ☐ 4. Severe ☐ 5. Unable
EQ5D5L5	Feelings of anxiety or depression	☐ 1. None ☐ 2. Slight ☐ 3. Moderate ☐ 4. Severe ☐ 5. Unable
EQ5D5L6	How good or bad is your health TODAY → 100 means the best health you can imagine. → 0 means the worst health you can imagine	

Vitality Assessment (MNA-SF)

Step 1: Vitality (Basic Assessment)		
Variable	Assessment Question	Response options
VA1	Have you unintentionally lost more than 3 kg over the last 3 months?	☐ No=0 ☐ Yes =1 ☐ Unknown=1
VA2	Have you experienced loss of appetite?	☐ No=0 ☐ Yes =1
If VA1 = 1 or VA2 = 1 then please proceed to step 2: vitality in depth assessment		
Step 2: Vitality (In-depth Assessment): Mini Nutritional Assessment- Short Form		
Variable	Assessment Question	Response options
MNA1	Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?	☐ Severe decrease (0) ☐ Moderate decrease (1) ☐ No decrease (2)
MNA2	Weight loss during the last 3 months	☐ Weight loss >3 kg (0) ☐ Does not know (1) ☐ Weight loss 1-3 kg (2) ☐ No weight loss (3)
MNA3	Mobility	☐ Bed or chair bound (0)

		☐ Able to get out of bed/chair but does not go out (1) ☐ Goes out (2)
MNA4	Psychological stress or acute disease in the past 3 months. (e.g., loss of a loved one, major surgery, or hospitalization for diseases such as stroke or pneumonia)	☐ Yes (0) ☐ No (2)
MNA5	Neuropsychological problems	☐ Severe dementia or depression (0) ☐ Mild dementia (1) ☐ No psychological problems (2)
MNA6	Calf Circumference	☐ 0 = <31 cm ☐ 3 = ≥31 cm
MNAF		Total score: ____
☐ 12-14: Normal nutritional status ☐ 8-11: At risk of malnutrition ☐ 0-7: Malnutrition		
Step 2: Vitality (In-depth Assessment): Handgrip Strength (HGS)		
Test Instructions: Participant seated; elbow flexed at 90°. Dominant hand used unless contraindicated. Three trials with 1 min rest between attempts.		
Variable	Trial	Grip Strength (kg)
HGS1	Trial 1 (Dominant hand)	
HGS2	Trial 2 (Nondominant hand)	
HGS3	Trial 3 (Dominant hand)	
HGSF	Maximum Grip Strength	
Interpretation (ICOPE reference) ☐ Low muscle strength (<28 kg for men and <18 kg for women) ☐ Normal muscle strength (≥28 kg for men and ≥18 kg for women)		

Locomotor Capacity Assessment (SPPB)

Step1: Locomotor capacity (Basic Assessment)		
Variable	Assessment Question	Response options
LC1	Chair rise test: Rise from chair five times without using arms. Did the person complete five chair rises within 14 seconds?	☐ Yes = 0 ☐ No = 1
If LC1 = 1 then please proceed to step 2: Locomotor capacity in depth assessment		
Step2: Locomotor capacity (In-depth Assessment): Short Physical Performance Battery (SPPB)		
Section A: Balance Test		
SPPB1A	Side-by-side Stand: Stand with feet together, side by side and hold this position without holding onto anything for 10 seconds.	☐ Able to hold 10 seconds (1) ☐ Unable (moves feet or needs support) (0)
SPPB1B	Semi-tandem Stand: Heel of one foot placed beside the big toe of the other foot for 10 seconds.	☐ Able to hold 10 seconds (1)

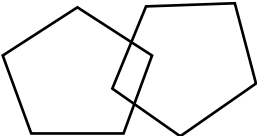
		☐ Unable (moves feet or needs support) (0)
SPPB1C	Tandem stand: Heel of one foot directly in front of and touching the toes of the other foot.	☐ ≥ 10 seconds (2) ☐ 3-9.99 seconds (1) ☐ < 3 seconds/unable (0)
Section B: Gait Speed Test (4 meters)		
SPPB2	Time required to walk 4 meters at a normal pace	☐ ≤ 4.82 sec (4) ☐ 4.83-6.20 sec (3) ☐ 6.21-8.70 sec (2) ☐ > 8.70 sec (1) ☐ Unable to walk (0)
Section C: Chair Stand Test		
SPPB3	Time required to perform 5 rises from a chair to an upright position as fast as possible without use of the arms.	☐ ≤ 11.19 sec (4) ☐ 11.20-13.69 sec (3) ☐ 13.70-16.69 sec (2) ☐ ≥ 16.70 sec (1) ☐ Unable (0)
SPPBF	Screening score (Maximum 12)	Total score: ____
Mobility status: ☐ Normal (SPPB 10–12) ☐ Limited (SPPB 0–9)		
ICOPE Locomotor Capacity Decline (Cut-off: SPPB ≤ 9) ☐ Yes ☐ No		

Cognition		
Basic assessment		
Filter question [If YES (BCOG1=1), proceed for in-depth assessment (Step 2)]		
BCOG1	Do you have problems with memory or orientation (such as not knowing where you are or what day it is)?	☐ 1. Yes ☐ 2. No
Remember three words (use nouns, for example): flower, door, rice.		
BCOG2	Orientation in time and space: What is the full date today? Where are you now (home, clinic, etc.)?	☐ 1. Both correct ☐ 2. Wrong to either question or does not know
BCOG3	Recalls all the three words?	☐ 1. Yes ☐ 2. No
[If BCOG2=2 or BCOG3=2, proceed for in-depth assessment (Step 2)]		
BAMSE FOR THOSE WHO ARE ILLITERATE		
Assessment of Cognitive Function		
Now I am going to ask you some questions that may seem irrelevant to you. However, the purpose of these questions is to see how well you can remember things. I would be grateful		

if you answer my questions. [Write the respondent's full answer. Write 1 for a correct answer and 0 for an incorrect answer. If there is any uncertainty about coding, do not code. If the respondent gives a wrong answer or does not answer for any special reason, write that reason in the comment column.]

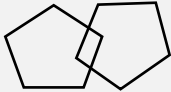
Question No.	Questions	Interviewee's Response	Correct 1	Wrong 0	Interpretation
Orientation to time:					
IBAMSE1A	What season/time of the year is it now?				
IBAMSE1B	Which month is it?				
IBAMSE1C	What part of the day is it now?				
IBAMSE1D	What day of the week is today?				
IBAMSE1E	What is today's date?				
Orientation to place:					
IBAMSE2A	Whose house is this?				
IBAMSE2B	What is the name of this area/street/neighborhood?				
IBAMSE2C	What is the name of this village/city?				
IBAMSE2D	What is the name of this district?				
IBAMSE2E	What is the name of our country?				
Registration: I will now say the names of three things: mango, flower, fish. Can you repeat these names? "Pronounce one word per second. After saying all the words the first time, ask the respondent to repeat them and record their response. If the respondent cannot say them correctly, repeat the words up to a maximum of five times."					
		Interviewee's Response	Correct	Wrong	Interpretation
IBAMSE3A	Mango		1	0	
IBAMSE3B	Flower		1	0	
IBAMSE3C	Fish		1	0	
Attention and Calculation: Can you tell me the names of the days of the week in reverse order? For example, Saturday comes before Sunday. So which day comes before Saturday—, before that—, and before that—? [Ask in this manner.]					
		Interviewee's Response	Correct	Wrong	Interpretation
IBAMSE4A	Friday		1	0	
IBAMSE4B	Thursday		1	0	

IBAMSE4C	Wednesday		1	0	
IBAMSE4D	Tuesday		1	0	
IBAMSE4E	Monday		1	0	
Now please do some calculations for me. Suppose I have 20 taka for rickshaw fare. Each day I spend 3 taka on rickshaw fare. After paying the fare on the first day, I have 17 taka left. After paying the fare the next day, how much will I have left? ... and the next day? ... and the next day? ... [Ask in this way a total of five times.]					
		Interviewee's Response	Correct	Wrong	Interpretation
IBAMSE5A	14		1	0	
IBAMSE5B	11		1	0	
IBAMSE5C	8		1	0	
IBAMSE5D	5		1	0	
IBAMSE5E	2		1	0	
Recall: Can you again tell me the three things I mentioned earlier?					
		Interviewee's Response	Correct	Wrong	Interpretation
IBAMSE6A	Mango		1	0	
IBAMSE6B	Flower		1	0	
IBAMSE6C	Fish		1	0	
Naming: • (Showing a glass) What is this?					
		Interviewee's Response	Correct	Wrong	Interpretation
IBAMSE7A			1	0	
• (Showing a stick) What is this?					
IBAMSE7B		Interviewee's Response	Correct	Wrong	Interpretation
			1	0	
Repetition: Listen carefully and repeat exactly: "Neither this nor that."					
		Interviewee's Response	Correct	Wrong	Interpretation
IBAMSE8			1	0	
Visual Command: Look at me and do exactly what I do. [Raise your hand and keep it raised for three seconds. Observe what the respondent does and record it. Write 1 for a correct response and 0 for an incorrect response. If the respondent does not understand your instruction, still write 0 and note this in the observation section.]					
	Right	Wrong	Observation		
IBAMSE9A	1	0			
If the respondent cannot see well, then ask them to listen carefully to what I say and do accordingly: raise your right hand.					
	Right	Wrong	Observation		

IBAMSE9B	1	0			
Three-Step Task: [Give the respondent the following three instructions and observe what they do, then record it.] a. Take this paper in your right hand. b. Fold it in the middle. c. Put the paper on the ground.					
		Right	Wrong	Observation	
IBAMSE10A	Step a	1	0		
IBAMSE10B	Step b	1	0		
IBAMSE10C	Step c	1	0		
Sentence: If you do not know my name, how would you find it out? (Any complete sentence = 1)					
	Complete Sentence	Incomplete Sentence	Interviewee's Response		
IBAMSE11	1	0			
Copying a Figure: I will make a picture using sticks. Now you make the same picture.					
IBAMSE12		Picture correctly made		1	
		Picture incorrectly made		0	
Write down your observation:					
Draw below the figure made by the respondent using the sticks.					
Draw the picture shown here. 					
BAMSE FOR THOSE WHO ARE LITERATE					
Assessment of Cognitive Function					
Ask the remaining questions only to those who can read and write. Otherwise, thank the respondent and end the interview at this point. Now I will ask you some questions, some of which I have asked before and some of which are similar in nature. However, I would be grateful if you would answer these questions once again. [Write the respondent's full answer. Enter 1 for a correct answer and 0 for an incorrect answer. If the respondent gives an incorrect answer or does not provide an answer for any reason, write the reason in the comments column.]					
Question No.	Questions	Interviewee's Response	Correct 1	Wrong 0	Comments
Orientation to time:					

LBAMSE1A	What year is it?				
LBAMSE1B	What season/time is it now?				
LBAMSE1C	What is today's date?				
LBAMSE1D	What day of the week is today?				
LBAMSE1E	What month is it?				
Orientation to place:					
LBAMSE2A	What is the name of this country?				
LBAMSE2B	What is the name of this district?				
LBAMSE2C	What is the name of this village/city?				
LBAMSE2D	What is the name of this area/road/neighborhood?				
LBAMSE2E	Whose house is this?				
Registration: I will now name three objects: pot, bed, umbrella. Can you repeat these names? "Pronounce one word per second. After saying all the words the first time, ask the respondent to repeat them and record their response. If the respondent cannot say them correctly, repeat the words up to a maximum of five times."					
		Interviewee's Response	Correct	Wrong	Comment
LBAMSE3A	Pot		1	0	
LBAMSE3B	Bed		1	0	
LBAMSE3C	Umbrella		1	0	
Attention and Calculation: Now please do some calculations for me again. If you subtract 7 from 100, what do you get? ... Then subtract 7 from that. ... Then subtract 7 again. ... [Ask in this way a total of five times.]					
		Interviewee's Response	Correct	Wrong	Interpretation
LBAMSE4A	93		1	0	
LBAMSE4B	86		1	0	
LBAMSE4C	79		1	0	
LBAMSE4D	72		1	0	
LBAMSE4E	65		1	0	
Spell a word backward: Please spell the following word backward: "Ha- Ja- Ba- Ra- La".					

Recall: Can you again tell me the three things I mentioned earlier?					
		Interviewee's Response	Correct	Wrong	Comment
LBAMSE5A	Pot		1	0	
LBAMSE5B	Bed		1	0	
LBAMSE5C	Umbrella		1	0	
Naming: (Showing a pencil) What is this?					
		Interviewee's Response	Correct	Wrong	Interpretation
LBAMSE6A			1	0	
(Showing a wristwatch) What is this?					
Interviewee's Response		Correct	Wrong	Interpretation	
LBAMSE6B		1	0		
Repetition: Listen carefully and repeat exactly: "Neither this nor that."					
		Interviewee's Response	Correct	Wrong	Interpretation
LBAMSE7			1	0	
Three-Step Task: [Give the respondent the following three instructions and observe what they do, then record it.] a. Take this paper in your right hand. b. Fold it in the middle. c. Put the paper on the ground.					
		Right	Wrong	Observation	
LBAMSE8A	Step a	1	0		
LBAMSE8B	Step b	1	0		
LBAMSE8C	Step c	1	0		
Visual command: Do what is written on this paper. (Show the written command "Close your eyes".)					
Interviewee's Response		Correct	Wrong	Interpretation	
LBAMSE9		1	0		
Sentence: Please write any one complete sentence.					
	Complete Sentence	Incomplete Sentence	Interviewee's Response		
LBAMSE10	1	0			

Copying a Figure: Please copy the picture shown here. 		
LBAMSE11	Picture correctly made	1
	Picture incorrectly made	0

Psychological capacity <i>Finally, some questions about thinking and mood. Over the last 2 weeks, how often have you been bothered by any of the following problems?</i>		
Basic Assessment		
PHQ1	Little interest or pleasure in doing things	☐ 1. Yes ☐ 2. No
PHQ2	Feeling down, depressed, or hopeless	☐ 1. Yes ☐ 2. No
[if both PHQ1 =2 and PHQ=2] (no need if any of PHQ1 =1 or PHQ=1) In-depth Assessment		
PHQ1	Little interest or pleasure in doing things	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
PHQ2	Feeling down, depressed, or hopeless	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
PHQ3	Trouble falling or staying asleep, or sleeping too much	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
PHQ4	Feeling tired or having little energy	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
PHQ5	Poor appetite or overeating	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day

PHQ6	Feeling bad about yourself – or that you are a failure or have let yourself or your family down	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
PHQ7	Trouble concentrating on things, such as reading the newspaper or watching television	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
PHQ8	Moving or speaking so slowly that other people could have noticed? Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
PHQ9	Thoughts that you would be better off dead or of hurting yourself in some way	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
Anxiety		
GAD1	Feeling nervous, anxious or on edge	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
GAD2	Not being able to stop or control worrying	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
GAD3	Worrying too much about different things	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
GAD4	Trouble relaxing	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
GAD5	Being so restless that it is hard to sit still	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
GAD6	Being so restless that it is hard to sit still	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day

GAD7	Feeling afraid as if something awful might happen	☐ 1. Not at all ☐ 2. Several days ☐ 3. More than half the days ☐ 4. Nearly every day
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Thank you for your time. The questionnaire is now complete, please proceed for physical examination.		
Exit1	Time completed	HH : MM
Exit2	Finalised by	

Section No: Measurement

Blood sugar Test					
	AGM_601	Interviewer ID			
	AGM_602	Device ID	_____.____.		
	AGM_603	Date & Time	____ : ____ Hour : Minute		
	AGM_604	How many hours has the participant been on an empty stomach?	____ Hour		
Test Results					
	AGM_605	Glucose (ml/l)	_____		
Instruction: If the blood glucose level is 7 or above mmol/l then please refer					
Anthropometry (Height, weight and waist circumference measurement)					
No	Variable	Question	Responses	Code	Instructions
	WAMA_606	Start Time of anthropometry	____ : ____ Hr: Min		Use 24 hr format
	WAMA_607	Weight Scale ID	____		
	WAMA_608	Height Scale ID	____		
	WAMA_609	Clothing type during weight measurement	1 = Light clothing 2 = Slightly heavy clothing 3 = Heavy clothing		
	WAMA_610	Name of measurer			
	WAMA_611	Code of measurer	____		
No	Variable	Measurement	Measurement 1	Measurement 2	Measurement 3

Anthropometry (Height, weight and waist circumference measurement)						
No	Variable	Question		Responses	Code	Instructions
	WAMA_612 A/B/C	Height (Cm)	A. 	B.	C. 	If A and B differs more than 0.5 cm, take 3rd measurement
	WAMA_613 A/B/C	Weight (Kg)	A. 	B.	C. 	If A and B differs more than 0.1kg, take 3rd measurement
	WAMA_614 A/B/C	Mid upper arm circumference (MUAC) (Cm)	A.	B.	C. 	If A and B differs more than 0.5 cm, take 3rd measurement
	WAMB_614 A/B/C	Calf circumference (Cm)	A.	B.	C. 	If A and B differs more than 0.5 cm, take 3rd measurement
Blood Pressure (BP) measurement						
No	Variable	Question		Responses	Code	Instructions
	WMBP_615	Start Time of measuring blood pressure		: Hr : Min		Use 24 hr format
Measurement - 1 (Take the first measurement considering at least 15 minutes rest)						
Number	Variable	Name of the measurment		Systolic	Diastolic	Time of the measurment
	WMBP_616 A/B/C	Blood Pressure (mm of Hg)		A. 	B. 	C. : Hr : Min
Measurement - 2 (Allow 1 minute interval between two measurements)						
	WMBP_617 A/B/C	Blood Pressure (mm of Hg)		Systolic A. 	Diastolic B. 	Time of Measurement C. : Hr : Min
Measurement - 3 (If difference of between 1st and 2nd measurement is more than 10 mm of Hg, then take 3rd measurement for Blood Pressure)						
	WMBP_618 A/B/C	Blood Pressure (mm of Hg)		Systolic A. 	Diastolic B. 	Time of Measurement C. : Hr : Min
	WMBP_619	Blood pressure measuring machine ID				
	WMBP_620	Measurer's Name and Code				
	WMBP_621	End Time of measuring blood pressure		: Hr: Min		
				Use 24 hr format		

Anthropometry (Height, weight and waist circumference measurement)					
No	Variable	Question	Responses	Code	Instructions
[During any measurement, If Systolic BP $\geq$ 140 mm of Hg, Diastolic BP $\geq$ 90 mm of Hg - refer the respondent to appropriate health centre]					

Lung function Test						
Number	Variable	Name of the test	Responses			Instruction
	APFM_622	Interviewer ID	_____			
	APFM_623	Device ID	_ _ _ _ _			
	APFM_624	Date & Time	_ _ _ _ _ : _ _ _ _ _ Hr: Min			Use 24 hr format
Expected PFR for the interviewee: Formula*: Females: PEF = -1.454 (Age) + 2.368 (Height) Males: PEF = -1.807 (Age) + 3.206 (Height)						
			Measurment 1	Measurment 2	Measurment 3	Comments
	APFM_625 A/B/C	PFR before using salbutamol				
		Average PFR _____ L/min		If the measured PFR is less than the expected PFR than need to use inhaler		
		Expected PFR of the participant: _____ L/min				
	APFM_626	Is salbutamol inhaler needed?	1 = Yes 2 = No			
			Measurment 1	Measurment 2	Measurment 3	Comments
	APFM_627 A/B/C	PFR after using the salbutamol				
		Average PFR after using the salbutamol _____ L/min		If the new PFR is not at least 20% higher than the previous PFR, a spirometry test is needed.		
	APFM_628	Is spirometry test required?	1 = Yes 2 = No			
	APFM_629	ID of the spirometry device		_ _ _ _ _		
			FVC	FEV 1	FEV 1/FVC	
	APFM_630A	Measurment 1				
	APFM_630B	Measurment 2				

	APFM_630C	Measurment 3			
	APFM_631	Average FEV1/FVC If the average is at or less than 0.7, then COPD	-----		
	If the measured PFR is less than the expected PFR than refer				
*Kodgule R R, Singh V, Dhar R, Saicharan B G, Madas S J, Gogtay J A, Salvi S S, Koul P A. Reference values for peak expiratory flow in Indian adult population using a European Union scale peak flow meter. J Postgrad Med [serial online] 2014 [cited 2023 Mar 23];60:123-9. Available from: https://www.jpgmonline.com/text.asp?2014/60/2/123/132311					

Referral

No	Variable	Question	Responses	Code	Instructions
	WAGM_632	Has the participant been referred?	1 = Yes 2 = No		If the answer is 'No' then go to the next section
	WAGM_633	Where was the participant referred?	1 = Upazila Health Complex 2 = District Hospital 3 = Medical College Hospital 4 = Doctor's Chamber 99 = Other (specify) _____		
	WAGM_634	For which domain was the participant referred?	1. Cognition 2. Psychological capacity 3. Vitality 4. Locomotor 5. Hearing 6. Vision 99 = Other (specify) _____		

Name of data entry personnel (saved in data tab): _____

	Interview time: (ended)	HH : MM
Geo	Record geolocation	Latitude: Longitude:
Intvr_com	Interviewer's comments	_____

Thank you for your participation.

Appendix B: Informed Consent Form

Consent paper for study participants

Title: Assessment of vitality and locomotor capacity of older adults : A cross-sectional study

Protocol No. TBD	Version No. TBD	Date: TBD
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Principal Investigator: Saima Ahmed Arni

Investigators' names: Malay K Mridha, Mahbub Latif, Sayeda Mahsina Akter, Md Mokbul Hossain, Ali Ahsan, Tanmoy Sarker, Sakib Rahman, Meghna Chakravarty, Saima Mehjabeen, Munia Afroz, Shahnaz Sharmin, Jakia Sultana.

Organization: BRAC James P Grant School of Public Health, BRAC University

Information Sheet

Introduction

Assalamu Walaikum/Nomoskar. I am (name), and I have come from BRAC James P Grant School of Public Health, BRAC University. Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate, we welcome you. Please inform us if you wish to participate. Our contact details are given at the end of this information sheet. If you decide not to participate, there will be no disadvantage to you, and we thank you for considering our request.

The objective of this study:

The purpose of this study is to assess the status of vitality and locomotor capacity among older adults aged 60 years and above living in rural areas of Bangladesh, and to identify the factors associated with a decline in vitality and locomotor capacity in this population.

What will participants be asked to do?

We are asking men and women aged 60 years and above, from Sujalpur union of Birganj upazila of Dinajpur district to participate in the study. No preference is shown to any ethnic or cultural group; we want everyone to get involved. We will collect data total number of participants will be 448. Data will be collected from selected participants. At this stage, we are asking participants for three things: i. to complete a questionnaire about their health, background, lifestyle, and diet; ii. to have some simple physical non-invasive measurements (e.g., physical strength and movement, height, weight, blood pressure, MUAC, Lung function). iii. To provide a small amount of blood sample from the finger (1–2 drops). These procedures, which include interview, household activity observation and physical measurement, will take approximately 1 hour and 30 minutes to 2 hours. We will inform you of the test results.

What are the potential risks and inconveniences?

All the measurements being carried out are well established. Providing a blood sample or participating in other examinations will not place you at any serious risk. However, some minor issues may occur on rare occasions. For example, you may feel slight discomfort during blood collection. These temporary side effects will resolve on their own without any medical treatment.

Can you change your mind and withdraw from the project?

You may withdraw from participation at any time, without giving an explanation and without any disadvantage to yourself of any kind. If you choose to withdraw after participation, your data will be excluded from the final analyses if you wish. Any unused material will be destroyed.

Anonymity and confidentiality of the research data

We need your name and address to record who has taken part. Thereafter, your research data will be held in an anonymized format using numeric identifiers. Only the senior members of the research team, or their approved representatives, will have access to code linking your identity to the research data and samples. The research data and samples collected will be stored securely in such a way that only approved researchers have access to them. De-identified data may be shared with investigators from other countries, the funding organization, and regulatory authorities. Results of this project will be published, including postings on the internet, but any data included will be fully anonymized and will not be individually identifiable. The raw data will be destroyed after the study has been completed according to research governance guidelines. The Institutional Review Board of BRAC James P Grant School of Public Health, BRAC University, has the authority to access all the research records.

Compensation

There will be no financial compensation for taking part in the study. But light snacks will be offered following the clinical measurements. Undergoing a comprehensive health assessment will raise awareness of your own health status or potentially identify unrecognized health issues. If any health issues are detected, you will be referred to the appropriate health care facility.

Who is organizing the research?

The work is organized and led by BRAC James P Grant School of Public health, BRAC University, and is funded by Masters of Public Health Program Thesis Fund and the Centre for Non-communicable Diseases and Nutrition project fund.

How does this affect my legal rights?

Taking part in the study does not impact your legal rights or release the investigator, the institution, the sponsor, or their representatives from legal responsibility of negligence. For more information about your rights and protection, you may contact the administrator of the Institutional Review Board:

IRB Administrator, Phone: 01993379512. Email: irb-jpgsph@bracu.ac.bd

BRAC James P. Grant School of Public Health, BRAC University;

What if I have any questions?

We appreciate that some of the language used in this consent form may appear technical. Please do ask us to explain anything that you do not understand, and we will do our best to answer your questions. In addition, if you have any questions about our project, please also feel free to contact the lead investigator:

Name: Saima Ahmed Arni, Title: Master's of Public Health student, Institution: BRAC James P Grant School of Public Health, BRAC University; Address: Floor 10-13, BRAC Tower, 65 Mohakhali Commercial Area Bir Uttam A K Khandakar Road, Dhaka-1213, Bangladesh. Phone: 01521432523, Email: saima.ahmed.arni@g.bracu.ac.bd

Thank you for taking the time to read this information sheet. If you wish to participate in this project, please sign/put thumbprint and date the consent form given to you. You will be given a copy of the information sheet.

Do you give permission for the interview to be recorded?

Yes No

Do you give permission to share your findings?

Yes No

Do you have any questions? (State the question)

Yes No

If required, do you give permission for photographs or video recordings to be taken during the interview for documentation or research purposes?

Yes No

Name of the Participant: _____ Signature or fingerprint of left thumb: _____ Date: / / 202__	Interviewer Name: _____ Signature: _____ Date: / / 202__
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