



**Prevalence of undiagnosed hypertension and associated factors  
among people over 18 years old living in rural Sucos, of 3  
Municipalities, in Timor Leste**

**Research Report Book**

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**Instituto Nacional  
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I declare, under my honor, that the data presented here is true and that no plagiarism or any copyright infringement has been committed in this presented study.

I authorize the full reproduction of this report for research purposes only.

National Institute of Science and Technology, on the 15th December, 2023.

Signature of the Responsible Investigator: \_\_\_\_\_



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## Abstract

**Background.** Even though, Hypertension is common public health problem, however, many people still not aware of their status, it was reported that 580 million people around the globe are not aware of their hypertensive condition, and this is not explored in Timor Leste, therefore; this study aims to determine the prevalence of undiagnosed hypertension in rural area in 3 Municipalities of Timor Leste. Methods: Community based -Cross sectional study.

**Results.** The Overall prevalence of undiagnosed hypertension in 3 rural aldeias of 3 municipalities was 15 % of these 63 % were males, and 37 % were females, most affected age group was 59-78, suggesting age related risk, and also poor health care for aging population, Interestingly, we found that 76 percent of the hypertensive individual were underweight. Factors associated to undiagnosed hypertension was education level, age, and knowledge about hypertension.

**Conclusion & and recommendations.** Undiagnosed hypertension prevalence was 15 %. Improve screening for hypertension in rural communities, using periodic and targeted approach would help in controlling Hypertension and other NCDs.

**Keywords:** *Undiagnosed hypertension, rural NCDs prevalence*



## **1. Introduction**

### **(1.1) Background**

Non-communicable diseases (NCDs) are a major public health threat in low and middle-income countries (LMICs) across the world. Globally, NCDs cause 41 million deaths every year. 17 million people under the age of 70 die annually due to NCDs; it is thought that 77 % of these deaths occur in LMICs (World Health Organization, 2022). World Health Organization reported that Hypertension is the major cause of premature death in the world, and it is estimated that 46 % of the affected persons worldwide are not aware of their hypertension status, and it is reported that 69 % of all deaths in Southeast Asia region due to NCDs, Hypertension is one of the leading cause of cardiovascular diseases such as heart attacks, and stroke, it is an urgent public health problem in South East Asia. (Oliva, 2019) .

Timor-Leste, a small and recently independent nation in Southeast Asia, faces a significant public health challenge due to its high burden of infectious diseases. The country records one of the highest incidences of tuberculosis in Asia, and until recent times, it was a hotbed for malaria transmission. This backdrop has necessitated a concentrated and sustained effort towards combating communicable diseases. However, this focus has inadvertently led to the relative neglect of non-communicable diseases (NCDs) . The only major study on NCDs in Timor-Leste was carried out in 2014 by the World Health Organization (WHO), in the form of a national survey to estimate the prevalence of NCDs and their risk factors in the general population (Martins *et al.*, 2014). The survey identified 39.3% of the general population as having high blood pressure.

The national survey from 2014 identified that 48.6% of the general population were users of tobacco, whilst almost 20% used betel nut. The national survey also identified almost a third of the population consumed alcohol regularly and a fifth drank alcohol on 5 to 6 days per week. In addition, there is a survey reported a significant burden of malnutrition, especially in rural areas, and some studies suggested that childhood undernutrition is linked to chronic diseases including diabetes and hypertension (Sawaya *et al.*, 2003).

## (1.2) Literature Review

### Definition of Hypertension, and clinical manifestations

Most of the guidelines define Hypertension as systolic blood pressure is equal or higher than 140 mmHg, and or diastolic blood pressure equal or higher than 90 mmHg. (Unger et al., 2020; Whelton et al., 2022). Most of the people present no symptoms, and signs the symptoms and signs usually presented are headaches, blurred vision, chest pain, and the case of very high blood pressure which can be manifested through severe headaches chest pain dizziness, difficulty breathing, nausea, vomiting, blurred vision or other vision changes, anxiety, confusion, buzzing in the ears, nosebleeds, abnormal heart rhythm. The stage of Hypertension(WHO, 2020a). According to the American Heart Association practice guideline 2020, the stage of blood pressure is classified as follows:

1. Normal Blood Pressure: SBP <130, and DBP <85
2. High Normal Blood Pressure; SBP 130-139, and or DBP 85-89
3. Grade 1 Hypertension; SBP 140-159, and or DBP 90-99
4. Grade 2 Hypertension ; SBP  $\geq$  160, and or DBP  $\geq$ 100

The risk factors for Hypertension are multiples, the risk factors are classified into two categories such as :

1. Modifiable risk factors, referring to the factors that can be modified it is related to life style, unhealthy diet(excessive salt consumption, a diet high in saturated fat and trans fats, low intake of fruits and vegetables), no physical exercise, smoking, alcohol intake, and obesity.
2. Non-modifiable risk factors ; Age, genetics(history of hypertension in family), co-existing chronic diseases such as kidney failure, diabetes. There is a growing concern on the rise of the NCDs, glob policys, and strategies has been established, research, and inovation to suport tackling this public health are in place. Meanwhile, Timor Leste still lack of evidences and regular report to measure the impact of the Hypertension in the adult population.

## **Prevalence of Hypertension and the risk factors in Southeast Asia**

Overall, Noncommunicable diseases(NCD's) are now the leading causes of the deaths in the world, it is estimated that deaths due the NCD's is over 70 %, in 2020. Though , the risk factors for NCDs are mostly modifiable factors related to lifestyle and behavioural risk such as tobacco use, unhealthy diet, lack of physical activity harmful use of alcohol.(WHO, 2020b). It is estimated that 1.3 billion adults aged 30–79 years worldwide have hypertension, most (two-thirds) living in low- and middle-income countries(Global Report on Hypertension, 2023).

According to a study published in The Lancet, the prevalence of hypertension in South East Asian countries varies. For example, in Indonesia, the prevalence of hypertension is estimated to be around 31.7%, while in Thailand it is around 32.2%. Other countries in the region, such as Cambodia, Laos, and Myanmar, also have relatively high prevalence rates ranging from 22-25%. Along with Diabetes, Hypertension is one the most frequent diseases of NCD, Hypertension refers to a rise of blood pressure higher than a normal and is measured in two or three times with standard measurements(Ayalew et al., 2022).

## **Prevalence of Undiagnosed Hypertension**

There are several definitions for Undiagnosed hypertension, authors want to refers to two simple definition as follows : Firstly, Mahwati et al, defined that undiagnosed hypertension refer to an individual who have not received a hypertension diagnosis from a health professional and have never been prescribed medication for treating hypertension.(Mahwati et al., 2022) . Another definition, by Essa et al, “Undiagnosed hypertension a systolic blood pressure (SBP) of at least 140 mm Hg and/or diastolic pressure (DBP) of at least 90 mm Hg, which was not diagnosed” (Essa et al., 2022)

Evidence demonstrated that undiagnosed Hypertension is a public health problem, and many people are not aware of their status, it was reported that 580 million people around the globe are not aware of their hypertensive condition. (Zhou et al., 2021), this can be caused by many factors, for instance, poor of health seeking behaviours, or other competing interest such as occupied with daily work and not able to check their status, a study conducted to a bank workers in ETHIOPIA 2020 reported

24.5 % of undiagnosed hypertension(Dejenie et al., 2021), study in Indonesia Nepal, and Ethiopia found that there are multiples factors that associated with the undiagnosed hypertension(Haider & Das Gupta, 2020; Mahwati et al., 2022).(Dejenie et al., 2021; Demamu et al., 2021). Undiagnosed hypertension increases risk of cardiovascular complication, renal failure, and premature death(Demamu et al., 2021).

### **(1.3) Unkown prevalence of undiagnosed Hypertension in rural area of Timor Leste**

For Timor Leste, the *first study we conducted in Makili, ATAURO 2021, found that among hypertension patients diagnosed, 74.6 % had undiagnosed hypertension, they were not aware that they had hypertension.* In addition, the existing studies provided data about the prevalence of NCDs in urban populations, however the burden of NCDs in small, rural populations across Timor-Leste which make up most of the population, remains undocumented. The WHO Package of Essential Non-Communicable Disease Interventions (WHO PEN) is a set of primary care interventions designed to improve early detection and management of NCDs yet does not offer policies to target NCD risk factors on a public health scale. A better understanding of local risk factors for NCDs in Timor-Leste's rural and most marginalised communities would allow for targeted, cost-effective public health interventions to reduce the burden of NCDs in the population.

### **(1.4.). Research Questions**

1. What is the prevalence of undiagnosed hypertension among people with over 18 years of age in the rural area?
2. What are the factors that associated to undiagnosed hypertension?

### **(1.5) Objectives**

#### **General objective**

Determine the magnitude of undiagnosed hypertension and associated factors among people over 18 years old living in the rural sucos in 3 municipalities of Timor Leste.

#### **Specifics objectives**

- To determine the prevalence of undiagnosed hypertension in a rural community
- To identify factors associated with undiagnosed hypertension.

## **(1.6.) RELEVANCE OF THE STUDY**

Timor-Leste is currently grappling with the dual challenge of both communicable and non-communicable diseases, necessitating the development and implementation of new and effective health interventions. In response to this evolving health landscape, the Ministry of Health and various stakeholders are now intensifying their focus on combating non-communicable diseases (NCDs). However, a significant yet often overlooked aspect of this health burden is arterial hypertension, a condition that typically presents no symptoms or signs unless actively measured. This characteristic makes hypertension challenging to detect and, as a result, frequently underdiagnosed. This study aims to contribute significantly to the efforts in addressing hypertension promptly and effectively in Timor-Leste.

### **Problem Justification:**

- There is a notable scarcity of research focusing specifically on hypertension in the rural areas of Timor-Leste. This gap in knowledge hampers the development of targeted health interventions.
- A preliminary, small-scale study conducted in Atauro Island revealed an alarming prevalence of undiagnosed hypertension, with over 70% of participants unaware of their condition.
- Hypertension is a major risk factor for cardiovascular diseases and is often underreported in Timor-Leste, contributing to a hidden health crisis.

### **Expected Outcomes:**

- The study aims to estimate the prevalence of undiagnosed hypertension across Timor-Leste accurately. This data is crucial for understanding the scale of the issue and for guiding health policy and resource allocation.
- Additionally, it seeks to identify the factors associated with undiagnosed hypertension. Understanding these factors is essential for developing targeted prevention and management strategies, ultimately improving health outcomes in the country.

## **(1.7) Research Process , and challenges**

The journey of this research began with an initial phase of consultation, where the researcher engaged in in-depth discussions with experts and stakeholders to refine the research question and methodology. This initial consultation laid the groundwork for a

comprehensive and meticulous literature review, which involved scrutinizing numerous studies, papers, and existing theories relevant to the research topic. The insights gained from this review were instrumental in crafting a well-informed and robust research proposal. As the researcher awaited the ethical approval from both the affiliated institutions and INCT, there was a sense of anticipation and preparation for the next stages of the research. Upon receiving the much-anticipated approval from INCT, the researcher immediately initiated the data collection phase. This phase commenced with informing and engaging stakeholders at both national and municipal levels about the study, ensuring transparency and collaboration. The data collection process was a meticulous and structured exercise, involving gathering information from a variety of sources and participants. As the data collection concluded, the researcher shifted focus to the data processing and management phase. This phase involved organizing, categorizing, and analyzing the collected data to extract.

However, it is important to note that the actual execution of the study deviated from the initial proposal. This deviation was primarily due to constraints in resources and budget limitations. These challenges necessitated adjustments and adaptations in the research methodology, while still striving to maintain the integrity and objectives of the study. The researcher had to make strategic decisions to align the study within the available means while ensuring that the core research questions were addressed. Despite these challenges, the study progressed with a commitment to rigor and quality, underpinned by a continuous adaptation to the evolving research environment.

### **(1.8) Study setting**

The study was conducted in Timor-Leste, also known as East Timor, is a Southeast Asian nation notable for its rich history and distinctive geographic features. Here's an overview of its geographic information:

**Location and Borders:** Timor-Leste is located on the eastern half of the island of Timor, the largest of the Lesser Sunda Islands in Maritime Southeast Asia. It lies at the eastern end of the Indonesian archipelago, north of the Timor Sea. The country shares its only land border with Indonesia, which occupies the western half of the island of Timor. Additionally, it has maritime boundaries with Australia to the south, across the Timor Sea. Timor-Leste covers an area of approximately 14,874 square kilometers (5,743 square



miles), which includes the eastern half of Timor Island, the nearby islands of Atauro and Jaco, and Oecusse, an exclave on the northwestern side of the island, surrounded by Indonesian West Timor. The terrain is predominantly mountainous, with the highest point being Mount Ramelau (also known as Tatamailau), standing at 2,963 meters (9,721 feet) above sea level. The climate is tropical and generally hot and humid, characterized by a distinct rainy season (from December to April) and a dry season (from May to November). Administratively Timor Leste has 14 Municipalities, with over 500 Sucos and 2225 villages(aldeias) due to the resources constraints the study was conducted only 3 villages(aldeai) of 3 rural Suco , in Aileu , Ermera, and Manatuto municipalities, the sucos selected were Lequiode (Fahisoi), Lacro(Atsabe), Cairui(Laleia). It was planned to conduct in all the aldeias in the sucos's, however due to resource limitations it was not possible. The below map , shows the local of where study was conducted .



## 2. Methods

### (2.1.) Research Methods

Community Based-Cross sectional Study, a quantitative approach was be applied. Cross-sectional studies are observational studies that analyze data from a population at a single point in time.(Wang & Cheng, 2020a). They are often used to measure the prevalence of

health outcomes, understand determinants of health, and describe features of a population, usually there is no hypothesis needed. (Levin, 2006), easy, relatively inexpensive, and faster to conduct, however, this method has several weaknesses, it might be difficult to make a causal inference Associations identified might be difficult to interpret Unable to investigate the temporal relation between outcomes and risk factors, and it is prone to nonresponses, and recall bias.(Wang & Cheng, 2020b).

## (2.2.) Population and Sample

a). Definition of the population and sample

Population of the study; All adults aged 18 years and above who lives in the rural Suco, of Aileu, Manatuto, and Ermera Municipality.

Sample Size: It was calculated that the sample for each suco was : Aileu (Suco Fahisoi):230, Ermera (Laclo): 229, Manatuto (Cairui):250 . Sample calculation will be based on the prevalence of the undiagnosed hypertension reported on the previous study conducted in Suco Makili Atauro, it was 4 %. Based on this, at least, Fahisoi need 230 participants, Laclo need 229, and Cairui needs 330 participants to obtain the estimated prevalence of undiagnosed hypertension, with a precision of 4%. Alpha error of 5 %, confidence interval 95 %. Due to the resources and time limitation , we recruit only 200 participants, from the 1 aldeia , of each 3 sucos.

Formula to applied to calculate sample size

$$n = \frac{N * Z_{\alpha}^2 * p * q}{e^2 * (N - 1) + Z_{\alpha}^2 * p * q}$$

**n** = The Sample Size

**N** = Population or Universe Size

**Z** = Standard error associated with the chosen level of confidenc (typically, 1.96)

**e** = Acceptable margin of sample error

**p** = Estimated percent in the population

**q** = (1 - **p**) = Probability that the event studied will not occur

**Sampling technique;** Non-Probability -Convenience Sampling



## Eligibility criteria.

### 1. Inclusion Criteria

- Those adults aged above 18 years who are previously not diagnosed and not using anti-hypertensive drugs.

### 2. Exclusion criteria

- Pregnant women and women in the post-partum period
- People with known hypertension
- Unable to participate .

## (2.3.) Techniques and Data Collection Instruments

The data collection instrument employed in this study was a carefully designed questionnaire consisting predominantly of closed questions with multiple-choice options adapted from WHO steps survey questionnaire.

## (2.4.) Data collection techniques

Data collection is basically conducted along with medical consultation and Screening, it was organized through 4 stations: (1). Register (2). Blood pressure measurement, after blood pressure measurement, the participants with HIGH BLOOD PRESSURE, will go through the interview, and then, proceed to, station (3) random capillary glucose measurement(optional), and at the end participants will proceed to station (4), for health promotion, and advice. MOH PEN protocol, standardized and calibrated electronic sphygmomanometer, and glucose test devices was used.

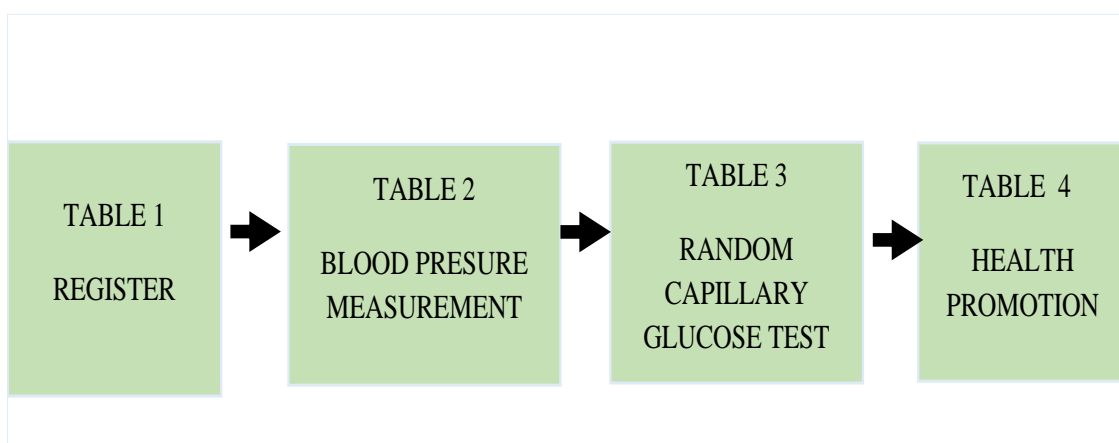
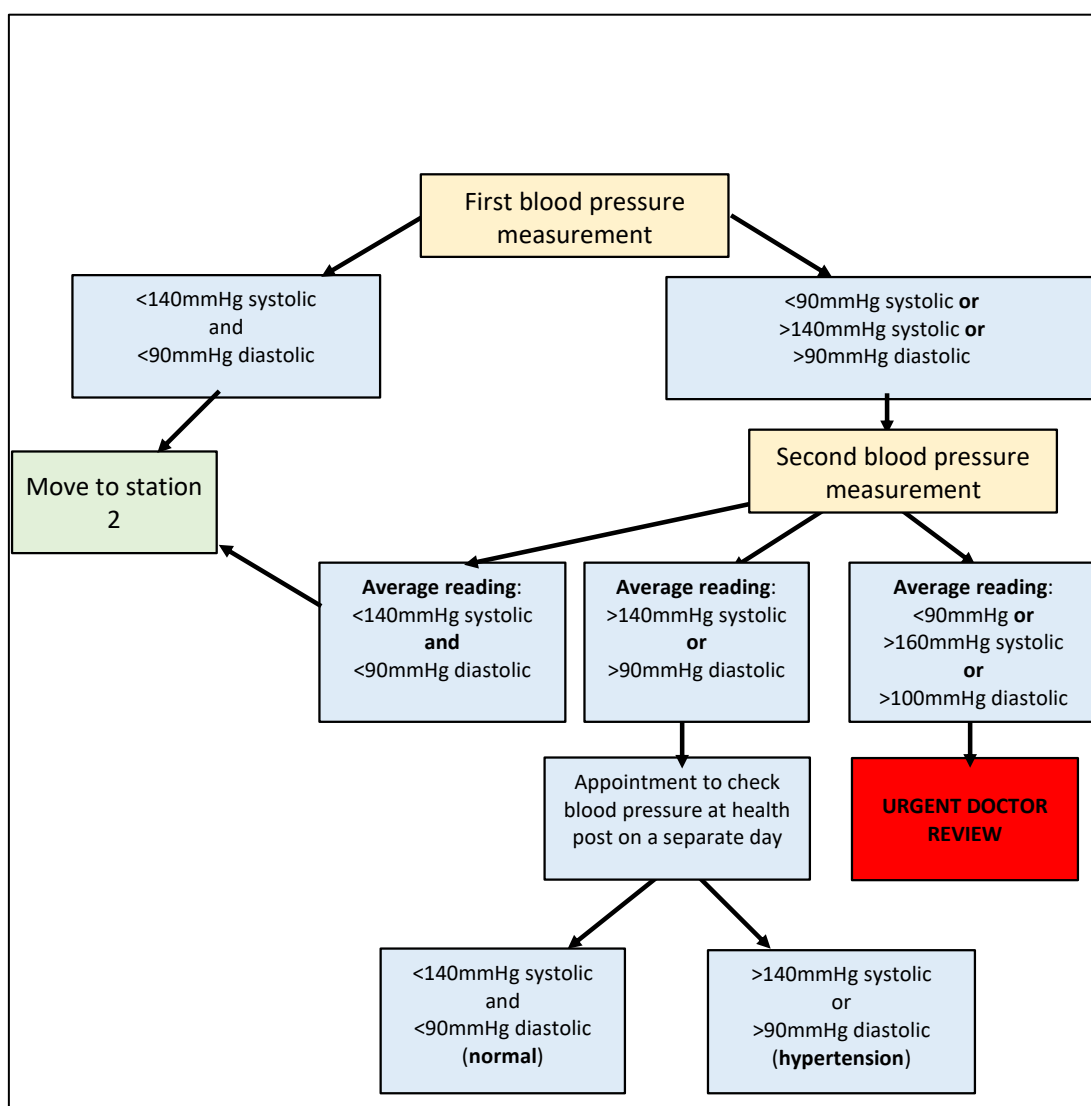


Figure 1. Flow chart data collection, adapted SISCA's model of care.(Martins & Trevena, 2014) Implementing what works: a case study of integrated primary health care revitalisation in Timor-Leste.

Cases of hypertension (figure 2): participants with a mean blood pressure reading of over 140mmHg systolic or 90mmHg diastolic will be given an appointment to attend the local health post to have their blood pressure re-checked on a separate day. The current WHO-PEN guidelines in Timor-Leste on the diagnosis and management of hypertension state “hypertension is diagnosed when the average systolic blood pressure is 140 mmHg or higher, or when the average diastolic blood pressure is 90 mmHg or higher, taken on two or more separate days”. All newly diagnosed hypertensive patients will be assessed by the doctor in the health post and assessed and treated as per national guidelines. Participants with a systolic blood pressure reading of under 90mmHg or over 160mmHg or a diastolic blood pressure reading of over 100mmHg will be reviewed urgently by the doctor on standby for emergencies.



**Figure 2. Flow chart for participants having their blood pressure measured. Any participant with a dangerous blood pressure reading will be reviewed urgently by a study doctor on standby for emergencies.**

At the third station, a random capillary blood glucose will be taken a rapid gluco test. We chose to use capillary blood glucose for this research due to the logistical difficulty in running a venous blood glucose sample. WHO has approved use of capillary blood glucose to diagnose diabetes mellitus in rural populations in Timor-Leste with these logistical issues in mind. Any participant with a random capillary blood glucose reading of 11.1mmol/L or above was asked about hyperglycemic symptoms of diabetes (polyuria, polydipsia, polyphagia, loss of weight), and had their capillary blood glucose test repeated. Validation test will be applied to test the sensitivity of gluco test, we will collobaorate with National Laboratory to confirm the result obtained from the gluco test and then compare.

**Operational definition of the variables**

Variables	Definitions	Scale	Measurement
Dependent			
Undiagnosed hypertension	Participants who has BP systolic at least 140/90 mmhg, and had not received a hypertension diagnosis from a health professional and had never been prescribed medication for treating hypertension.	Quantitative	Survey qs
Independent			
demographic factors	Age, sex, geography, knowledge	Quantitative	Survey qs
Lifestyle	Smoking, diet, exercise, BMI	Quantitative	Survey qs
Comorbidity	Concomitant diseases	Quantitative	Survey qs

**Data management & analysis**

The data processing and analysis in this study were conducted using a systematic approach, employing both Microsoft Excel and SPSS (Statistical Package for the Social Sciences) Version 26. Data was managed and stored in locked cabinets and password

protected computers in the doctor's office in the local health post for the duration of the study. At the conclusion of the study, final unidentifiable data will be transferred to and stored in the principal investigator's office and then destroyed 7-years after the completion of the study.

Detailed description of each step in the process:

1. **Data Processing:**

- **Tabulation:** Data was initially tabulated in Microsoft Excel. This involved organizing the data into rows and columns to facilitate easy viewing and manipulation.
- **Coding and Recoding:** Responses from the questionnaires were coded for statistical analysis. This coding involved assigning numerical values to different responses. Recoding was also done as necessary to categorize and simplify the data for analysis.
- **Cleaning:** The data was meticulously cleaned to ensure accuracy. This process involved checking for and rectifying inconsistencies, missing values, and outliers that could skew the results.

2. **Data Transfer for Analysis:**

- After initial processing in Excel, the data was transferred to SPSS 26 for more advanced statistical analysis. This transfer was done to utilize the robust analytical capabilities of SPSS.

3. **Descriptive Statistics:**

- Key descriptive statistics such as mean, median, standard deviation (SD), and frequency of responses were calculated.
- The estimated prevalence of undiagnosed hypertension was calculated using the number of patients tested as the denominator, providing a clear picture of the scope of the issue within the study population.

4. **Regression Analysis:**

- **Simple Linear Regression:** This was applied to explore the relationship between two variables, looking at how one variable change when the other one does.

5. **Data Presentation:**

- The results of the analysis were presented in tables and graphs. Tables were used to concisely display numerical data, while graphs provided

visual representations of the findings, making complex data more accessible and easier to understand for a wider audience.

## **Ethics**

The research project adhered to strict ethical guidelines to ensure the integrity and ethical conduct of the study. Here's a detailed description of the ethical considerations and procedures followed:

### **1. Ethics Approval:**

- The study received formal ethical approval in the form of a letter from the Institute of National Clinical Trials (INCT). This approval was sought to ensure that the research met the required ethical standards and guidelines, particularly concerning participant welfare and data handling.
- The ethical approval process involved a thorough review of the study's objectives, methodologies, potential risks, and benefits to participants. This review was conducted by an independent ethics committee at INCT, which assessed the ethical implications and provided recommendations for conducting the study responsibly.

### **2. Informed Consent Forms:**

- Prior to participation, all participants were provided with detailed information about the study, including its purpose, the nature of their involvement, and any potential risks and benefits. This information was crucial to ensure that participants could make an informed decision about their participation.
- Verbal consent was obtained from each participant before the interview and capillary glucose measurement. This process involved explaining the study in a language and manner understandable to the participant and ensuring that consent was given freely without any coercion.

### 3. Local Authority Approval:

- Permission was also sought from local authorities, such as the Xefe Suco (village chief) and Xefe Aldeia (sub-village chief), before conducting the study in their communities.
- Approaching local authorities was a critical step in respecting local governance structures and obtaining community-level consent. It also facilitated community engagement and cooperation, which are essential for the smooth conduct of fieldwork in rural areas.
- Engaging with local authorities helped in understanding community dynamics and in ensuring that the study was conducted in a manner that was culturally sensitive and respectful of local customs and practices.

These ethical procedures underscored the commitment to conducting the research in a manner that was respectful, transparent, and considerate of the rights and well-being of all participants and stakeholders involved.

### 3. Result, and discussion

#### (3.1) Results Analysis

##### a) Demographic characteristics of the participants and prevalence of undiagnosed hypertension.

A total of 200 individuals were screened for raised blood pressure, majority (56%) of the participants were female. There were 20 (10%) known cases of hypertension who were already taking anti-hypertensive medication, and the point prevalence of undiagnosed hypertension was 15 %.

**Table 1. Prevalence of undiagnosed participants**

n=200

Age	Frequency	Percentage (%)
19-28	34	17
29-38	34	17
39-48	32	16
49-58	25	12,5
59-68	36	18
69-78	35	17,5
79-88	4	2
<b>Gender</b>		
Male	88	44
Female	112	56
<b>Location</b>		
Ailisu	54	27
Cairui	76	38
Fahiria	70	35
<b>Diagnostic status</b>		
Known hypertension	10	5
<b>Unknown Hypertension</b>	<b>30</b>	<b>15</b>

## b) Characteristics of participants with undiagnosed Hypertension

**Table. 2. Characteristics of participants with undiagnosed Hypertension**

n=30		
Age	Frequency	Percentage (%)
19-28	2	7
29-38	3	10
39-48	1	3
49-58	4	13
59-68	10	33
69-78	8	27
79-88	2	7
<b>Gender</b>		
Male	19	63
Female	11	37
<b>Education</b>		
Illiterate	17	56
Elementary	9	30
High school	1	3
University	3	10

The point prevalence of undiagnosed hypertension calculated to all 200 participants from this 3 rural aldeia was 15 %. As presented in below table 2, most of them 19 (63. %) were male. Only 11 (30%) of participants with unknown hypertension were female. Majority 17 (56 %) of the participants with undiagnosed were illiterate. The above data shows that most affected age group were age group 59 -68, and 69-78, with 33, and 27 percentage respectively.



**c) Clinical characteristics of undiagnosed hypertension**

For the clinical importance, we also include to analysis the clinical stage of the patients with undiagnosed Hypertension, mean systolic blood pressure for both sexes at all ages was 157 mmhg, Alarmingly, 10% of the undiagnosed cases are experiencing Hypertension Stage 3, with systolic blood pressures exceeding 180 mmHg. This condition, often referred to as hypertensive crisis, requires immediate medical attention to prevent acute health events such as stroke, heart attack, or organ failure. In summary, the table portrays a concerning situation where a large fraction of the population is living with high blood pressure that has not been detected or treated. The undiagnosed hypertension is a silent threat that increases the risk of severe health issues, emphasizing the need for widespread blood pressure screening programs and health interventions to identify and address this hidden health crisis.

**Table 3. Distribution of the Hypertension according to clinical stage -Systolic**

Clinical Stage	Systolic BP	Frequency	Percentage	Mean systolic for both sexes at all ages
<b>140-159</b>	<b>HTA STAGE 1</b>	<b>14</b>	<b>47</b>	157 mmhg
<b>160-179</b>	<b>HTA STAGE 2</b>	<b>13</b>	<b>43</b>	
>180	HTA SATGE 3	3	10	

**d) Risk factors associated with undiagnosed hypertension.**

The table 4, presents a summary of risk factors for undiagnosed hypertension, revealing that lifestyle choices such as smoking and alcohol consumption are quite common, each reported by 56% of the participants. Interestingly, knowledge about family history of hypertension is notably lacking, with a significant 83% of respondents unsure about their

familial health background. Additionally, the data indicates a surprising trend in body weight, with the majority (76%) of the sample size being underweight (BMI less than 18kg/m<sup>2</sup>), a condition not typically associated with hypertension, which suggests that this population may have unique health characteristics. No participants were recorded in the overweight or obese BMI categories, which diverges from the common risk profiles for hypertension seen in other studies. Overall, the findings highlight prominent behavioral risk factors and an unexpected BMI distribution within the surveyed group, underscoring the complexity of health risk factors and the importance of context in understanding health issues.

**Table 4. Distribution of the Risk factors associated to Undiagnosed Hypertension**

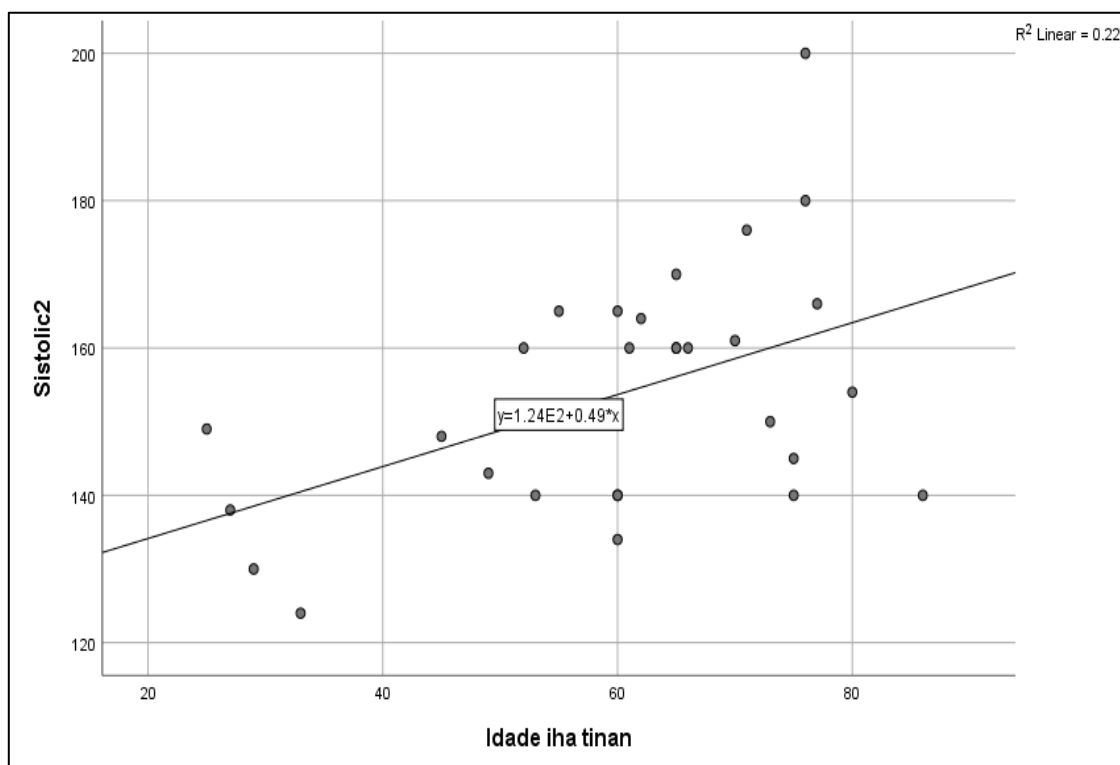
RISK FACTORS	FREQUENCY	PERCENTAGE
<b>BEHAVIOURS</b>		
SMOKING	17	56
BETEL NUT	12	40
DRINKING ALCOHOL	17	56
<b>FAMILY HISTORY</b>		
YES	2	7
NO	3	10
DON'T KNOW	25	83
<b>BMI</b>		
<b>&lt;18KG</b>	<b>23</b>	<b>76</b>
18.5-22.9	7	24
23.0-24.9	0	0
25=>	0	0

**e) Bivariate analysis**

Due to the small sample size collected , it was not sufficient to draw best conclusion on the risk factors assoociated to undganosed hypertension , however we have adjusted the ezisting data try to understand the factors associated to hypertension .

### 1) Association between Age and Systolic Blood Pressure

Graphic 1. Regression analysis for age and systolic blood pressure

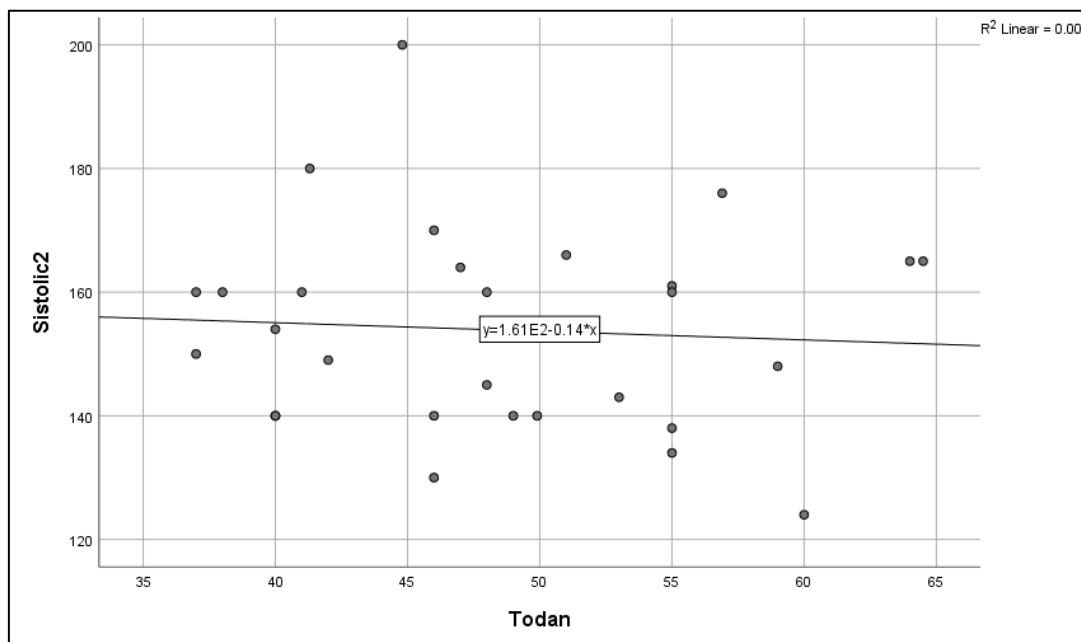


From the graph, we can observe that as age increases, there is a general trend for systolic blood pressure to increase as well. This is evidenced by the upward slope of the regression line. The equation of the line,  $y = 1.242E-2 + 0.497x$ , gives us the relationship between age and systolic blood pressure. Here,  $y$  represents the systolic blood pressure, and  $x$  represents age in years. The coefficient of age, 0.497, suggests that for each additional year of age, the systolic blood pressure increases by approximately 0.497 units. The coefficient of age, 0.497, suggests that for each additional year of age, the systolic blood pressure increases by approximately 0.497 units.

The  $R^2$  value, or the coefficient of determination, is 0.229, which indicates that approximately 22.9% of the variability in systolic blood pressure can be explained by age alone. This is a relatively low  $R^2$  value, suggesting that other factors in addition to age might influence systolic blood pressure, and that age by itself does not strongly predict systolic blood pressure.

## 2) Weight and Systolic blood pressure

Graphic 2. Regression analysis for weight and systolic blood pressure



The linear regression equation given in the scatter plot is  $y = 1.61E-2 - 0.14x$ . Here,  $y$  represents the systolic blood pressure, and  $x$  represents weight. The slope of the line is  $-0.14$ , which suggests that for every unit increase in weight, there is a predicted decrease in systolic blood pressure of  $0.14$  units. This negative relationship is contrary to common medical knowledge, where typically, an increase in weight is associated with an increase in blood pressure due to factors like increased volume load and arterial stiffness.

However, the  $R^2$  value of  $0.005$  indicates that weight only explains  $0.5\%$  of the variability in systolic blood pressure among the individuals in this dataset. This value is very low, suggesting that weight is not a significant predictor of systolic blood pressure for the participants in this study.

In conclusion, while the regression equation suggests a slight negative relationship between weight and systolic blood pressure, the extremely low  $R^2$  value tells us that there is almost no linear correlation between these two variables in the sample observed. It implies that other factors not accounted for in this regression model may be influencing systolic blood pressure, or the data might not be capturing the relationship accurately, perhaps due to the range of weights, the sample size, or variability in blood pressure readings not related to weight.

### **(3.2) Discussions**

This cross-sectional study was conducted in 3 rural aldeia of 3 sucos , in Aileu, Ermera and Manatutu Municipality, Timor-Leste. The purpose was to identify the prevalence of undiagnosed hypertension, and the associated risk factors in a community with restricted access to healthcare. The point prevalence of the undiagnosed hypertension in this 3 rural aldeia was 15%, which is greater than the study previously conducted in Atauro.

The estimated prevalence of hypertension in this study was also lower compared to the prevalence in other South East Asian countries, for instance, a study in Cianjur District, West Java, Indonesia found a high prevalence of hypertension among adults (Diana et al., 2018). The most recent published systematic review with meta-analysis on prevalence of NCDs across South East Asia identified a wide range in the reported prevalence of hypertension between and within countries (Neupane et al., 2014). This supports the notion that NCD prevention strategies should consider that risk factor profiles will be heterogeneously distributed even within countries and at a regional level.

#### **Risk factors**

Perhaps the most pertinent finding of this study was the number of participants who were not aware they had hypertension were mostly people above 59 years old, there are several plausible reasons for this. First, there is only poor implementation of aging friendly health care program, Secondly, the age population find difficult to get the health centre due to the distance, and transportation issues, in addition, the aging population also has less opportunity for health promotion, diagnosis, and ongoing management of known cases. This finding, was similar to the study conducted in Indonesia, locals are also anecdotally reported to be more likely to seek advice from traditional healers initially, rather than attend the health post, other factors, like Age, education, geographical zones and economics condition were found to be associated with undiagnosed hypertension(Mahwati et al., 2022).

Risk factor analysis in the study suggests that the risk factor profile for NCDs differs considerably between men and women in the population of interest. Men reported significant use of cigarettes and alcohol, whereas women of all ages were much more likely to report betel nut use. Interestingly, the national survey carried out in 2014 identified that 57.5% of women over the age of 49 used betel nut at the time and the

findings in this study would suggest that betel nut use continues to be a prevalent risk factor and would be a worthwhile target for public health interventions to reduce the risk of future cardiovascular disease. Betel nut is grown throughout the country and is a highly addictive stimulant that is chewed. It has been found to be associated with cardiovascular diseases, arterial stiffness (Wei et al., 2017) greater risk of cardiovascular disease (CVD) and all-cause mortality in recent meta-analyses. (Yamada et al., 2013), and recent study suggested the association between betel nut chewing and kidney disease, which can be secondary cause of hypertension (Chang et al., 2022), in other hand, a longitudinal study conducted in Taiwan observe significant association between history chewing , and metabolic syndrome.(Huang et al., 2022).

The undiagnosed hypertension is a silent threat that increases the risk of severe health issues, emphasizing the need for widespread blood pressure screening programs and health interventions to identify and address this hidden health crisis.

Timor-Leste is in the fight against communicable diseases, while, has to balance an efforts and strategies , to revert the increasing burden of NCDs, in particular, ischemic heart disease and stroke was reported in the top 3, (after Tuberculosis ), cause of death.(WHO, 2020a) . Targeted health promotion towards men would need to focus on smoking and alcohol as these were the predominant risk factors across all age groups. Increasing awareness by doing health promotion is necessary to reduce undiagnosed hypertension(Mahwati et al., 2022).

Another interesting finding was the association between BMI , and Blood pressure, it is known that obesity is one of the major risk of HTA , however, being underweight is just recently emerged as one of the risk factor for CVD's, a study conducted in India (Sharma S, Singh H, Mehta K, Verma, 2022), and the USA.(Park et al., 2017)found the association between Hypertension, Cardiovascular diseases, and underweight.

Despite the national implementation of the WHO PEN interventions, the study identifies that there is likely to be a significant burden of undiagnosed and uncontrolled hypertension in Timor-Leste. NCD care must be accessible and extended to the marginalized populations in rural areas. Although WHO PEN recommends domiciliary visits as a method of tackling this issue, these are labor- and time-inefficient and the findings in this study suggest that a model that entails village screening over 1 to 2 days

may yield the highest number of new cases and provide a useful opportunity for high-impact health promotion.

## **Strengths and limitations of the study**

The robustness of this study is grounded in its innovative screening model, employing a community-based approach aligned with the renowned SISCa model, recognized as a leading strategy for primary healthcare in Timor Leste. Our adaptation of the SISCa model to suit the specific objectives of the study enhances its applicability for future screenings and interventions targeting Non-Communicable Diseases (NCDs).

However, it is essential to acknowledge certain limitations. The study's cross-sectional design, capturing data at a specific point in time, restricts our ability to establish causal relationships among variables. This limitation is inherent in the nature of the design, making it crucial to interpret findings with consideration for temporality.

Another potential limitation is the susceptibility to reporting bias from participants. The reliance on self-reported information might introduce inaccuracies, influenced by individual perceptions, or recall bias. Addressing this concern could involve implementing additional measures to validate self-reported data or employing a longitudinal design for more comprehensive insights.

Furthermore, due to constraints in time and resources, the study was unable to encompass all potential factors contributing to hypertension. While the identified risk factors were diligently analysed, the omission of certain variables may limit the study's comprehensiveness. Future research endeavours should strive to overcome these limitations, possibly through expanded resources and a more exhaustive data collection process, ensuring a more nuanced understanding of the complex dynamics influencing hypertension. Despite these constraints, the study's tailored screening model holds promise for informing public health initiatives and contributing to the growing body of knowledge addressing NCDs in the context of Timor Leste.

## **4. Conclusion and recommendations**

### **(4.1.) Conclusion**

- The point prevalence of undiagnosed hypertension was 15 %, and male was most affected.
- Sex, age, underweight, and education level was the factors associated with undiagnosed hypertension.
- Undiagnosed hypertension was high in aging population, 59-78 was the most affected age group.
- 56 % of the undiagnosed hypertensive are active smokers.

### **(4.2.) Recommendations**

- Increased screening for hypertension in rural communities.
- Targeted health promotion about lifestyle modification.
- Education on medication adherence in rural areas of Timor-Leste.
- Strengthening primary healthcare services for better diagnosis and management of NCDs (hypertension).
- Enhancing outreach services for aging-friendly care in all conditions.
- Future research to focus on exploring and analyzing factors associated with undiagnosed hypertension in rural areas.
- Utilization of the screening model adapted from SISCa's model of care.
- Investigating the association between underweight and high blood pressure in future research.



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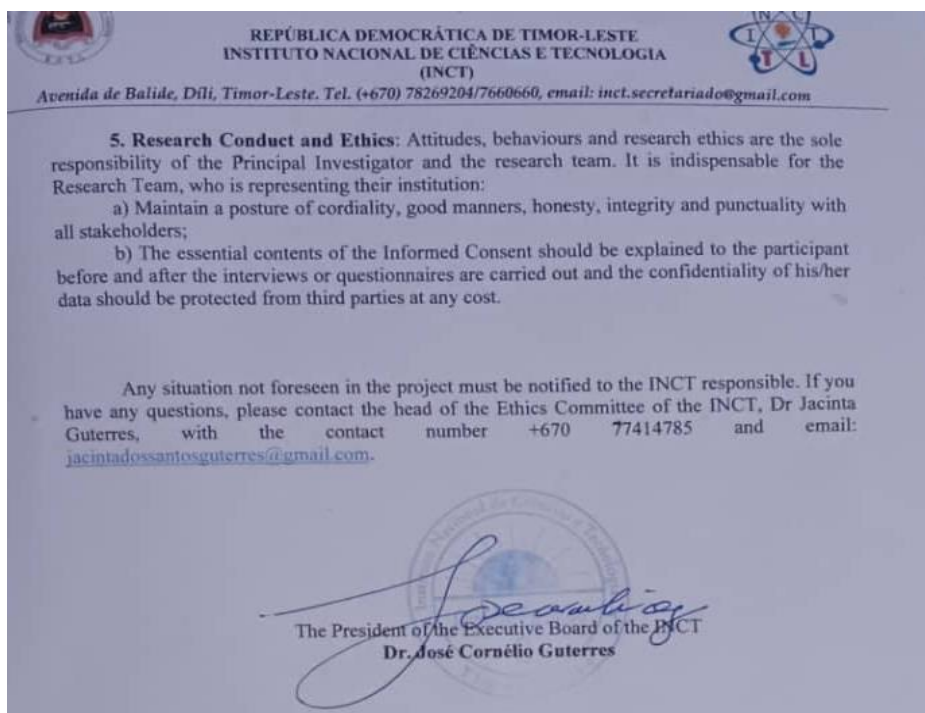
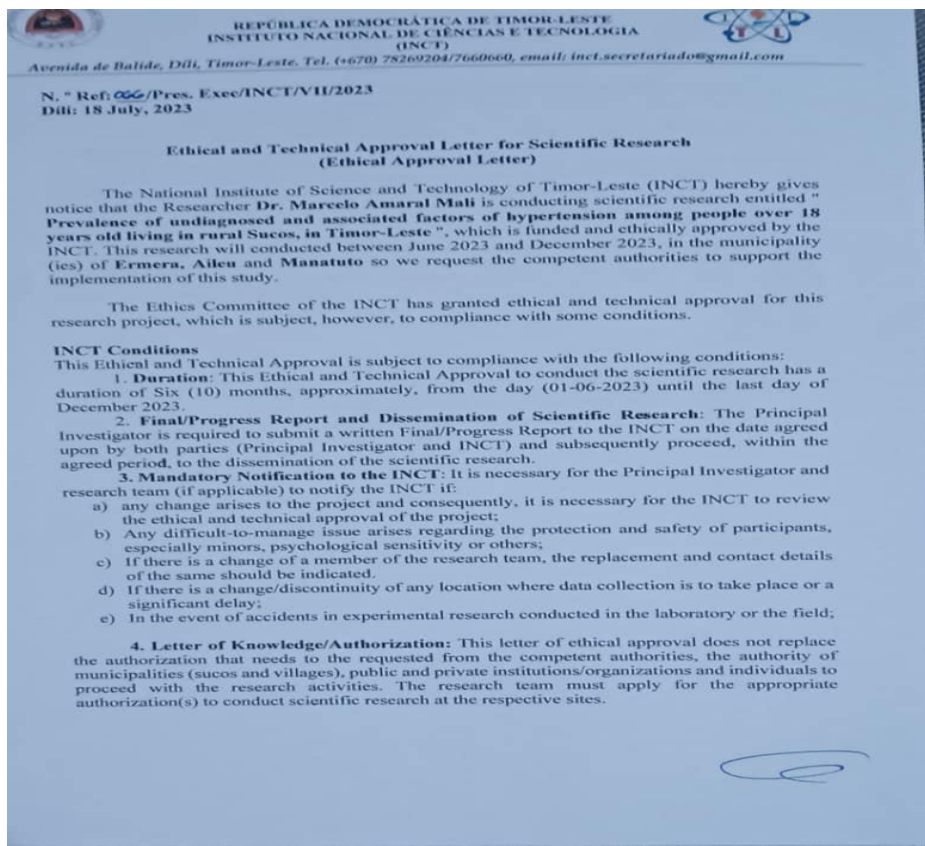
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ANNEX

STUDY TIME LINE

No	Activity	MONTH, 2023											MONTH, 2024					
		4	5	6	7	8	9	10	11	12	1	2	3	4				
1	Proposal presentation																	
2	Ethical Clearance																	
3	Recruitment, and training enumerator																	
4	Data collection																	
5	Data analysis																	
6	Report writing																	
7	Result presentation/dissemination																	
8	Writing manuscript																	
9	Submit to a journal																	

## ETHICS APPROVAL



Annex. Questionare

General Data

Interviewer

Data

Participants Name

Address

Part I.Socio demographic

Age/year

Sex

Male

Female

Marital status

Educational level.....

Part II. Knowledge towards Hypertension

(A. Knowledge towards the causation of Hypertension)

1. Eating diet rich in salt can cause Hypertension.

Yes No

Don't Know

2. Being overweight can cause Hypertension.

Yes No

Don't Know

3. Anxiety or anger can cause Hypertension.

Yes No

Don't Know

4. Too much drinking of alcohol can cause Hypertension.

Yes No

Don't Know

5. Smoking cigarette can cause Hypertension.

Yes No

Don't Know

6. Hypertension will occur genetically.

Yes No

Don't Know

### Knowledge towards the signs and symptoms of Hypertension

7. Headache is the symptoms of Hypertension.

Yes No

Don't Know

8. Dizziness is the symptoms of Hypertension.

Yes No

Don't Know

9. Shortness of breath is the symptoms of Hypertension.

Yes No

Don't Know

10. Palpitation is the sign and symptoms of Hypertension.

Yes No

Don't Know

### Knowledge towards prevention of Hypertension

11. Exercising regularly could prevent Hypertension.

Yes No

Don't Know

12. Monitoring of blood pressure is very important to prevent high blood pressure.

Yes No

Don't Know

13. Reducing stress level could prevent Hypertension.

Yes No

Don't Know

14. Eating fruits and vegetables could prevent Hypertension.

Yes No

Don't Know

15. Reducing the amount of salt intake could prevent Hypertension.

Yes No

Don't Know

16. Knowledge towards complication of Hypertension

17. Hypertension can cause heart diseases, if left untreated.

Yes No

Don't Know

18. Hypertension can cause visual impairment, if left untreated.

Yes No

Don't Know

19. Hypertension can cause kidney failure, if left untreated.

Yes No

Don't Know

20. Hypertension can cause premature death, if left untreated.

Yes No

Don't Know

#### Knowledge towards Hypertension treatment methods

21. Herbal medications used to control hypertension.

Yes No

Don't Know

22. Chemical drugs used to control hypertension.

Yes No

Don't Know

23. Taking healthy diet used to control hypertension.

Yes No

Don't Know

24. Minimizing stress used to control hypertension.

Yes No

Don't Know

25. Smoking and alcohol cessation used to control hypertension.

26. Performing regular exercise used to control hypertension.

Yes No

Don't Know

#### Part III. Behavioral characteristics

##### (A. Cigarette smoking)

Do you smoke cigarettes?

Yes No



How frequently do you smoke?

Note: If your answer is No for previous question ignore this question

Daily

Once/Week 2-3 days/week

4-5 days/week One/month

During the time of smoking how many cigarettes do you smoke?

1 or less cigarette 2-5 cigarettes

6-10 cigarettes

11 and more cigarettes

B. Betel nut chewing

Do you have a habit of betel nut chewing ?

Yes No

How frequently do you chew the betel nut?

Note: If your answer is No for previous question ignore this question and go to the next question

Daily

Most week days

Weekends only

On occasions

Do you drink alcohol?

Yes No

How often do you take alcoholic drinks?

Note: If your answer is No for previous question ignore this question and go to next question

Daily

5-6 days per week 1-4 days per week 1-3 days per week once / month

How much do you usually drink alcohol? (one portion of alcohol is having at least 1 glass of wine, 1 bottle of beer, a 50g of ouzo)

On Average only

Less than one drink

One to three drinks

Four to six drinks

Seven or more drinks

#### D. Dietary history

Do you eat fruits?

Yes No

In a typical week, on how many days do you eat fruit?

Note: If your answer is No for previous question ignore this question and go to next question

Daily

1- 4 days per week

Option 3

How many servings of fruits do you eat on one of those days? (1 serving= one orange/apple/banana/peach/mango/grapes etc).

1- 4 serving of fruits

5 or more servings of fruits

Do you eat vegetables?

Yes No

In a typical week, on how many days do you eat vegetables?

Note: If your answer is No for previous question ignore this question and go to next 2 question

Daily

1- 4 days per week

How many servings of vegetables do you eat on one of those days? (1 serving= three tablespoons of cooked vegetables)

1- 4 serving of vegetables

5 or more servings of vegetables

#### E. Physical activity

Do you perform regular physical exercise?

If your Answer is NO please go to Part IV. History of Chronic Illness

Yes No

What type of exercise do you perform?

Walking Jogging Cycling Swimming

How often do you exercise?

< 5 days per week     $\geq$  5 days per week

For how many minutes do you exercise per session?

<30 minutes     $\geq$ 30 minutes

#### Part IV. History of Chronic Illness

Do you have family history of hypertension?

Yes    No

I Don't Know

Who is your family?

: If your answer is No or Don't know for the previous question please go to next question

Father    Mother

Grand Father    Grand Mother

Have you ever been told by a doctor that you have diabetes mellitus?

Yes    No

Have you ever been told by a doctor that you have cardiovascular problem?

Yes    No

Have you ever been told by a doctor that you have kidney problem?

Yes    No

#### Part V. Body Mass Index and Blood Pressure level

(A. Height and Weight)

Weight.....Height.....BMI Level

B. Blood Pressure level

First BP :    Second BP; .....Mean .....