Spatial Analysis of Dengue Infection Using Geographic Information Systems in Dili, Timor Leste

Zito Viegas

A Thesis Submitted in Partial Fulfillment of Requirements for
degree of Master of Science in Tropical Health Innovation (Internation Program)

June 2023

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ของ

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June 2023

The examining committee has unanimously approved this Thesis, submitted by Mr. Zito Viegas , as a partial fulfillment of the requirements for the Master of Science Tropical Health Innovation (Internation Program) at Mahasarakham University

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ABSTRACT

Dengue is an acute arthropod virus infection transmitted mainly by the *Aedes sp.* mosquito. It is the most common arbovirus disease globally and mainly occurs in the tropics and subtropical regions of the world, with an estimated burden of 390 million cases annually. Dili municipality is the capital of Timor Leste; it is an endemic area for the dengue infection outbreak. Therefore, the aim of this study is to develop appropriate models for the identification of areas with the dengue risk factors assessed in Dili municipality by applying the Geographic Information System (GIS) as a tool for a spatial data collection system with integrated attribute data or non-spatial data to study factors influencing this municipality (Capital). There were two categories of data collected: primary data on the knowledge, attitude, and practice (KAP) of housewives regarding dengue prevention and control and mosquito larvae density surveys (container index (CI)); and secondary data on the number of dengue cases from January 2016 to August 2022, household numbers, residential areas, natural water resources, and improper drainage areas to analyze the relationship with dengue infection patients. The data were analyzed using Pearson correlations and descriptive statistics with stepwise multiple regression. According to the GIS model of dengue infection risk assessment, it was discovered that 9% of the total areas were very high-risk areas, 17.75% were high-risk areas, 10.30% were moderate-risk areas, and 62.96% were low-risk areas. At an administrative post (sub-district) level, including Dom Aleixo, Cristo Rei, Vera Cruz, Nain Feto, Metinaro, and Atauro, it was found that Dom Aleixo was only a very high-risk area covering 33.12 km^2. At the village level, seven villages were at very high risk, eight villages were at high risk, thirteen villages were at moderate risk, and eight other villages were at low risk. The factors influencing the household number were shown. After applying the GIS to dengue infection risk assessment, it was demonstrated that the GIS was an effective tool for dengue infection surveillance.

Keyword : Dengue Spatial analysis GIS Timor Leste.

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CHAPTER 1
INTRODUCTION

1.1 Background

Dengue is an acute arthropod virus infection transmitted mainly by the *Aedes sp.* mosquito and is the most common arbovirus disease globally, mainly occurring in the tropics and subtropical regions of the world [1]. According to the World Health Organization (WHO), dengue fever has an estimated burden of 390 million cases annually, approximately 2.5 billion people worldwide are at risk of contracting dengue fever by living in endemic areas, and there are 21,000 deaths per year [2]–[4].

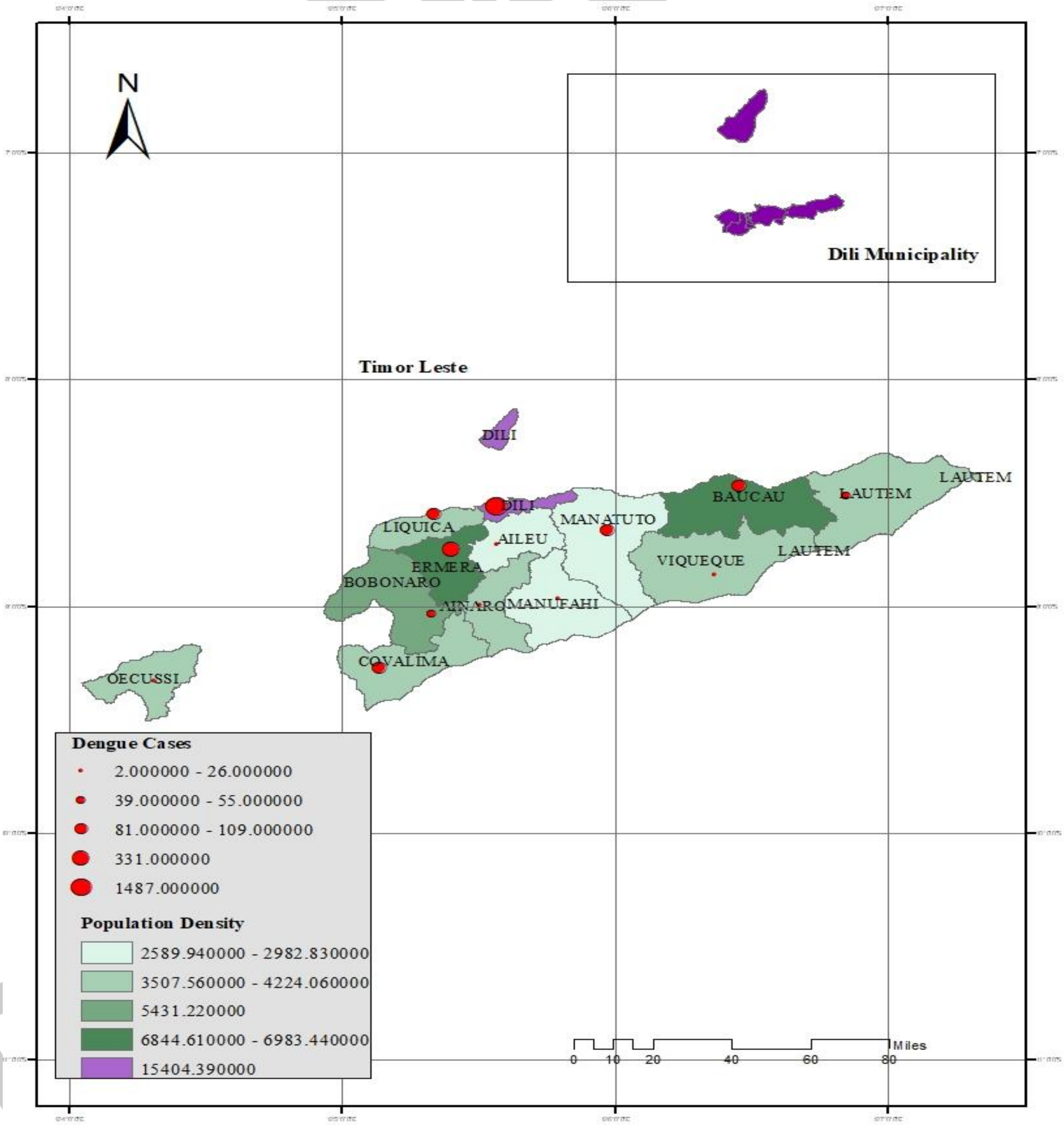
With 16% of these infections, Africa is one of the most affected regions [5]. Further, in Latin American countries from 2010 to 2019, more than 16 million cases were reported across the Americas, and about 10 million cases, or approximately 62%, were reported only in Brazil [1], [6]. Additionally, in the WHO Southeast Asia Region (SEA), 1.3 billion people live in dengue-endemic areas in 10 countries, which accounts for more than half of the global burden. Further, five countries (India, Indonesia, Myanmar, Sri Lanka, and Thailand) are among the 30 most dengue-endemic countries in the world [2], [7]. In Indonesia, an estimated 600,000 cases of dengue fever are reported each year, with approximately 180,000 resulting in hospitalization [8]. In India, the annual incidence of dengue fever is estimated to be around 7.5–32.5 million, and it is one of the leading causes of hospitalization and death [9].

The worldwide spread of dengue is a complex issue that may be accelerated by several factors, such as climate change, the geographical, environmental, and sociodemographic conditions of the city, including the poor knowledge, attitude, and practice (KAP) of the population in dengue prevention and control, the expansion of the reach of its main vector (the *Aedes* mosquito), inefficient vector control, rapid and unplanned urbanization, the movement of people for trade, tourism, or because of natural disasters, and vulnerability in public health and vector control programs are all key factors in the occurrence of dengue [7], [10]–[14]**.**

Timor-Leste is one of the countries in the Southeast Asia (SEA) Region [15], after separating from Indonesia in 1999, the first severe dengue outbreak was reported from January to May 2005, with a total of 1,067 reported cases and 39 deaths, with a case fatality rate (CFR) of 3.6% [16]. Further, in the last two and a half years, according to the Department of Communicable Disease Control (CDC), Ministry of Health (MoH) of Timor Leste, there were 1,451 reported cases of dengue infections and 10 deaths with a case fatality rate (CFR) of 0.7% in 2020; 901 cases and 11 deaths (CFR 1.2%) in 2021; and 4,985 cases and 56 deaths (CFR 1.1%) from January to May 2022 [17].

The majority of the cases lived in the most populous municipality of Timor Leste, Dili, the capital. It was the municipality that reported the highest number of dengue infections among the other 12 municipalities since the start of the outbreak, which was reported from January to May 2005 through 2022 and represented more than 50 percent of the national total number of cases each year [16], [18]. Further, the case fatality rate has increased annually in the capital city of Timor Leste and coincides with the limited health care capacity in the country and poor access to health care, and because of the COVID-19 pandemic [17]. Therefore, as the number of patients and mortality rates continue to increase every year, dengue remains a major public health problem in Timor Leste, particularly in Dili, the capital city, which is a dengue endemic area, and it is more concerning to have an intervention seriously considered by studying and identifying dengue risk factors.

Geographic Information of Dengue cases in Timor Leste



Regarding dengue prevention and control in Timor Leste, it is implemented using the guidelines outlined in the Bi-regional Dengue Strategy (2008–2015) (WHO South-East Asia and Western Pacific regions) [19]. This involves a multi-pronged approach based on case management through early detection and diagnosis; vector control via spraying; source reduction activities in the community, including distributing larvicides, fumigating with malathion (A mosquito adulticide) in residential quarters, and mobilizing communities and volunteers to clean up water containers; and environmental education on prevention and surveillance [11], [20].

Dengue is mostly diagnosed based on clinical findings. While current guidelines recommend the use of rapid diagnostic tests (RDTs), they are not widely used. Further, the Ministry of Health of Timor Leste is leading the outbreak response activities in the field; the Community Health Center (CHC) is handling the treatment of dengue patients and referral services; and other non-governmental organizations are also reported in the field, such as the World Health Organization (WHO), Red Cross and Red Crescent Movement partners, and academia, which provide support and assistance by deploying volunteers and actively participating in the operation [18], [21]. However, even though many efforts have been established in Timor Leste, dengue remains a problem that draws attention from the public health sector, and globally, there is no specific antiviral treatment for the dengue virus, and the use of the vaccine recently introduced is limited [22]. Furthermore, in a global environment, both local and global change scenarios affect physical phenomena and health informatics issues, which change from personal to global in reach. Health records on outbreaks of tropical diseases and non-communicable diseases among all national and international health organizations still require new technological approaches to create prevention and control of care, and integrating multidisciplinary networks is still considered very important [23]–[29]. Timor Leste, which is localized in a tropical climate area with most tropical diseases reported, including dengue endemics [11], [16], [30], [31], certainly needs to adapt to the technological developments that are occurring at this time, particularly in the public health sector in vector control measures, including the vitally important study of the risk factors influencing dengue infection and making a strategy for effectively controlling dengue infection in Timor Leste, especially in the capital city.

Afterward, previously related to Geographic Information Systems (GIS), a spatial epidemiological study of dengue incidence in Timor Leste has identified positive associations between dengue incidence and temperature, precipitation, and demographic factors. However, there was little focus at the municipal administrative level as well as the administrative post (subdistrict) and village on identifying risk factors based on the severity of the dengue risk factors assessed [11]. Therefore, the aim of this study is to develop appropriate models for the identification of areas with the dengue risk factors assessed in Dili municipality by applying the Geographic Information System (GIS) as a tool for a spatial data collection system with integrated attribute data or non-spatial data [32].

The data is stored in a database and can be modified and analyzed by overanalyzing, which is a technique for loading information. Aside from that, geographic information systems (GIS) are an effective tool for presenting disease incidence, disease factor analysis, and designating risk areas for dengue infection control and prevention [8], [33], particularly in the Dili municipality. In addition, correlated with the result of this study, the researcher is expected to assist the government's communicable disease control (CDC) department under the ministry of health (MoH) in Timor Leste in formulating policies, strategies, and dengue surveillance plans and can contribute to efficient epidemic control and prevention in an area.

1.2 Objectives

1.2.1 To identify specific dengue infection risk factors in Dili, Timor Leste.
1.2.2 To apply the Geographic Information System (GIS) as a tool for a spatial data collection system with integrated attribute data or non-spatial data to study factors influencing Dili municipality (Capital).

1.3 Research Questions

1.3.1 What kind of data will be used in the research and who are the key people or related organizations that will be contacted?
1.3.2 What are the determining related factors in the dengue infection's causation?
1.3.3 How do we collect and manage the data?
1.3.4 How do we create a Geographic Information System (GIS) model of dengue infection and risk factor assessment in the study area?
1.3.5 How do we determine the most dengue infection-influencing factor in the study area?

1.4 Research Contributions

1.4.1 The contribution to the Dili municipality selected in this study under the Ministry of Health in Timor Leste is mainly to the Department of Infectious Disease Control (CDC), particularly the Health Work of Dili municipality (HWDM/SSMD), Timor Leste, to assist policymakers with more effective strategies for dengue infection prevention and control in each area identified.
1.4.2 Other sectors in the study area related to the risk factors identified which contributed to increasing the number of dengue cases, such as geographical conditions, environmental factors, sociodemographic conditions, unplanned urbanization, poor knowledge, attitude, and practice of the population in dengue prevention and control, and so on (under the Ministry of State Administration, Ministry of Agriculture, Ministry of Public Works, and ministry of education).
1.4.3 Local power units (schools, churches, markets, airports, ports, and tourism sections) serve as warnings and information for visitors and the community in general to be careful in areas that have determined risk factors for dengue infection, as well as areas that are highly at risk of suffering from dengue disease, to contribute to the reduction of its spread.
1.4.4 Local authorities on how to organize their community in collaboration to prevent and control dengue infections in their area, respectively.
1.4.5 Other researchers as well as the reference to their further study and can be implemented in other areas.

1.5 Definition and Key Terms

Geographic information systems (GIS), is a computer-based system, consisting of hardware and software that facilitate the capture, retrieve, management, manipulation, analysis, and display the spatially geo-referenced data (Aronoff, 1989) [34], [35].

Spatial analysis is "In broad terms one might define spatial analysis as the quantitative study of phenomena that are located in space." (Bailey et al. 1995, p. 7)

"A general ability to manipulate spatial data into different forms and extract additional meaning as a result." (Bailey 1994, p. 15)

1.6 Acronyms and Abbreviations

QGIS/GIS: Quantum Geographic Information System
WHO/PAHO: World Health Organization / Pan American Health Organization
SEA: Southeast Asia Region
CFR: Case Fatality Rate
DENV (1,2,3 & 4): Dengue Virus
COVID-19: Corona Virus Disease 2019.
RDT: Rapid Diagnostic Test
CDC: Communicable Disease Control
MoH.TL: The Ministry of Health of Timor Leste
KAP: Knowledge, Attitude, and Practice
DF: Dengue Fiver
DHF: Dengue Hemorrhagic Fiver
DSS: Dengue Shock Syndrome
SPSS: Statistical Program for Social Science
ANN: Average Nearest Neighbor

CHAPTER 2
LITERATURE REVIEW

In order to employ concepts, theories, analysis types, and innovations that are most suitable for this research about the related factors in dengue infection causation. In this study, we obtained the literature from several previews study reviews and fallow the strategy searching as follows:

2.1 Search strategy

This review consisted of an online literature search published in English using Google scholar, PubMed/ MEDLINE (https://pubmed.ncbi.nlm.nih.gov), and BMC (https://www.biomedcentral.com). A searchable database with combinations of key terms "Geographic Information System", "GIS", Risk factors, surveillance, spatial, Dengue infections (DF, DHF, and DSS) is contained in the title and abstract. The Journal article chosen is publications during 2017-2021. Article journal filtering is done by looking at the title, keywords, and abstract as appropriate, next is the full text which met the inclusion criteria included in the analysis.

2.2 Inclusion criteria

The criteria include the following:

1. The article should explain the use of GIS in Dengue infection risk assessment and surveillance
2. Articles should use epidemiological study designs such as spatial, temporal, and descriptive studies.
3. Should use the data of dengue fever (DF), dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS).
4. Research took only research published during the years 2017-2021

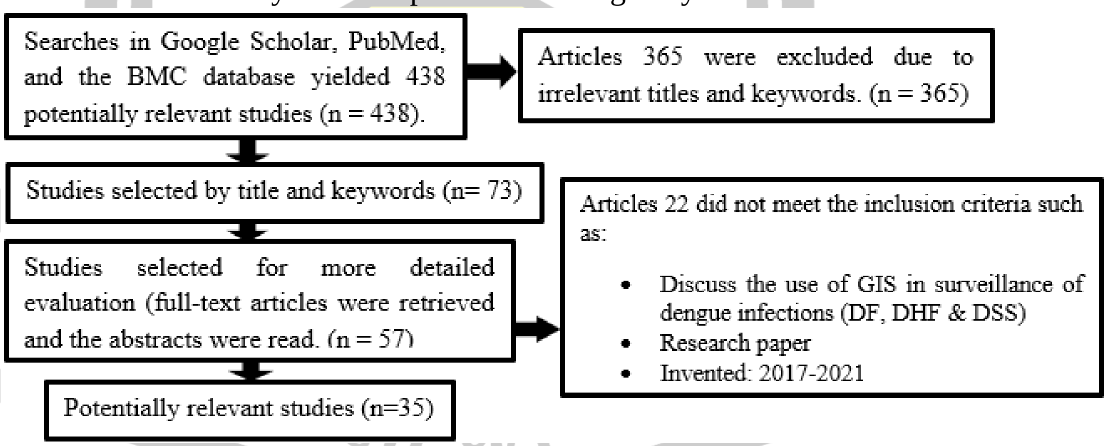


Figure 1 Review flow charts

The initial search of Google Scholar, PubMed (https://pubmed.ncbi.nlm.nih.gov), and BMC (https://www.biomedcentral.com) resulted in 438 articles. Review titles and keywords that do not include 365 articles, leaving 73 articles. Then they were identified based on full text produced in 57 articles. Of these, 35 articles met the inclusion criteria based on relevant abstracts. The methodology and the main findings of 35 articles are summarized in (Table 1).

Table 1 Characteristic of studies on Geographic Information Systems (GIS) for dengue surveillance

No.	Autor (s)	Study area	Model used	Findings
1	Gananalatha *et al*. (2017) [12]	Matara District, Sri Lanka	GIS analysis	▪ The presence of a high density of dengue vectors within three years, particularly during the rainy season ▪ Based on GIS analysis, Hittatiya City west, Fort, Isadeen, and Kotuwegoda are identified as Dengue hotspots.
2	Roma *et al*. (2017) [36]	Morelos state, Mexico	Spatial analysis (GIS)	▪ The mobility of the population living in a small urban setting exceeded the administrative limits set by local health authorities.
3	Wangdi *et al*. (2018) [11]	Timor Leste	GIS, Moran's I, LISA The brittle-Ord	▪ Children under the age of 14 and women are more vulnerable. ▪ Climatic factors influence dengue cases. ▪ A high incidence of dengue fever in January ▪ Temperature, precipitation, and demographic factors are all positively related.
4	Kahamba *et al*., (2020) [37]	Tanzania	A survey of *Ae. aegypti* aquatic habitats (Dry vs Rainy season), GIS. 1515 aquatic habitats 1933 aquatic habitats 2315 houses visited 2832 houses visited	▪ 286(contained *Aedes* immatures) ▪ 283(contained *Aedes* immatures) ▪ (CI:18.9–14.6%). ▪ 114 *Aedes* positive ▪ 186 houses had at least one *Aedes*-positive habitat, respectively (House index, HI: 4.9–6.6%)
5	Liu *et al*. (2018) [38]	China	Spatiotemporal cluster analysis using SaTScan9.4.4 and Arcgis10.3.0 and ecological niche models in Maxent 3.3.1 software.	▪ Guangdong province and Yunnan are areas with a high risk of dengue cases. ▪ The influencing factors are the environment and meteorology, such as temperature, rainfall, and land cover.
6	Chaiphongpachara *et al*. (2017)	Samut Songkhram,	GIS analysis Person's correlations statistic with SPSS program version	▪ Samut Muang Songkhram, the only region with a very high risk, includes 79,787 km².

No.	Autor (s)	Study area	Model used	Findings
	[32]	Thailand	20	▪ The residential area is a location that has a high risk of dengue fever. ▪ Meteorological factors not related to the incidence of dengue in the region of Samut Songkhram
7	Sulistyawati, Sukesi, and Mulasari (2019) [39]	Sleman district, Indonesia	GIS analysis, Microsoft Excel were used to analyses the data	▪ The majority of dengue cases are found in urban areas with high population density
8	Arifin, Adi, and Suwondo (2018) [40]	Tanjungpinang City, Indonesia	GIS through the spatial analysis	▪ The population density is correlated with the number of dengue cases. ▪ In the area of land use, such as housing, dengue cases are normatively transmitted.
9	Sulistyawati *et al.*, (2020) [41]	Yogyakarta, Indonesia	Mapping of dengue case was done by using Arc GIS and Spatial scan statistics (StatsCan)	▪ The demographic structure is suspected to be the critical factor in dengue transmission. ▪ Mergangsan sub-district is an area with a significant number of high dengue cases in Yogyakarta.
10	Nagarani *et al.*, (2017) [42]	Subang Jaya, Malaysia	GIS analysis Kernel density estimation (KDE) method	▪ The population density as a risk factor for the incidence of dengue
11	Faridah *et al.*, (2021) [8]	Bandung, Indonesia	(GIS) analysis with kernel density estimation method	▪ Identifying disease hotspots for dengue cases in Ban-Dung. ▪ The kernel density estimation showed strong cluster groups of dengue cases in the city. ▪ The pattern is strongly related to meteorological factors such as rainfall and humidity which
12	Respati *et al.*, 2017 [43]	Bandung, Indonesia	(GIS) analysis with ArcView software	▪ The spread of dengue fever cases has a wide impact in the area of East Bandung. ▪ The use of land to be used as housing is a factor in increasing disease transmission.

No.	Autor (s)	Study area	Model used	Findings
13	Huang *et al*., 2018 [44]	Tainan, Kaohsiung, and Pingtung, Taiwan	Spatial autocorrelation analysis and using the GIS database access another green metric, green land use in Taiwan	▪ Results of spatial autocorrelation analysis showed a high aggregation of dengue epidemic in southern Taiwan, and the metropolitan areas were the main hotspots. ▪ Results of correlation analysis and generalized linear mixed models (GLMM) showed a positive correlation between parks and dengue fever, and the other five green space metrics and land types revealed a negative association with DF
14	Ganguly, 2018 [45]	Kolkata, Bengal, India	GIS, Spatial autocorrelation analysis, Moran's I	▪ In 2014, more males are affected (1.25 male for each female), while the sex-ratio rises to 1.19 males for each female in 2015,
15	Velasco-salas *et al*., 2017 [46]	Maracay, Venezuela	GIS Hot Spot Analysis	▪ DHF cases highly clustered in and around the house at an average distance of 20-110 meters
16	Liu *et al*., 2018 [47]	Guangzhou, China	GIS Spatial-temporal analysis	▪ Baiyun district was the region with the highest spread of dengue cases
17	Id *et al*., 2019 [48]	Queensland, Australia	Spatial and temporal analysis Space-time cluster analysis	▪ The most severe outbreaks occurred during 2013 and 2014 in the north of tropical Queensland. ▪ Cairns has the highest number of dengue cases.
18	Ong *et al*., 2019 [49]	Singapore	Spatial analysis Richards	▪ Improved breeding Aedes percentages (BP) as risk factors for dengue transmission spatial
19	Sanna *et al*., 2018 [50]	Guangdong, China	GIS Richards models Spatiotemporal cluster analysis	▪ Model Richards show hotspot areas such as Yuexiu, Baiyun, Liwan, Tianhe, Haizhu, Zengcheng, Dongguan City, The Yuexiu Guangzhou area is the starting point of an outbreak that spreads to neighboring regions and other cities.
20	Pangilinan *et al*., 2017 [51]	Philippines	GIS, Moran's I and Kulldorff's	▪ High DHF cases occurred in the northern cities such as Malabon, Navota, Caloocan and Valenzuela as

No.	Autor (s)	Study area	Model used	Findings
				vulnerable to flooding will be a breeding place of mosquitoes
21	Lowe *et al.*, 2021 [52]	Brazil	GIS Lag non-linear models Spatiotemporal Bayesian hierarchical model	▪ The risk of dengue fever increased between 0 and 3 months following extremely wet conditions. ▪ During extremely wet conditions, the risk of dengue fever was higher in rural areas than in urban areas. ▪ It is higher in densely populated areas than in rural areas after severe drought. ▪ The risk of dengue fever following an extreme drought was higher in areas with a higher frequency of water supply shortages.
22	Astuti *et al.*, 2019 [53]	Cirebon, Indonesia:	GIS (Temporal and spatial analysis, Moran's I LISA (Local indicator of spatial association) GLM (generalized linear model) NDVI (normalized difference vegetation index) IRR (incidence rate ratio)	▪ Dengue fever is common in Cirebon's pediatric population. ▪ The incidence trend is likely to increase over time. ▪ The regular outbreaks were strongly linked with the local climate and environmental variability. ▪ Identified high-risk village clusters in the north along major road networks
23	Carabali *et al.*, 2022 [54]	Medellin, Colombia	Spatial point process model (spatial analysis) Hierarchical Bayesian model	▪ Age, insurance status, and socioeconomic status are key sociodemographic variables. ▪ geographical factors related to the presence of dengue in the city. ▪ The severity was low, and there was no evidence of spatial clustering.
24	Luiz *et al.*, 2020 [55]	Garanhuns, state of Pernambuco, northeastern Brazil	GIS (spatial analysis, kernel maps, and The Geocentric Reference System for	▪ Wide variations in temperature and precipitation, with prolonged periods of drought and densely populated neighborhoods, have contributed to greater

No.	Autor (s)	Study area	Model used	Findings
			the Americas)	reproduction and dis- semination of the transmitting vector.
25	Chumpu, Khamsemanan and Id, 2019 [56]	Thailand	Generalized linear models time series analysis, Constructing prediction models	▪ Dengue incidences occur most often during the rainy season. ▪ Wind direction, wind power, and barometric pressure also have an influence on the number of dengue cases.
26	Fuentes-Vallejo, 2017 [57]	Girardot, Colombia	Quantum GIS (Getis-Ord index and Kulldorff's scan statistics).	▪ A general trend was observed, in which dengue cases increased during the dry seasons, especially between December and February.
27	Caso *et al*., 2019 [58]	Peru	The DIVA-GIS software version 7.5.0 SPSS version 21	Determined the hotspot area, such as: ▪ The highest incidence was determined in Puerto Inca. Of the 11 districts, 2 were classified as having a high risk of transmission, 3 as moderate risk, 3 as low risk, and in 3 of them the risk of virus transmission could not be determined.
28	Pramanik *et al*., 2020 [59]	India	Arc-GIS platform to create spatial correlation map. The algorithm 'Inverse distance weighted' (IDW)	▪ Dengue out-breaks are highly correlated with ENSO (El Niño Southern Oscillation), monsoon and post-monsoon rainfall
29	Adyro *et al*., 2017 [60]	Colombia	ArcGIS server. Bayesian hierarchical model for spatial analysis of areal data. Markov Chain Monte Carlo simulations. Cohen's Kappa agreement measures.	▪ The NDVI (normalized difference vegetation index) provided more information than LST (land surface temperature) for estimating the relative risk of dengue, although their effects were small. ▪ NDVI was directly associated with a high relative risk of dengue.
30	Sirisena, Noordeen and Kurukulasuriya, 2017 [61]	Sri Lanka	Arc GIS 10.2 SPSS (Version 20, 2011 R studio (2012) a	▪ There is a statistically significant positive relationship between rainfall and temperature. However, no correlation was found between dengue incidence and

No.	Autor (s)	Study area	Model used	Findings
				temperature or humidity. ▪ Rainfall prior to dengue incidence was positively correlated with dengue incidence.
31	Nagar, Nagar and Nagar, 2020 [62]	Mysuru district and India	GIS, Spatial statistical analysis inverse distance weight (IDW) spatial autocorrelation tool	▪ Locations of the hotspots and cold spots of the registered dengue cases. ▪ The locations of the registered dengue cases revealed the number of incidences, high and low clustered areas, hotspots, and cold spot locations of the registered dengue cases.
32	Id *et al.*, 2021 [33]	Bhutan	GIS analysis and a weighted linear combination (WLC).	▪ Dengue high risk was mostly associated with relatively high population density, agricultural and built-up landscapes and relatively good road connectivity.
33	Zafar *et al.*, 2021 [63]	Laos and Thailand	GIS analysis, Index Based on Water Associated Disease Index (DVIWADI)	▪ The DVIWADI indicated high vulnerability in urban centers and in areas with plantations and forests.
34	Adnan, 2020 [64]	Malaysia	GIS, Technology has been used to integrate socio-environmental and climatic factors with dengue cases.	▪ Environmental factors that contribute to the transmission of DHF consist of play areas and vegetation in sheltered houses. ▪ Climate analysis reveals significant determinants such as relative humidity, temperature, and precipitation.
35	(Harapan *et al.*, 2018) [14]	Indonesia	A community-based cross-sectional study, GIS. With 609 participants	▪ 55% had poor knowledge regarding dengue ▪ 68% Poor attitude and poor practice in dengue preventive

2.3 About the study design used

Almost all of the studies used retrospective analytic studies, but there was one study that used a prospective cohort study [36]. Most studies use secondary data of dengue cases with periods ranging from 5 months to 16 years. There are ten sets of data on dengue cases used for more than five years and the remaining 25 studies use the data for less than five years. GIS was used in the review of these literature reviews, among which the Point Density method, Empirical Bayesian Kriging method, Moran's I, Kilduff's, Average Nearest neighbor (ANN), Spatiotemporal cluster analysis, Ecological niche models, LISA brittle-Ord, Predictive models (MAXENT), Person's Correlations statistic with SPSS program, and hot spots. The modeling and the risk map of dengue represented the dengue fever cases. In addition to the frequency distribution, it is also seen by age group, population, gender, demographics, climate, and environment.

2.4 The Geographic Information System (GIS) data used

A Geographic Information System (GIS) is a computer-based system that enables the capture, retrieval, management, manipulation, analysis, and display of spatially geo-referenced data [65]. GIS integrates spatial and other kinds of information within a single system; it offers a consistent framework for analyzing geographical data. GIS makes connections between activities based on geographic proximity. Looking at data geographically can often suggest new insights and explanations, and the linkages between spatial and non-spatial data are often unrecognized without GIS [66].

Regarding the preview study, it shows that almost all of the studies are conducted using spatial data. According to research by Liu *et al.*,(2017) global spatial autocorrelation analysis and local indicators of spatial association (LISA) were used to analyze the overall and localized spatial clustering patterns of dengue incidence in 2005–2017 using ArcGIS (version 10.3) [38]. In research by Gananalatha *et al.*,(2017) the temporal and spatial outbreak of geographical aspects of the dengue epidemic in the Matara district, Indonesia were analyzed using Arc GIS 10.1, which is used for software mapping [12]. The study by Wangdi *et al.*, (2018) In Timor Leste, where Arc GIS software was used to generate maps of the spatial distribution of the posterior means of the unstructured and structured random effects, it was identified that dengue in Timor Leste has positive associations with temperature, precipitation, and demographic factors [11]. Furthermore, a descriptive study was carried out by Sulistyawati *et al.*,(2019), in Sleman district, Indonesia using a GIS program with spatial data to provide a spatial-temporal mapping of dengue cases, the data was grounded in subdistrict level mapping of dengue using GIS and was helpful in understanding the disease presence and dynamic disease over time [39], Additionally, according to the research by Arifin *et al.*, (2018), they used Geographic Information System modeling through spatial analysis to obtain the pattern of dengue hemorrhagic fever (DHF) transmission and identify the spread (transmission) of dengue hemorrhagic fever [40].

2.5 Dengue data used

Almost all studies used secondary data of dengue cases from related organizations as well as daily, monthly, and annual reports of diagnosed dengue cases collected from the Dengue Disease Surveillance database of the city health office, and several studies used dengue data according to the severity of the dengue cases such as dengue fever (DF), dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS) based on symptoms and laboratory results (number of hemoglobin, leukocyte, Thrombocyte, hematocrit, and rapid diagnostic tests (RDTs). The study by Faridah *et al*., (2021) used data collected from monthly reports of diagnosed dengue cases from 16 hospitals in Bandung, Indonesia. The reports were obtained from the Dengue Disease Surveillance database of the city health office for the period January 2014 to December 2016 and used confirmed dengue hemorrhagic fever (DHF) cases only [8].

The study by Respati *et al*.,(2017) showed that the study used secondary data of dengue cases from 2009 to 2014. Dengue Hemorrhagic Fever (DHF) cases were reported to the Bandung City District Health Office [43]. The study by Huang *et al*. (2018) showed that dengue fever (DF) has been classified as a notifiable infectious disease category 2 in Taiwan, and suspected cases must be reported within 24 hours of clinical diagnosis. Suspected dengue cases are confirmed by the Taiwan Centers for Disease Control (CDC) based on the positive results of a serological test (IgM Enzyme-Linked Immunosorbent Assay), nucleotide sequence, or viral isolation [44].

The study of Ganguly *et al*.,(2018) used dengue data according to sero-epidemiologic secondary data. The data used for the study has been collected from the Health Department of the Kolkata Municipal Corporation (KMC) for the calendar-years of 2014 and 2015 in respect of the city of Kolkata [45]. In China, the research by Liu *et al*., used the dengue data by the Chinese Center for Disease Control and Prevention and extracted identified daily Dengue Fever (DF) data from the China Information System for Disease Control and Prevention from 2005 to 2017. The collected information about individual dengue cases included the onset and confirmation date, case category, onset location, clinically diagnosed and laboratory confirmed cases. Based on the source of infection, imported cases were defined as cases that were more likely from outside of the resident area in the 15 days before illness onset and were excluded [38]. The research by Wangdi *et al*., (2018) in Timor-Leste by using the secondary data of dengue cases was provided by the Ministry of Health, Timor-Leste and consisted of patient records containing 4546 notifications, classified as Dengue Fever (DF), suspected dengue cases, Dengue Hemorrhagic Fever (DHF), and Dengue Shock Syndrome (DSS) from January 2005 to December 2013. However, after data cleaning, only 3206 cases were matched and assigned to current recognized villages of residence (The spatial unit of analysis) [11].

2.6 Data related to the knowledge, Attitude and Practice (KAP) towards dengue

Regarding dengue prevention and control, knowledge, attitude, and practice (KAP) of the population is one of the key factors in the occurrence of dengue infection, which is a disease caused by a virus transmitted by *Aedes* mosquitoes, especially *Ae. aegypti*. Thus, the population and source of the *Aedes* mosquito are closely related to this disease. In accordance with the significantly increased dengue incidence in Ace Province, a cross-sectional study by Harapan *et al*., (2018) reported that, out of 609 participants, 55% had poor knowledge regarding dengue and 68% had poor attitudes and poor dengue preventive practices [14]. Further Despite the rapid spread of DENV in Nepal, Dhimal et al., (2014) discovered that 88 percent of 589 individuals interviewed had poor knowledge of Dengue Fever (DF) and 63 percent had poor practices in dengue prevention and control, despite 83% having a positive attitude [67]. And In Jamaica, a cross-sectional study by Alobuia et al., (2015) found that, out of 361 participants, 87% had poor knowledge of dengue prevention and control and 78% had poor practice; however, 78% had a good attitude, confirming that a good KAP in dengue prevention and control is necessary to decrease dengue infection [68].

Therefore, the knowledge, attitude, and practice of the population in dengue prevention and control in an area are considered important dengue risk factors to discuss.

2.7 Climate and Environment

Almost all of the studies link the spread of dengue infection with climate conditions. According to research by Gananalatha *et al*., (2017) in the Matara District, Sri Lanka, the high dengue vector distribution within three years occurred primarily during the rainy season [12]. In Timor Leste, dengue cases were also positively associated with temperature and rainfall [11]. However, for the area in Samut Songkhram, Thailand, climatic factors studied are not associated with dengue because this area has a proper drainage system [32]. and then Containers are one of the main risk factors in the contribution to the existence of hosts, viruses, and vectors and the transmission of dengue infection in an area, and it is caused by the environmental conditions that are favorable for vector breeding sites. It is mostly found in areas close to human habitation. According to a study by Kahamba *et al*., (2020) in Tanzania, a potential breeding ground (containers) for *Aedes* in several cities is containers used for daily life, such as drums, jars, bathtubs, and buckets, including used tires, discarded containers, and flowerpots; coconut harvesting; the associated tree-holes; and so on. And the survey results showed that of 1515 and 1933 aquatic habitats examined in the dry and rainy seasons, 286 and 283 contained *Aedes* immatures (container index, CI: 18.9–14.6%). In the 2315 and 2832 houses visited in the dry and rainy seasons, 114 and 186 houses had at least one *Aedes*-positive habitat, respectively (House index, HI: 4.9–6.6%) [37].

2.8 Population data, Household number, Residential area, Natural water resources and Demographic

To illustrate the risk of dengue infection, most studies use population distribution, density, household number, and data on elevation, temperature, average humidity, and environment. Secondary data was taken primarily from government health agencies such as health departments and community health centers. Several studies have found that sociodemographic factors such as meteorological and environmental factors (temperature, land cover, natural water resources and annual average precipitation), demographic structure, and urbanization all have an impact on dengue virus spread [38], [69], [70]. Rapid population growth creates densely populated areas, including high household numbers and large residential areas, increasing the potential for dengue virus transmission [32], [39]. It also supported research by Arifin *et al*.,

(2018) who stated that the dengue distribution is influenced by unplanned settlements such as the number of buildings, population density, land-use patterns of settlement, and population mobility, which are difficult to predict [40].

2.9 The difference between this study and the preview studies reviewed.

This study is different from those previous studies above, as can be seen from the subject. Aside from that, what distinguishes this study from others is the method of data collection; in this study, both primary and secondary data will be used, and then the dengue data used in this study will be collected from the Department of Health Information Statistics (HIS/EIS) under the Ministry of Health, Timor Leste as a whole, which is not based on the severity of the disease (DF, DHS, or DSS), as well as the gender and age group of the patients.

Then, the housewives will be the respondents in this study for knowledge, attitude, and practice (KAP) in dengue prevention and control because one of the factors associated with living in a dengue hot spot household was occupation (being a domestic worker or housewife) [71]. Further, housewives spend more time at home than men, taking care of their kids and homes. Therefore, they bear a great deal of responsibility for having knowledge, attitude, and practice in dengue prevention and control; further, scores for these variables (knowledge, attitude, and practice) will be summed as well and considered one of the variables discussed in this study [72].

After determining the sample size (household number) for the survey, the data on container index (CI) positivity with mosquito larvae was collected. In this study, we just used the data from the container index (CI) with mosquito larvae as a variable [73], [74]. However, consider that larval density can be identified from the container index (CI), house index (HI), and Breteau index (BI) in an area performing vector control [37], [75], [76]**.** Further, there was no way to bring the survey results to the laboratory to identify the larvae according to the type of mosquito due to a lack of support funds.

In addition, regarding the dengue risk factors that have been identified based on the preliminary literature review related to this project, the data on dengue risk factors will be obtained from relevant organizations. The first step will be to analyze the correlation between dengue case numbers and the risk factors assessed before being input into the geographic information system (GIS) program database in order to demonstrate the areas for dengue risk factors assessed.

CHAPTER 3
MATERIALS AND METHODS

3.1 Study design and setting

A cross-sectional and observational study was conducted in the Dili municipality, which is located in the northern region of Timor Leste and has a surface area of 368.12 square kilometers (km²), Dili had a total population of 277,279 in 6 administrative posts (subdistricts) and 32 villages [77]. The study was conducted at six administrative posts. In this study, we will use the primary and secondary data and divide them into two groups of variables: dependent variables and independent variables. Afterward the data were analyzed by Pearson correlation statistic model to analyze the significance correlations between dependent and independent variables, and, in addition, by applying the GIS model to show the area according to the severity of dengue risk factors assessed on the map, stepwise applying the multicollinearity statistic model to determine the dengue infection risk factor more influenced in Dili municipality, as follows:

3.1.1 Primary data including:

3.1.1.1 Knowledge, Attitude and Practice (KAP)

a. Sampling and sample size

So far, no data related to the KAP towards dengue in Dili has been available. Therefore, to calculate a representative sample size for the Dili population (277,279) [77], [78] we assumed that more than 50% of participants would have poor KAP regarding dengue incidence in Timor Leste, which is the most reported in Dili municipality among twelve other municipalities, as well as one of the most important risk factors in the causation of increased dengue incidence in Dili municipality, therefore to analyze by using Pearson correlation statistic models in the SPSS program. With a 5% margin of error and a 95% confidence level, 384 participants (Housewives) were required to achieve the minimum recommended sample size.

Therefore, in this variable, we follow the process to collect the population and sample to distribute the questioners by applying the formula of (Krejcie & Morgan) with a 5% margin of error and a 95% confidence level [79], such as follows:

Population: 277,279 (Total Population in Dili municipality)

$$\text{Sample (n)} = \frac{X^2 NP(1-P)}{e^2(N-1) + X^2\,P(1-P)}$$

Where:

N=population size

n=sample size

e =acceptable sampling error (0.05)

P= Proportion of population (0.5)

X^2 = Chi-square (3.841)

$$n = \frac{3.841 \times 277{,}279 \times 0.5 \times 0.5}{(0.05)^2 \times (277{,}279 - 1) + 3.841 \times 0.5\,(1 - 0.5)}$$

n=~ 383 Samples

Because this study will be conducted in each of the 6 administrative posts (subdistricts) at the Dili municipality where there are similar sociodemographic conditions [80], [81]. The number above will be divided into 6 such as:

$$n = \frac{383}{6}$$

$n = \sim 63.83333 \ldots (64)$

Therefore, the minimum number of participants (housewives) from each study site was 64. To reduce the study design effect and obtain more robust statistical power in this study, the percentage of total respondents will be increased by 10%; additionally, a minimum of 70 participants from each study site were required, for a total of 420 respondents [14].

Regarding knowledge, attitude, and practice (KAP) in dengue prevention and control, namely knowledge about symptoms and signs of dengue, and about DENV transmission, Attitude: defined as a respondent's opinions about dengue prevention, awareness, daily care, and socio-cultural perspective, Practice: defined as a respondent's practice towards dengue prevention, such as action taken to avoid dengue occurrence. This domain contains 30 items of "Yes/No" with "know and don't know" categories in each question. The medium of interview was in the Austronesian Language (Tetun / *Austronesian*) since it is the mother tongue of the respondents. Further, the questionnaire items were adopted from a previous study in Indonesia [14], Due to Timor Leste being a neighboring country and having a similar sociodemographic condition, furthermore, each item of the questionnaire was adopted with the protocol of dengue prevention and control in Timor Leste [19] and was evaluated and approved in the native language (Tetun / *Austronesian*) by two specialists in a research center under the National Health Institution (NHI/INS) of Timor Leste (Appendix 4 and 5.b.).

Those are 10 questions about knowledge; 10 questions about attitude; and 10 questions about practice (Appendix 4). Correct answers received one point; incorrect or no answers received zero points. The score was given based on good knowledge, attitude, and practice (KAP) and none for poor knowledge, attitude, and practice (KAP). Data from the knowledge, attitude, and practice (KAP) domains was summed into a percentage score to treat the variable as continuous data. And these adapted from previous studies were used to measure this domain [14], [82] by adopting Guttman scales [72] such as:

The number of choices (C) = 2
The number of questions (Q)=30
The determination of scoring on the objective
The lowest (L)= 0 (wrong or no answer)

The highest (H)= 1 (correct answer)
The lowest score count = (L×Q) = 0×30 = 0 (0%)
The highest score count = (H×Q) = 1×30 = 30(100%)
Range (R)=Maximum Score – Minimum Score
R=100%-0%=100%
Category (K)=2 (Good KAP and Poor KAP)
Interval (I)= Range(R)÷Category(K)
Interval (I)=100%÷2=50%
Scoring criteria=(H-I) =100%-50%=50%
The limit = Good KAP: > 50% and Poor KAP: ≤ 50%

In this variable, only the frequency number of poor KAP (Poor KAP: <50%) in each of the six administrative posts will be analyzed in Pearson's correlation statistic model with the number of dengue cases by using the SPSS program.

Material needed:

1. Print out questionnaires on 4 pages for every volunteer.
2. The eraser-equipped pencils
3. A laptop or PC with an active internet connection (to input the data into the database)

b. Study instrument:

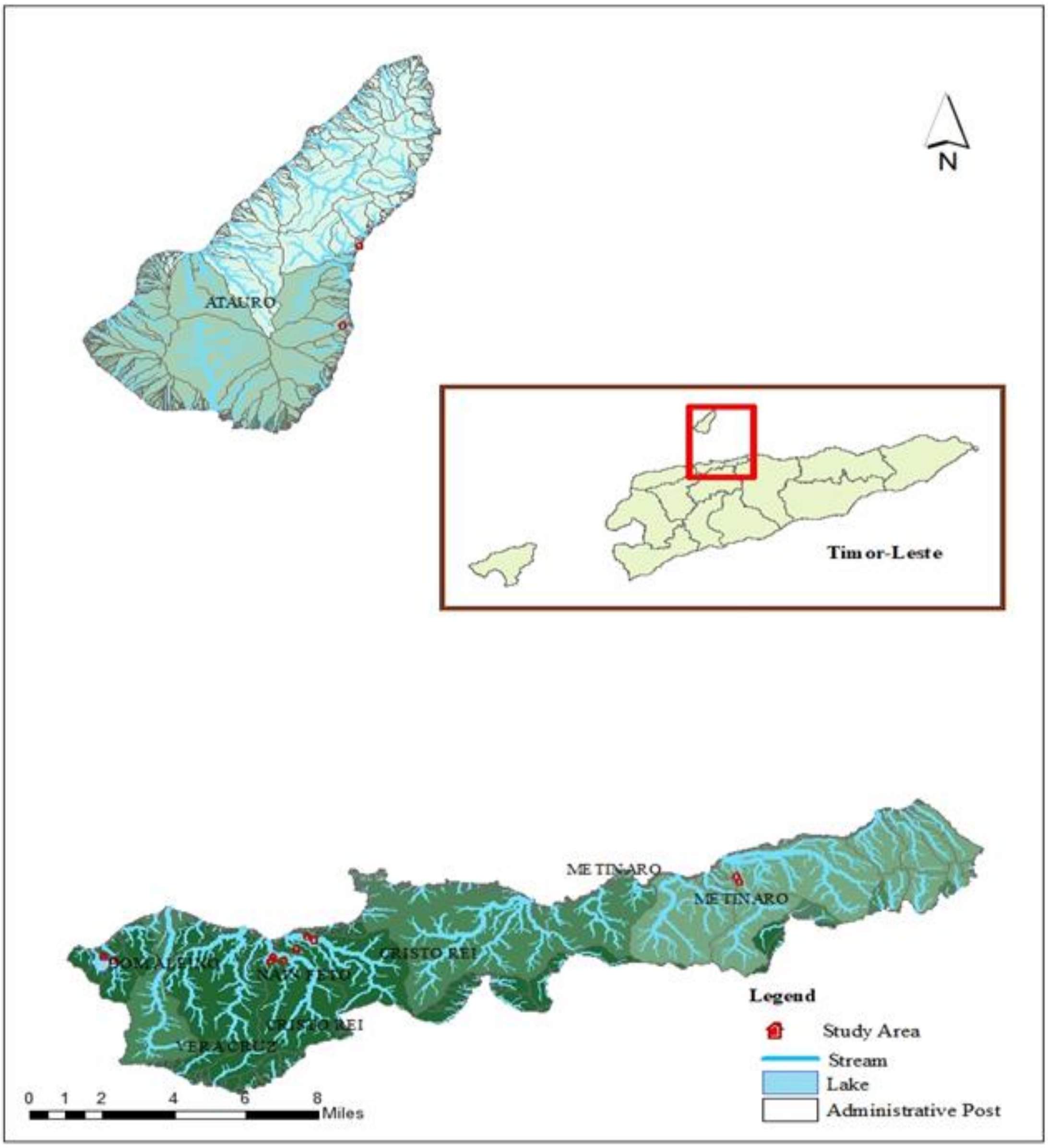
To facilitate the interviews, a set of validated and pretested questionnaires were evaluated and approved in the native language (Tetun / *Austronesian*) by two specialists in a research center under the National Health Institution (NHI/INS) of Timor Leste (Appendix 5.a - 5.b.), consisting questions related to Knowledge Attitude and Practice (KAP) regarding dengue fever prevention and control [14], [19] was used. Before the questionnaire was used in the study, it was tested for internal consistency among 40 participants in two administrative posts (Dom Aleixo and Cristo Rei). The data from these participants were not included in the final analysis. A minimum of Cronbach's Alpha of 0.7 was considered to reflect acceptable internal reliability [14], [83].

3.1.1.2. The container index data is positive for larvae (CI)

The discovery of containers as potential breeding sites for mosquitoes, including *Aedes* sp. provides a chance for an increase in dengue cases [73], [74]. Therefore, used this data collection conduct during rainy season in Timor Leste (November-February) [84], [85] for container survey, all artificial indoor and outdoor containers [37], [75], [86]. Every house was inspected to determine the presence or absence of mosquito larvae.

The positions of the houses in the six administrative posts (sub-district) were selected randomly in each village (suco) at higher risk for mosquito breeding sites, such as the residences nearby the river, stream, and lakes. This is followed by the preview studies [37], [75], were mapped using a Digital Elevation Model (DEM) from USGS Earth Explorer. Also, the data, including river, stream, lake, and administrative post (subdistrict) names, as well as the potential area for mosquito breading sites and containers, were mapped and imported into Geographic Information Systems (GIS) software for further construction (Arc Map 10.8) (Figure 2).

Figure 2. Risk area in six administrative post of Dili municipality selected for the study.



In this variable, using the World Health Organization check list of recognized containers (WHO, 2003) [86], each inspected container was classified as either a recognized container or an unrecognized container (Appendix 1, Table 13). Furthermore, we follow the process to collect the population and sample to distribute the check list by applying the formula of Krejcie & Morgan with a 5% margin of error and a 95% confidence level [79], such as follows:

Population: 39,310 (Total Household in Dili municipality) [78]

Sample: $n = \frac{X^2 NP(1-P)}{e^2(N-1)+X^2 P(1-P)}$

Where:

N = Population size
n = Sample size
e = Acceptable sampling error (0.05)
P = Proportion of population (0.5)
X^2 = Chi-square (3.841)

$$n = \frac{3.841 \times 39{,}310 \times 0.5 \times 0.5}{(0.05)^2 \times (39{,}310 - 1) + 3.841 \times 0.5 \times 0.5}$$

$$n = \sim 380 \text{ samples (households)}$$

Because this study will be conducted in each of the 6 administrative posts (subdistricts) at the Dili municipality where there are similar sociodemographic conditions [80], [81]. The number above will be divided into 6 such as:

$$n = \frac{380}{6}$$

$$n = 63.33$$

$$n = \sim 64$$

Therefore, the minimum number of participants (households) from each study site was 64 households. Further, to reduce the study design effect and obtain more robust statistical power in this study, the percentage of total households will be increased by 10%; additionally, a minimum of 70 households from each study site were required, for a total of 420 households.

Material needed:

1. A flashlight will be used for dark-colored containers where mosquito larvae are harder to see,
2. The checklist has 1 page per household for every 70 households in each of the 6 administrative posts (subdistrict), with a total of 420 pages printed out,
3. The eraser-equipped pencils,
4. A laptop or PC with an active internet connection.

Processes:

1. An inspection of all potential artificial container-breeding sites of mosquitoes was performed in each household.
2. Every room of each household will be searched systematically for containers.

3. All artificial containers were inspected for the presence of mosquito larvae through gross examination with unaided eyes.
4. Fill out the checklist of container guidelines (WHO, 2003), (Appendix 1).
5. Input the data into the database.

For each type of container were computed using the following formula [86]:

$$\mathbf{CI} = \frac{\text{Number of positive artificial containers}}{\text{Total number of Container inspected}} \text{ x } 100$$

3.1.2 Secondary data including:

Collected from related organizations. The secondary data included the number of dengue infection patients from January, 2016 to August, 2022, and other data for analysis as follows:

1. The Health Statistic Information (HSI/EIS) department, Ministry of Health Timor Leste (MoH.TL), provided data on the number of dengue infection patients in each administrative post (subdistrict) of Dili municipality from January 2016 to August, 2022.

2. The data on total population and surface in each administrative post (subdistrict) of Dili municipality comes from the Dili municipality statistical office [87].

3. The Dili Municipal Statistical Office provides data on the number of households in each administrative post (subdistrict).

4. The spatial data on administration at the village and administrative post (subdistrict) levels in Dili municipality comes from the Department of Municipal Administration.

5. Under the Ministry of Public Works, the Department of Roads, Bridges, and Flood Control. The data includes: drainage areas.

6. The spatial data on land use in Dili Municipality comes from the application Google Earth Pro, Free Download (https://earth.google.com/web/search/). The data includes: Natural water resources and Residential areas.

3.2 Determining related factors in the Dengue infections Causation

Determining factors for the Dengue infection risk assessment in the areas of Dili municipality. The factors are as follows:

- Independent variables;
  1. The data of (Poor KAP: ≤ 50%)
  2. The container index (CI)
  3. The data of the household number
  4. The data of residential areas (km^2)
  5. The data of improper drainages areas (m^2)
  6. The data of natural water resources(m^2)
- Dependent variable; The number of dengue cases (2016-2022).

According to Harapan *et al., (*2018), Kahamba *et al*., (2020), Ridha *et al.*, (2022), Martini *et al.*, (2019), Chaiphongpachara *et al.*, (2017), and Id *et al.*, (2021) research, it was also demonstrated that these factors were relevant to the increase in dengue outbreaks and vulnerability in each area [14], [32], [33], [37], [73], [74].

3.3 Analysis data

3.3.1 The creation of a GIS model of dengue infection and risk assessment in Dili municipality.

a) Analyzing all of the previously mentioned dengue infection risk factors in the Dili municipal areas (six administrative posts).

This research adopted Pearson's correlation Statistic to measure the relationship between 6 independent variables and their dependent variables, which was the number of dengue infection patients in Dili municipality from 2016 to August 2022 with the SPSS program. Afterwards, assessing the risk of the disease with the analyzed factors at a statistical significance of less than 5% (p-value < 0.05).

$$r = \frac{\sum(xi - \bar{x})(yi - \bar{y})}{\sqrt{\sum(xi - \bar{x})^2 \sum(yi - \bar{y})^2}}$$

Where:

r = Pearson correlation coefficient

xi = Variable samples

yi = y variable samples

$\bar{x}$ = mean of values in x variable

$\bar{y}$ = mean of values in y variable

b) After determining which of the independent variables (dengue risk factors) is significantly correlated with the dependent variable (dengue case number), fill in the variables' blank boxes below. Further, the weighted score (W) is the serial number of each variable according to the significance statistic correlated with the dependent variables (dengue case number), and then to determine the three types (Table 2) of every variable in the blank box below by using the process of formula frequency distribution, which will be the interval width equal to the range divided by the number of intervals. It was scored, adopting a preview study [32], on a scale ranging (*fr*) from 1-3 (Table 3).

Table 2 Determining related factors for dengue infection risk assessed in Dili municipality

No.	Variables	Type	Weighted score (W)	Score (S)	Total Score (W x S)
1	Dengue Cases		7	3	21
			7	2	14
			7	1	7
2			6	3	18
			6	2	12
			6	1	6
3			5	3	15
			5	2	10
			5	1	5
4			4	3	12
			4	2	8
			4	1	4
5			3	3	9
			3	2	6
			3	1	3
6			2	3	6
			2	2	4
			2	1	2
7			1	3	3
			1	2	2
			1	1	1

Table 3 The process of dividing every variable into three types

n	Number of Data	6 (Administrative Post)	Class Interval (CI)	Score (*fr*)
Max.	Maximum score data	…	≤ …	1
Min.	Minimum score data	…	… to …	2
Range (R)	Max. - Min.	…	≥ …	3
Class (C)	1+(3.322 x Log n)	…		
Interval (I)	R ÷ C	…		

c) Building the Geographic Information System models of the Dengue infection and disease risk assessment after analyzing the related factors in the dengue infection causation with the QGIS system. The process to determine the grade of risk factors assessed (Table 2)

$$\text{Max. (Score)}: 21 + 18 + 15 + 12 + 9 + 6 + 3 = 84$$

$$\text{Min. (Score)}: 7 + 6 + 5 + 4 + 3 + 2 + 1 = 28$$

Using the Overlay Analysis of GIS to analyze the obtained scores and assess risks of the Dengue infection in each post administrative (subdistrict) of Dili municipality. Dividing risk degrees into four colors including, dark red, red, yellow, and green and setting the score level of the very high risk at ≥ 72, the level of the high risk at $58 - 71$, the level of the moderate risk at $44 - 57$, and the level of the low risk at ≤ 43 respectively (Table 4 & 5). To create a frequency distribution, the interval width equaled to range divided by the number of intervals. Afterwards, analyzing the Dengue infection risks at four administrative levels: Municipality, Administrative Post (Subdistrict), and village (Suco).

Table 4 Random data from 28 to 84 (Random between in Excel) in 6 administrative Post of Dili municipality.

			Random data from 28 to 84 (Random Between)		
60	79	35	n	Number of Data	6
30	63	80	Max.	Maximum score data	80
			Min.	Minimum score data	30
			Range (R)	Max.-Min.	50
			Class (C)	1+(3.322×Log n)	4
			Interval (I)	(R)÷(C)	14

Table 5 Risk factors degree assessed in each administrative post

Class Interval (CI)	Risk degree (*fr*)	Color in the GIS Map
≤ 43	Low risk	
44 - 57	Moderate risk	
58 - 71	High risk	
≥ 72	Very high risk	

3.3.2 The study factors influencing of Dili municipality

Stepwise multiple regression was selected as the method for studying the dengue infection factors influencing the increase of dengue cases. First of all, we determined whether there was multicollinearity among the 6 gathered factors of independent variables. After that, we employed stepwise multiple regressions to analyze the independent factors at a *p*-value of 0.05.

To find out how much influence the existing independent variables have on the dependent variable (Dengue) partially or simultaneously and what percentage of the influence of these independent variables we will conduct several hypothesis tests, namely the **t** test, the **F** test and how much is the value of **R** square. simultaneous in this study, we use several formulas in the SPSS program that have been used in a previous study [32], such as follows:

- **Primary data:**

Hypothesis 1 (H1): There is an effect of Poor KAP: $< 50\%$ (X1) on dengue cases (Y).

Hypothesis 2 (H2): There is an effect of Container Index (CI) with positive larvae (X2) on dengue cases (Y).

Hypothesis 3 (H3): There is an effect of Poor KAP: $< 50\%$ (X1) and CI (X2) simultaneously on dengue cases (Y).

With level of confidence is 95%, α=0.05.

The decision-making basis:

a) **t**-test

1. If the p-value is less than 0.05 or the **t**-test more than the **t**-table (Appendix 2), variable X has an effect on variable Y.
2. If the p-value is more than 0.05 or the **t**-test is less than the **t**-table (Appendix 2), then there is no effect of variable X on variable Y.

The Formula to Calculate ***t*** table as follows:

$$\mathbf{t}\text{ table} = \mathbf{t}\left(\frac{\alpha}{2}; n - k - 1\right) = \mathbf{t}\left(\frac{0.05}{2}; 6 - 2 - 1\right), \mathbf{t}\text{ table} = 0.025; 3(\text{Appendix } 2) = 3.162$$

Where:

$\alpha = 0.05$ (confidence value)

$n =$ Total sampel (6 administratives post)

$k =$ total variable X (X1 and X2)

b) **F** test

1. If the p-value is less than 0.05 and the F test is less than the F table, the hypothesis is rejected. There were two variables (X1 and X2) that simultaneously affected the variable Y.
2. If the p-value is more than 0.05 and the F test is more than F table. There was no effect of variables X1 and X2 on variable Y simultaneously. The formula to Calculate **F** table as follows:

$$\mathbf{F}\text{ table} = \mathbf{F}(k; n - k) = \mathbf{F}(2; 6 - 2) = F(2; 6 - 2) = \mathbf{F}\text{ table} = 2; 4(\text{Appendix } 3) = 6.94$$

Where:

$k =$ total variable X (X1 and X2)

$n =$ total sample (6 administratives post)

- **Secondary data:**

Hypothesis 3 (H3): There is an effect of the household number (X3) on dengue cases (Y).

Hypothesis 4 (H4): There is an effect of residential areas (km^2) (X4) on dengue cases (Y).

Hypothesis 5 (H5): There is an effect of drainage areas with water stagnant (m^2) (X5) on dengue cases (Y).

Hypothesis 6 (H6): There is an effect of natural water resources (m^2) on dengue cases (Y).
With level of confidence is 95%, $\alpha=0.05$.
The decision-making basis:

c) **t** test

1. If the p- value = < 0.05, or **t** count > **t** table (Appendix 2), then there is an effect of variable X on variable Y.
2. If the p-value = > 0.05, or **t** count < **t** table (Appendix 2), then there is no effect of variable X on variable Y.

The Formula to Calculate ***t*** table as follows:

$$\mathbf{t}\text{ table} = \mathbf{t}\left(\frac{\alpha}{2}; n-k-1\right) = \mathbf{t}\left(\frac{0.05}{2}; 6-4-1\right), \mathbf{t}\text{ table} = 0.025; 1(\text{Appendix }2) = 12.71$$

Where:
$\alpha = 0.05$ (confidence value)
$n =$ Total sampel (6 administratives post)
$k =$ total variable X (X3, X4, X5 and X6)

d) **F** test

1. If the value of sig. < 0.05, or **F** count < **F** table, then there is an effect of variables (X3, X4, X5 and X6) on variable (Y) simultaneously.
2. If the value of sig. >0.05, or **F** count > **F** table, then there is no effect of variables (X3, X4, X5 and X6) on variable (Y) simultaneously.

The formula to Calculate **F** table as follows:

$$\mathbf{F}\text{ table} = \mathbf{F}(k; n-k) = \mathbf{F}(4; 6-2) = F(4; 6-4) = \mathbf{F}\text{ table} = 4; 2(\text{Appendix }3) = 19.2$$

Where:
$k =$ total variable X (X3, X4, X5 and X6)
$n =$ total sample (6 administratives post)

e) **R** square

To determine the coefficients of **R** square, just see the table of model summary in the SPSS program.

3.4 Ethics Statements

The primary data were analyzed anonymously, and individuals were coded with unique numeric identifiers. All housewives provided written informed consent or voluntarily accepted the offer from the investigator during these investigations. The study was approved by the Ethics Review Committee for research involving human subjects at Mahasarakham University, Thailand (approval number: 029-387/2023) and the National Health Institution in Timor-Leste. Furthermore, the use of these secondary data on dengue cases was also approved by the chief of the department of Statistics and Health Information (SHI/EIS) under the Ministry of Health Timor Leste, and the data on improper drainage areas was approved by the director of the Ministry of Public Works' Department of Roads, Bridges, and Flood Control.

CHAPTER 4
RESULT

4.1 Related Factors in the Dengue Infection Causation for the Created GIS Model

4.1.1 Primary data

a. Knowledge, Attitude and Practice (KAP)

The internal consistency of the questionnaire was confirmed using 40 interviews with participants from two different study sites (Dom Aleixo and Cristo Rei) that have socio-demographic backgrounds similar to the main study participants [88], [89]. The Cronbach's Alpha coefficient of KAP domain was 0.843 and 0.846, respectively. Details of questions used to assess the KAP domain and the distribution of correct responses among participants are presented in Additional files (Appendix 6.a and 6.b) respectively.

- **Study population characteristics**

The data presented in this study was part of the Dili Municipality dengue study, and the characteristics of the research participants, in part, have been described elsewhere [14], [67], [68]. Briefly, for this specific study, 420 healthy housewives were surveyed, and 31 (7.38 %) were excluded from the analysis due to missing information. A total of 389 (92.61 %) inhabitants, who provided data for all sections of the questionnaire, were included in the final analysis (Appendix 7.a - 7. f).

Following the distribution of the questionnaire, 49.36% of the 389 total participants (housewives) had good knowledge, attitude, and practice (KAP), with a score total greater than 50 percent (> 50%). Further, 50.64% had poor knowledge, attitude, and practice (KAP), with a score below or equal 50 percent (≤ 50 %) [72], regarding dengue prevention and control. From the 49.36% good (KAP) respondents, there were 44 (11.31%) respondents found in the Atauro administrative post, followed by the Metinaro administrative post with a total of 36 (9.25%) respondents and the Nain Feto administrative post with a total of 33 (8.48%) respondents; further, the Vera Cruz administrative post presented 33 (8.48%) respondents, the Cristo Rei administrative post presented 25 (6.43%) respondents,and the Dom Aleixo administrative post presented 21 (5.40%) (Table 6 & Appendix 7.a - 7.f).

Furthermore, from the 50.64% poor (KAP) respondents, the most high-poor (KAP) was found in Dom Aleixo's administrative post with 49 (12.60 %) respondents, followed by Cristo Rei's administrative post with 43 (11.05 %) respondents, further in Vera Cruz's administrative post with 33 (8.48 %) respondents, Nain Feto's administrative post with 31 (7.97 %) respondents, Metinaro's administrative post with 25 (6.43 %) respondents, and Atauro's administrative post with 16 (4.11 %)(Table 6 & Appendix 7.a - 7.f).

Table 6. Characteristics of study participants **(n** = 389 Housewives**)**

Administrative Post	Respondent (Housewives)	Good KAP	%	Poor KAP	%
Dom Aleixo	70	21	5.40	49	12.60
Cristo rei	68	25	6.43	43	11.05
Vera Cruz	66	33	8.48	33	8.48
Nain Feto	64	33	8.48	31	7.97
Metinaro	61	36	9.25	25	6.43
Atauro	60	44	11.31	16	4.11
Total	389	192	49.36	197	50.64

b. Containers surveyed with positive mosquito larvae (CI)

Briefly, for this specific study, 420 households were surveyed, and 39 (9.28%) were excluded from the analysis due to missing information. Further, mosquito larvae were found in 195 (51.18%) of 381 houses artificial containers. 752 (44.29%) of the 1,698 containers of water contain mosquito larvae (Table 7). In Dili municipality, most of the population uses wells and PAM (Abbreviation in Indonesian Language) water provided by the government as water sources. Based on the results of the survey in six administrative posts (sub-districts), buckets are the most commonly used container, but the most positive container was concrete water storage tanks for bathrooms (Appendix 8.1. – 8.6.).

Dom Aleixo's administrative posts have two types of water sources: wells and lakes. with nine types of recognized containers and three types of artificial, unrecognized containers examined. Most of the types of containers commonly found are buckets, but most of the larvae-positive containers found were concrete water storage tanks for bathrooms (Appendix 8.1.), and most of the population in the Cristo Rei administrative post used wells and tap water as a source of water. Buckets are the most commonly used containers, followed by concrete water storage tanks for bathrooms (Appendix 8.2.). Concrete water storage tanks for bathrooms are the most larvae-infested containers. Furthermore, most of the population in the Vera Cruz administrative post used PAM water provided by the government and tap water as a source of water. Buckets are the most commonly used containers, followed by concrete water storage tanks for bathrooms. Concrete water storage tanks for bathrooms are the most larvae-infested containers (Appendix 8.3.). However, in Nain Feto's administrative post, most of the population used wells and PAM water provided by the government as a source of water. Buckets are the most commonly used containers, followed by concrete water storage tanks for bathrooms. Concrete water storage tanks for bathrooms are the most larvae-infested containers (Appendix 8.4.). Most of the population in the Metinaro Administrative Post used wells and tap water as sources of water **(**Appendix 8.5.). Buckets are the most commonly used containers, followed by concrete water storage tanks for bathrooms. While the types of containers that have the most larvae are concrete water storage tanks for bathrooms, most of the population in the Atauro Administrative Post uses wells and tap water as a source of water. Buckets are the most commonly used containers, followed by concrete water storage tanks for bathrooms (Appendix 8.6.). Concrete water storage tanks for bathrooms are the most larvae-infested containers. Privasy out of the 1,698 containers examined, 400 were discovered in Dom Aleixo, 246 in Cristo Rei, 281 in Vera Cruz, 287 in Nain Feto, 265 in Metinaro, and 219 in Atauro's administrative post (Table 7).

With 195 out of 381 households having artificial containers positive for mosquito larvae. Furthermore, regarding to the formula measured mosquito larvae density (Methodology section) from the 752 (44.29 %) positive container index with mosquito larvae, there was in Dom Aleixo's admirative post has the highest Container Index (CI) with 17.02 %, followed by Cristo Rei administrative post with 8.66 %, Vera Cruz 8.42 %, Nain feto administrative post 4.95 % Metinaro administrative post 2.71 % and Atauro Administrative post presented 2.53% of Container index (Table 7).

Table 7. Containers surveyed result in each administrative post level, Dili municipality.

Administrative Post (Sub-districts) n= 6	House Inspected	House found with mosquito larvae	Container Inspected	Positive Container Inspected	Container Index (CI)
Dom Aleixo	64	41	400	289	17.02 %
Cristo Rei	64	35	246	147	8.66 %
Vera Cruz	64	35	281	143	8.42 %
Nain Feto	63	33	287	84	4.95 %
Metinaro	63	28	265	46	2.71 %
Atauro	63	23	219	43	2.53 %
Total	381	195	1698	752	44.29 %

4.1.2 Secondary data

Besides the primary data, secondary data were obtained from relevant organizations as part of the Dili municipality dengue study, and it was considered that those were the risk factors that contributed to increased dengue incidence in an area, in part as described elsewhere [32], [38], [40].

The five variables of secondary data obtained from relevant organizations in Dili municipality (Table 8) were dengue cases from 2016 to 2022, and 3,522 (52.1%) of the total 6,761 dengue cases were reported in Dom Aleixo administrative post, and five other administrative posts reported less than half of the total 6,761 dengue cases reported. a while according to the incidence rate per 1000 population there was Metinaro administrative post was most reported with 34.1 cases per 1000 population compare with five other atministrative post.

Regarding the area of housing, the largest residential area was in Dom Aleixo administrative post, with 17.5 km² (36.2%) of the total 48.3 km² residential area, and the next largest was in Cristo Rei administrative post, with 15.1 km² (31.3%) of the total 48.3 km² residential area. And fallowed by four other administrative posts such as Vera Cruz administrative post with 6.5 km² (13.5%), Nain Feto administrative post with 2.6 km² (5.4%), Metinaro administrative post with 4.4 km² (9.1%), and Atauro administrative post with 2.2 km² (4.6%) of the total 48.3 km² residential area (Table 8) in Dili municipality.

The household number most obtained was in Dom Aleixo administrative post, with 17,499 (41.7%) of the total 39,310 households, followed by Cristo Rei administrative post with 8,149 (24.5%) of the total households in Dili municipality, and less than one-tenth of the households in four other administrative posts (Table 8).

The Natural water resources in this study include rivers, streams that do not have seasons, and lakes that exist in each of the six administrative posts; thus, the Dom Aleixo administrative post had the largest reported area with 3.7 km^2 (45.6%) of the total 8.2 km^2, followed by the Cristo Rei administrative post with 3.1 km² (38%), the Vera Cruz administrative post with 1.1 km² (13.6%), and the Nain Feto, Metinaro, and Atauro administrative posts with 0.1 km² (1.2%) (Table 8).

Ditching on national roads, cross-administrative post roads (inter-sub-districts), and community roads in residential areas with poor drainage, such as the risk of puddles and puddles of water due to waste, and other areas still in the construction phase or lifted by the construction company many times, are included in this study's drainage areas. As a result of the data obtained, Dom Aleixo Administrative Post had the largest improper drainage area with 1,450,000 m^2 (44.1%) of the total 3,286,692 m² followed by Cristo Rei Administrative Post with 1,215,020 m^2 (37.0%) of the total 3,286,692 m^2. And fallowed by four other administrative posts, such as Vera Cruz administrative post with 411,672 m^2 (12.5%), Nain Feto administrative post with 110,000 m^2 (3.3%), Metinaro administrative post with 10,000 m^2 (0.3%), and Atauro administrative posts with 90,000 m^2 (2.7%) of the total 3,286,692 m^2 improper drainage area in Dili Municipality (Table 8).

Based on all the secondary data obtained, it shows that the area with the most significant risk factor assessed in Dili municipality is the Dom Aleixo Administrative Post (subdistrict), where seven villages (Bairro Pite, Bebonuk, Comoro, Fatuhada, Madohi, Manleuana and Kampung Alor) are located, and the Cristo Rei Administrative Post, where eight villages (Ailok, Balibar, Becora, Bidau Santana, Camea, Culu Hun, Hera, and Meti Aut) are located, followed by four other administrative posts (sub-districts) such as Vera Cruz with seven villages (Caicoli, Colmera, Dare, Lahane Ocidental, Mascarenhas, Motael, and Vila Verde), Nain Feto with six villages (Acadiru Hun, Bemori, Bidau Lecidere, Gricenfor, Lahane Oriental, and Santa Cruz), and Atauro with five villages (Beloi, Biqueli, Macadade, Maquili, and Vila Maumeta) and In Metinaro's administrative post, there were three villages (Benunuc/Duyung, Mantelolao, and Sabuli) [80].

Table 8. The secondary data on dengue and risk factors assessed in Dili municipality at each administrative post (subdistric)

No.	Administrative Post	Dengue Cases 2016-2022	(%)	Dengue Case/1000 Pop.	(%)	Household Number	(%)	Residential Area/km²	(%)	Natural Water resources (km²)	(%)	Drainage area (m²)	(%)
1	Dom Aleixo	3522	52.1	30.8	21	17,499	41.7	17.5	36.2	3.7	45.1	1,450,000	44.1
2	Cristo Rei	1264	18.7	21.5	14	8,149	24.5	15.1	31.3	3.1	37.8	1,215,020	37.0
3	Vera Cruz	874	12.9	28.2	19	4,797	15.7	6.5	13.5	1.1	13.4	411672	12.5
4	Nain Feto	819	12.1	24.1	16	6,255	10.3	2.6	5.4	0.1	1.2	110000	3.3
5	Metinaro	187	2.8	34.1	23	864	2.4	4.4	9.1	0.1	1.2	10000	0.3
6	Atauro	95	1.4	10.2	7	1,746	5.4	2.2	4.6	0.1	1.2	90000	2.7
	Total	6761	100	148.9	100	39,310	100	48.3	100	8.2	100.0	3,286,692	100

Sources: The Ministry of Health Timor Leste (MoH.TL)'s Health statistic information (HIS) department (Appendix 10), the Ministry of Public works, the department of Road, Bridges, and flood control, and the application Google Earth Pro (free download at http://earth.google.com/web/search), as well as the result of the 2015 population and housing census [77], [78], [90].

4.2 Related Factors in the Dengue Infection Causation for the Created GIS Model

As a result, we analyzed a total of six factors related to the disease's causation with the statistical analysis and employed Pearson's correlation coefficient to measure the relationship between independent and dependent variables. The result revealed that six of them were factors relating to the dengue infection outbreak in Dili municipality with a statistical significance of *p*-value < 0.05, including the poor Knowledge, Attitude and Practice (KAP) of housewives regarding dengue prevention and control, the mosquito habitat survey such as the Container Index (CI) with positive mosquito larvae, the largeness of residential areas, the household number, the natural water resources, and improper drainage areas, as shown in (Table 9**)**.

Table 9 Related factors in the Dengue infection causation and statistics for measuring Dengue patient number relation.

Correlations							
		Poor KAP: (≤50 %)	Container Index (CI)	Household Number	Residential Area/km²	Natural Water resources (km²)	Improper Drainage area (m²)
Dengue Case	Pearson Correlation	.873*	.975**	.988**	.847*	.858*	.864*
	Sig. (2-tailed)	0.023	0.001	0.000	0.033	0.029	0.026
	N (Administrative post)	6	6	6	6	6	6

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The number of dengue infection patients was the most important factor causing the spread of the disease. As a result, the researcher analyzed the number of dengue infection patients along with the other six factors for the created Geographic Information System (GIS) model. Afterwards, seven factors were scored by an adopted preview study with five specialists [32] on a scale ranging from 1-3 for an overlay analysis of Geographic Information System (GIS) as shown in (Table 10**)**.

Table 10. Determining related factors for Dengue infection risk assessment in Dili Municipality.

No.	Variables	Type	Weighted score (W)	Score (S)	Total Score (W x S)
1	Dengue Cases	≥ 28 / 1000 Pop.	7	3	21
		16 - 27/ 1000 Pop.	7	2	14
		≤ 15 / 1000 Pop.	7	1	7
2	Household number	≥ 14784	6	3	18
		5504- 14783	6	2	12
		≤ 5503	6	1	6
3	Container index (CI)	≥ 14.5 %	5	3	15
		6.5 % - 14.4 %	5	2	10
		≤ 6.5 %	5	1	5
4	Poor KAP (≤ 50 %)	≥ 49	4	3	12
		29 - 48	4	2	8
		≤ 28	4	1	4
5	Improper Drainages areas (m^2)	≥ 1,215,015	3	3	9
		411,672 - 1,215,014	3	2	6
		≤ 411,671	3	1	3
6	Natural water resources(km^2)	≥ 3.1	2	3	6
		1.1 - 3.0	2	2	4
		≤ 1.0	2	1	2
7	Residential areas (km^2)	≥ 17.2	1	3	3
		7.2 - 17.1	1	2	2
		≤ 7.1	1	1	1

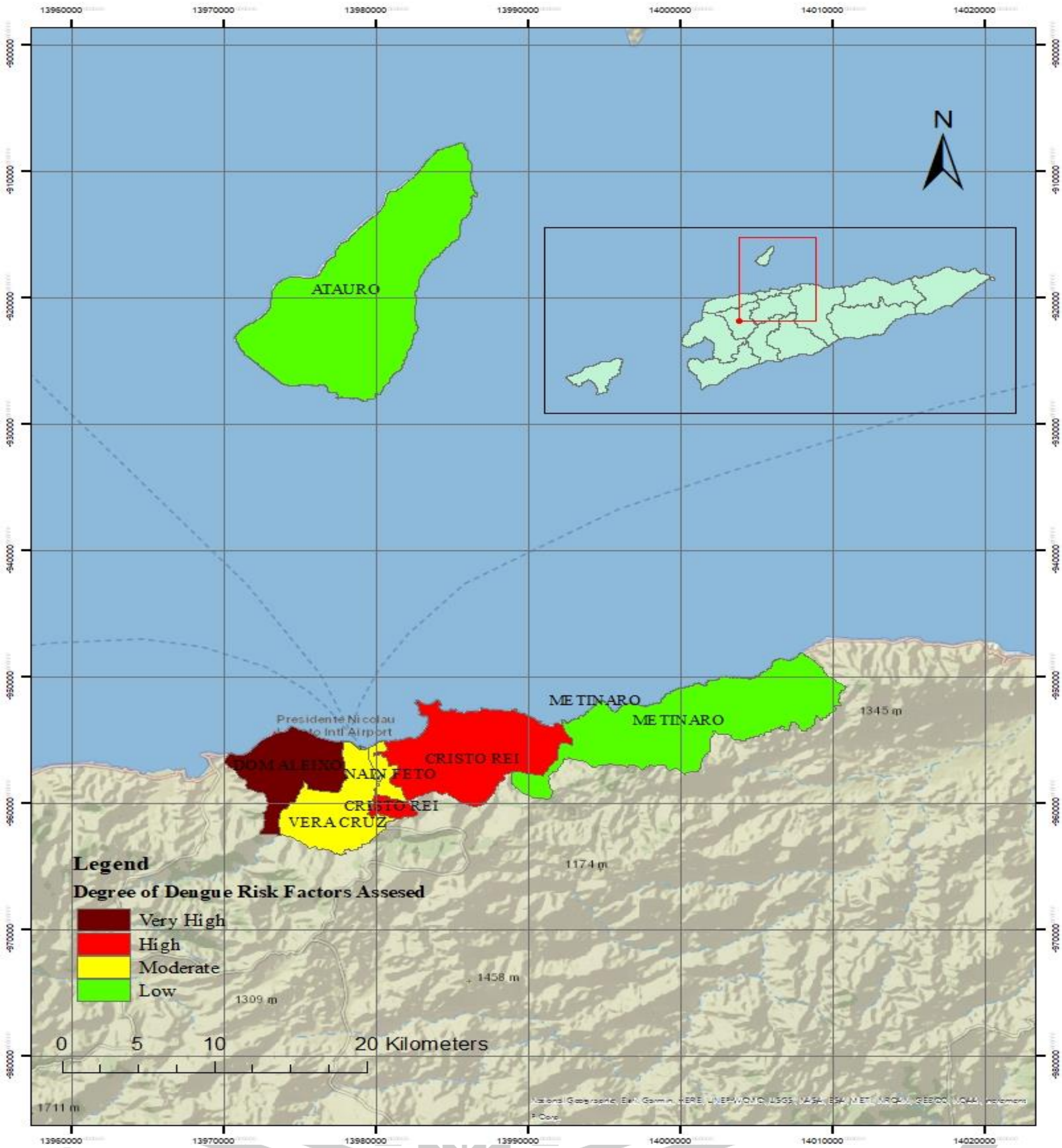
4.3 Geographic Information System (GIS) Model of Dengue Infection and Risk Factors Assessment in Dili Municipality.

4.3.1 Dengue infection risk assessment at a Municipality level

According to the Geographic Information System (GIS) model of dengue infection created with ArcGIS and Overlay Analysis based on related factors such as poor Knowledge, Attitude and Practice (KAP) of housewives regarding dengue prevention and control, mosquito habitat survey such as the Container Index (CI) with positive mosquito larvae, the number of dengue infection patients per thousand inhabitants of each of the six administrative posts (subdistricts), the household number, the largeness of the Residential area, Natural water resources, and Improper drainage areas, as shown in (Fig. 3).

The risk factor assessment in Dili municipality, with a total area of 368.12 square kilometers (km^2), was divided into four degrees: very high-risk areas; high-risk areas; moderate-risk areas; low-risk areas, it was found that the very high-risk areas covered 33.12 square kilometers (km^2), equivalent to 9% of the total areas, and the high-risk areas covered 65.33 square kilometers (km^2) or 17.75 % of the total areas. The moderate-risk areas covered 37.92 square kilometers (km^2) or 10.30 % of the total area, and the low-risk areas covered 231.75 square kilometers (km^2) or 62.96 % of the total areas.

Figure 3. Geographic Information System (GIS) model of dengue infection with risk factors assessed in Dili municipality.



4.3.2 Dengue infection risk assessment at an administrative post (Subdistrict) level.

According to the results of dengue infection risk assessment at four degrees in six administrative posts (subdistricts) as shown in the (Table 11), it was found that Dom Aleixo Administrative Post, Dili municipality was the very high-risk area. The high-risk area included Cristo Rei Administrative post (subdistrict). The moderate risk area was Vera Cruz and Nain Feto Administrative posts (subdistrict). The low-risk areas included two Administrative Posts (subdistricts), namely: Metinaro and Atauro administrative posts (Subdistricts).

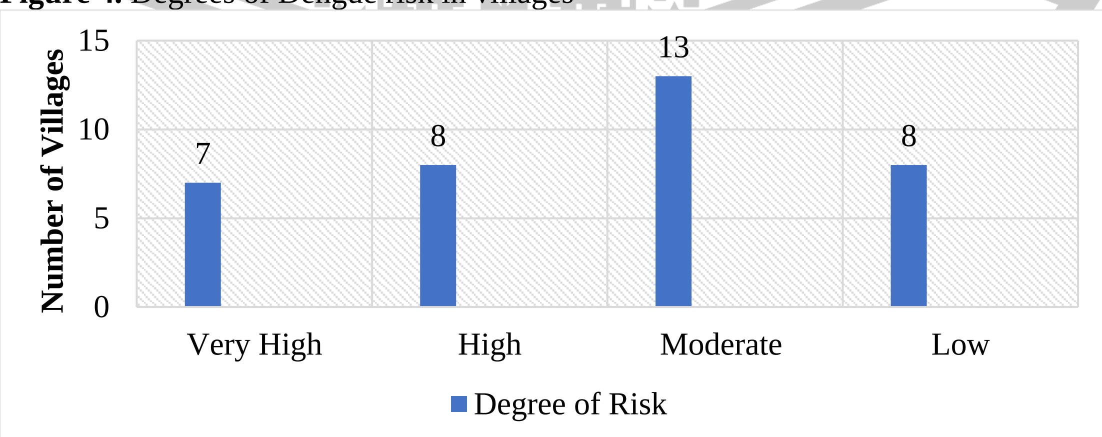
Table 11. Dengue infection degree of risk at an administrative post (subdistrict) level.

No.	Administrative post (subdistrict)	Point	Degree of Risk
1	Dom Aleixo	84	Very High
2	Cristo Rei	61	High
3	Vera- Cruz	57	Moderate
4	Nain Feto	44	Moderate
5	Metinaro	42	Low
6	Atauro	28	Low

4.3.3 Dengue infection risk assessment at a village (Suco) level

The results of the dengue infection risk assessment at four degrees in 32 villages of Dili Municipality showed that seven villages were at very high risk, where residents reside in Dom Aleixo Administrative Post (Bairro Pite, Bebonuk, Comoro, Fatuhada, Kampung Alor, Madohi, and Manleuana); eight villages were at high risk, where residents reside in Cristo Rei Administrative Post (Ailok, Balibar, Becora, Bidau Santana, Camea, Culu Hun, Hera, and Meti Aut); and thirteen villages were at moderate risk, where residents reside in Vera Cruz (Caicoli, Colmera, Dare, Lahane Ocidental, Mascarenhas, Motael, and Vila Verde) and in Nain Feto Administrative Posts (Acadiru Hun, Bemori, Bidau Lecidere, Gricenfor, Lahane Oriental, and Santa Cruz); and eight other villages were at low risk, where residents reside in Metinaro (Benunuc/Duyung, Mantelolao, and Sabuli) and Atauro administrative posts (Beloi, Biqueli, Macadade, Maquili, and Vila Maumeta) [80], as shown (Fig. 4).

Figure 4. Degrees of Dengue risk in villages



4.4 Factors influencing of Dili Municipality

According to an interpreted result of six independent variables of primary and secondary data from the multiple regression analysis, the major factor influencing the dengue infection patient number in the Dili municipality was household number, as shown in (Table 12). According to the multiple regression analysis, the variation between the household number and the dengue patient number was 97.7% (R^2 = 0.977), and the coefficient B was 0.206. It demonstrated that when other factors were controlled, an increase in the number of households in residential areas per km^2 caused a 0.26% increase in dengue patient numbers. When taking coefficient (B) changed to beta into account, household number influenced the increase in the number of dengue patients (Beta = 0.988). In addition, according to the **t** test of 12.899 or more than **t** table 12.71 (Methodology section secondary data Hypothesis 3) [91], household numbers were related to dengue patient numbers, showing a statistical significance of $p < 0.000$. Household numbers, therefore, could explain the variation in dengue patient numbers. And according to the **F**-test of 166.373, or more than **F**-table 19.2 [92], household numbers were related to dengue patient numbers, showing a statistical significance of $p < 0.000$. Household numbers, therefore, could explain the variation in dengue patient numbers.

Table 12. Regression Correlation Coefficient Analysis of factors related to dengue infection in the Dili municipality (n=6 administrative posts)

Step	Predictor	R	R^2	R^2 Change	F
1	Container Index (CI)	.975a	0.951	0.951	77.95
2	Household Number	0.988	0.977	0.977	166.373
3	Poor (KAP)	.873a	0.762	0.762	12.839
4	Improper Drainage area (m^2)	.864a	0.747	0.747	11.798
5	Natural Water resources (km^2)	.858a	0.736	0.736	11.127
6	Residential Area (km^2)	.847a	0.718	0.718	10.194

Step	Predictor	B	Standard (Std). Error	Beta	t (test)	p-value
1	Container Index (CI)	225.641	25.557	0.975	8.829	0.001
2	Household Number	0.206	0.016	0.988	12.899	0.000
3	Poor (KAP)	91.704	25.593	0.873	3.583	0.023
4	Improper Drainage area (m^2)	0.002	0.001	0.864	3.435	0.026
5	Natural Water resources (km^2)	658.595	197.436	0.858	3.336	0.029
6	Residential Area (km^2)	160.699	50.333	0.847	3.193	0.033
Household Number		R	0.988			
		R^2	0.977			
		p-value	0.000			
		F (test)	166.373			
		t (test)	12.899			

CHAPTER 5
DISCUSSION

This is the first study to explore the spatial analysis of the dengue risk factor in Dili, Timor-Leste. There was evidence of spatial clustering of dengue risk after accounting for the covariates, suggesting that variability in geographical and environmental conditions and control explain much of the spatial dynamics of the disease. This is similar to findings from studies in other parts of the world [8], [11], [13], [29], [37], [75]. Regarding dengue control and prevention in Timor Leste, many efforts have been made to establish it. However, dengue still remains a concern for the public health sector in Timor Leste, and this is in accordance with Indonesia's status as a dengue-endemic country that has made many efforts to establish it, but dengue still remains a serious public health problem [39].

Dili municipality, as well as the country's Capital, is considered an endemic area, with the most reported dengue cases annually among twelve other municipalities [16], [17]. As a result, in this study, we assessed the spatial analysis of dengue risk factors in Dili municipality using the Geographic Information Systems (GIS) model, Pearson's correlation coefficient, and the multiple regression analysis method to measure the statistical relationship of dengue in Dili municipality after analyzing all related factors and in accordance with the preview studies [14], [32], [37], [74], [93]. It was discovered that a total of six factors related to dengue incidence in Dili municipality, such as the Poor Knowledge Attitude and Practice (KAP) of housewives in dengue prevention and control, the container index (CI) survey, as an indicator of mosquito larvae density and breeding sites; Household numbers; residential areas; improper drainage areas; and natural water resources.

Based on our survey, poor Knowledge, Attitude, and Practice (KAP) of among housewives was associated with a significant number of dengue patients reported in each of the six administrative posts (subdistricts). This poor KAP in dengue prevention and control by housewives will lead to increased dengue incidence in an area. This is consistent with studies by Dhimal *et al*., (2014), Harapan *et al.,* (2018), and Alobuia *et al*., (2015), which report that poor knowledge, attitude, and practice in dengue prevention and control are associated with the rapid expansion of dengue [14], [67], [68]. However, this is different from the study by Aziz *et al*., (2015), which reported that while their knowledge and practice of dengue were good, their attitudes toward the disease needed to be improved [94].

Mosquito larvae densities, or the Container Index (CI), had a significant association with the number of dengue patients reported in each administrative post (subdistrict) in this study; further, the behavior of respondents in each administrative post belonged to the poor category, and the majority of respondents were not routinely eliminating mosquito breeding sites. This is consistent with a study by Martini *et al.*, (2019), Ridha, and Sulasmi (2022), which found that larval density (CI) was associated with Dengue Hemorrhagic Fever (DHF) incidence and that the behavior of respondents in the study area belonged to the category of poor, along with the majority of respondents not routinely doing the elimination of mosquito breeding sites [73], [74]. The potential breeding ground (containers) for mosquito larvae was found in containers used for daily life, such as drums, jars, bathtubs, and buckets, as well as used tires, discarded containers, and flowerpots. These are in accordance with the preview study's findings [37], [86]. However, aside from the Container Index (CI), larvae density can be identified from the House Index (HI) and Breteau Index (BI) in an area performing vector control [75], [95].

The household number and residential areas were the major and important factors in the increase in *Aedes aegypti* breeding sites and numbers in this study. The household number with a significant association with dengue cases reported in each administrative post, including all over the Dili municipality, is consistent with studies by Chaiphongpachara *et al*., (2017) and Rodrigues *et al*., (2015), reporting that the higher the number of households and the larger the residential area, the more associated it was with an increase in *Aedes aegypti* breeding sites and dengue cases [32], [96].

The improper drainage area was a significant factor associated with the dengue cases reported in each administrative post (subdistrict) in Dili municipality, and according to the preliminary discussion with the Director of the Department of Roads, Bridges, and Flood Control under the Ministry of Public Work (MPW/MOP) in Timor Leste, the improper drainage areas included the ditching on national roads, cross-administrative post roads (inter-sub-districts), and community roads in residential areas with poor drainage, such as the risk of puddles of water due to waste, and other areas still in the construction phase or lifted by the construction company at many times. This is consistent with studies by Ali *et al.*, (2022) and Charlesworth *et al.*, (2022), which reported that improper drainage systems can contribute to mosquito breeding sites and dengue incidence [97], [98]. Further, a study in Pakistan suggests that aside from the higher drainage density areas, there were low-elevation areas with calm winds and minimum temperatures higher than normal, a rapid increase in unplanned urbanization, and low flow accumulation that favored dengue transmission [99]. However, this result differs from a study in Samut Songkhram, Thailand, by Chaiphongpachara *et al*., (2017), in which climatic factors studied, including dengue cases, were not associated with dengue because this area has a proper drainage system [32]. Furthermore, in this study, the findings did not include the association between dengue case number and elevation; precipitations included unplanned urbanization (population density) as important risk factors that contribute to increasing dengue transmission and patient number [39], [56], [61], [64], due to Dili municipality's small area and similar sociodemographic conditions; precipitations included elevation among six administrative posts (subdistricts) [80], [81]. However, compared to other municipalities, Dili had a higher population density and unplanned urbanization [77]. Therefore, we considered those to be important factors that favor dengue transmission in the Dili municipality.

The natural water resources were a significant factor associated with the dengue cases reported in each of the six administrative posts (subdistricts) in Dili municipality; there were streams, unseasonable rivers, and lakes nearby the residential area in each of the six administrative posts that contributed to the creation of the mosquito breeding site and dengue incidence. This is consistent with studies by Sheela *et al*., (2017) and Young *et al*., (2007), who reported that natural water bodies were creating habitats for variable species of mosquitoes, including *Aedes sp.*, and probably increasing dengue infections in an area [69], [70].

Furthermore, as for the degrees of dengue infection risk in Dili municipality, it was discovered that the very high-risk area covered 9% of the total areas and the high-risk area covered 17.75% of the total areas. These areas, aside from the more significant risk factors discussed above, including more reported dengue cases compared with four other administrative posts (subdistricts), were mainly urban, including more crowded places such as an international airport, churches, and touristic places (Sao Joa Paulo II and Areia Branca) [78]. This possibly caused a risk of dengue infection development for the tourists, in accordance with Thavara *et al*., (1996), who studied dengue vector mosquitoes at a tourist attraction [100].

Therefore, the government agencies in Dili municipality, particularly the health work direction in Dili municipality, including other sectors, should accordingly give a main focus to these areas in order to monitor the dengue outbreak among the population, including tourists from the area to other areas.

Further, there were four other administrative posts that were at moderate and low risk; dengue control and prevention are still essential. Because Dili is a small municipality, including the capital city of Timor Leste and the unique international airport function in Timor Leste, this can facilitate population dispersal [87]. This is in accordance with Altassan *et al*.'s (2019) report that, historically, Saudi Arabia was often the site of dengue outbreak reports; however, Dengue Fever (DF) transmission in Saudi Arabia is also affected by several unique factors, including large numbers of migrant workers and religious pilgrims from other dengue endemic areas across the Middle East, North Africa, and Asia [101].

There are a number of limitations to this study. First, concerning the primary data, such as the container survey, we only conducted it in one phase over a period of time, primarily during the rainy season (November–February) [85], and we did not bring the results to the laboratory to identify the type of mosquito larvae obtained. Secondly, dengue patient data was obtained solely on the basis of administrative post (sub-distinct) levels and not adjusted according to severity, age group, gender, or the average number of dengue patients per year, which are relationship measures, but in this study only the total number of dengue patients during the last seven years was used in the analysis of this study.

Furthermore, the strengths of this study were demonstrated after obtaining the results of applying the Geographic Information System (GIS) to dengue infection risk assessment, it was shown that the geographic information systems (GIS) was an effective tool [66], in assisting government agencies and the Department of Communicable Disease Control (CDC) particularly in Dili Municipality Health Work (HWD/SSMD) office in developing a policy, strategy, and plan for dengue infection surveillance in the Dili municipality, including other sectors, to prioritize areas of action in the study area related to the identified dengue risk factors that contributed to an increase in the number of dengue incidences, such as geographical conditions, environmental factors, and climatic changes (under the ministries of state administration, public works, and education).

In addition, considering this is the first study result of poor Knowledge, Attitude, and Practice (KAP) of housewives in dengue prevention and control due to the scores of the three items we summed as well as one variable in this study, there are several limitations, including the similarity with other variables from this study. However, further study should be conducted as a cross-sectional study focused on the correlation among the population (housewives) in terms of knowledge of dengue symptoms and how to cut off the epidemiologic chain of dengue infection transmission in the population, the population's attitude toward control and prevention, and the daily practices of the population in dengue control and prevention. Therefore, it could be more effective to facilitate the program manager's making an intervention according to the problem identified [14], [68]. Furthermore, conducted an entomological study according to the address of the patient in villages and sub-villages level with the latitude and longitude data of each individual to conduct GIS mapping [102], including implementing two other indicators to measure mosquito larvae density such as the House index (HI) and Breteau index (BI) [37], [86].

Moreover, the results of the mosquito breeding site survey have to be brought to the laboratory to conduct an entomological study on the identification of mosquito species. Furthermore, human population growth (rapid and unplanned urbanization) should be controlled, including the movement of people for trade, tourism, and other relevant risk factors such as natural disasters and vulnerability in public health, particularly in vector control programs, and the dengue case management and hospitalization systems should be improved by adopting every possible innovation.

CHAPTER 6
CONCLUSIONS

The dengue risk factor is very highly assessed in Dili, Timor-Leste, where it occupies 9% and nearly 17.75% of the total area. It is mainly caused by environmental and geographical conditions, which are significant predictors of dengue cases.

The main risk factors associated with dengue cases in Dili municipality, particularly in each of the six administrative posts (subdistricts), were the poor knowledge, attitude, and practice (KAP) of housewives regarding dengue prevention and control; the artificial container (CI); the density of household numbers; the large density of residential areas; improper drainage areas; and natural water resources.

The administrative post with very high dengue risk factors assessed was Dom Aleixo, and high dengue risk factors were assessed at the Cristo Rei administrative post. At the village level, there were seven villages with very high dengue risk factors assessed, including eight villages with high dengue risk factors assessed. Furthermore, the most influential dengue risk factor in the Dili municipality was household number; because other dengue risk factors were held constant, an increase in household number caused a 97.7% increase in dengue infection patient numbers.

Nowadays, the Geographic Information System (GIS) is applied in discovering risk areas of epidemic diseases, including Dengue Hemorrhagic Fever (DHF) globally [103], [104], and is one of the most effective tools for dengue surveillance in an area. This calls for public health actions and other sectors to mitigate future dengue risk factors from environmental and geographical conditions. In addition, the Geographic Information System (GIS) is a very useful tool for Timor-Leste as a young country and as an innovation tool to contribute to dengue surveillance, among other infectious diseases.

Further studies are needed to define if these risk areas are maintained through time, while similar studies can be applied to other neglected tropical diseases such as malaria, tuberculosis, and filariasis, which affect both municipalities in Timor Leste and other Southeast Asian countries.

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Appendix

Appendix 1

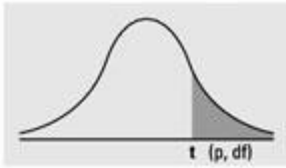
Table 13. Mosquito larval surveys in containers in each of the six administrative posts in Dili Municipality.

No.	Type of container	Total number of containers inspected	Number of positive containers
	Recognized containers		
1	Concrete water storage tanks		
2	for bathrooms		
3	Discarded tires		
4	Discarded bottles and tin cans		
5	Metal drums for water storage		
6	Buckets		
7	Plastic containers		
8	Water trays of refrigerators		
9	Pots		
10	Animal water container		
	Unrecognized containers		
1	Water trays of dispenser		
2	Aquarium		
3	Pan		
	Total		

(Prasetyowati, Ipa and Widawati, 2018, p. 24) [86]

Appendix 2

Numbers in each row of the table are values on a *t*-distribution with (*df*) degrees of freedom for selected right-tail (greater-than) probabilities (*p*).



df/p	0.40	0.25	0.10	0.05	0.025	0.01	0.005	0.0005
1	0.324920	1.000000	3.077684	6.313752	12.70620	31.82052	63.65674	636.6192
2	0.288675	0.816497	1.885618	2.919986	4.30265	6.96456	9.92484	31.5991
3	0.276671	0.764892	1.637744	2.353363	3.18245	4.54070	5.84091	12.9240
4	0.270722	0.740697	1.533206	2.131847	2.77645	3.74695	4.60409	8.6103
5	0.267181	0.726687	1.475884	2.015048	2.57058	3.36493	4.03214	6.8688
6	0.264835	0.717558	1.439756	1.943180	2.44691	3.14267	3.70743	5.9588
7	0.263167	0.711142	1.414924	1.894579	2.36462	2.99795	3.49948	5.4079
8	0.261921	0.706387	1.396815	1.859548	2.30600	2.89646	3.35539	5.0413
9	0.260955	0.702722	1.383029	1.833113	2.26216	2.82144	3.24984	4.7809
10	0.260185	0.699812	1.372184	1.812461	2.22814	2.76377	3.16927	4.5869
11	0.259556	0.697445	1.363430	1.795885	2.20099	2.71808	3.10581	4.4370
12	0.259033	0.695483	1.356217	1.782288	2.17881	2.68100	3.05454	43178
13	0.258591	0.693829	1.350171	1.770933	2.16037	2.65031	3.01228	4.2208
14	0.258213	0.692417	1.345030	1.761310	2.14479	2.62449	2.97684	4.1405
15	0.257885	0.691197	1.340606	1.753050	2.13145	2.60248	2.94671	4.0728
16	0.257599	0.690132	1.336757	1.745884	2.11991	2.58349	2.92078	4.0150
17	0.257347	0.689195	1.333379	1.739607	2.10982	2.56693	2.89823	3.9651
18	0.257123	0.688364	1.330391	1.734064	2.10092	2.55238	2.87844	3.9216
19	0.256923	0.687621	1.327728	1.729133	2.09302	2.53948	2.86093	3.8834
20	0.256743	0.686954	1.325341	1.724718	2.08596	2.52798	2.84534	3.8495
21	0.256580	0.686352	1.323188	1.720743	2.07961	2.51765	2.83136	3.8193
22	0.256432	0.685805	1.321237	1.717144	2.07387	2.50832	2.81876	3.7921
23	0.256297	0.685306	1.319460	1.713872	2.06866	2.49987	2.80734	3.7676
24	0.256173	0.684850	1.317836	1.710882	2.06390	2.49216	2.79694	3.7454
25	0.256060	0.684430	1.316345	1.708141	2.05954	2.48511	2.78744	3.7251
26	0.255955	0.684043	1.314972	1.705618	2.05553	2.47863	2.77871	3.7066
27	0.255858	0.683685	1.313703	1.703288	2.05183	2.47266	2.77068	3.6896
28	0.255768	0.683353	1.312527	1.701131	2.04841	2.46714	2.76326	3.6739
29	0.255684	0.683044	1.311434	1.699127	2.04523	2.46202	2.75639	3.6594
30	0.255605	0.682756	1.310415	1.697261	2.04227	2.45726	2.75000	3.6460
z	0.253347	0.674490	1.281552	1.644854	1.95996	2.32635	2.57583	3.2905
CI	———	———	80%	90%	95%	98%	99%	99.9%

Appendix 3

Critical values of F for the 0.05 significance level:

	1	2	3	4	5	6	7	8	9	10
1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.39	19.40
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14
10	4.97	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98
11	4.84	3.98	3.59	3.36	3.20	3.10	3.01	2.95	2.90	2.85
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49
17	4.45	3.59	3.20	2.97	2.81	2.70	2.61	2.55	2.49	2.45
18	4.41	3.56	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35
21	4.33	3.47	3.07	2.84	2.69	2.57	2.49	2.42	2.37	2.32
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.38	2.32	2.28
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.26
25	4.24	3.39	2.99	2.76	2.60	2.49	2.41	2.34	2.28	2.24
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.17
31	4.16	3.31	2.91	2.68	2.52	2.41	2.32	2.26	2.20	2.15
32	4.15	3.30	2.90	2.67	2.51	2.40	2.31	2.24	2.19	2.14
33	4.14	3.29	2.89	2.66	2.50	2.39	2.30	2.24	2.18	2.13
34	4.13	3.28	2.88	2.65	2.49	2.38	2.29	2.23	2.17	2.12
35	4.12	3.27	2.87	2.64	2.49	2.37	2.29	2.22	2.16	2.11

Appendix 4

RESEARCH QUESTIONNAIRE

KNOWLEDGE, ATTITUDE AND BEHAVIOR TOWARD DENGUE INFECTIONS IN THE COMMUNITY OF DILI MUNICIPALITY, POST ADMINISTRATIVE LEVEL

I. KNOWLEDGE

1. Is dengue disease caused by mosquito (*Aedes aegypti* or *Aedes albopictus*) bites?
   a) Yes
   b) No

2. The signs of a person suffering from dengue infection are sudden fever, Headache, joint/bone/muscle pain, Heartburn Red spots on the skin, bleeding gums/nose, coughing up blood, defecating blood, and so on?
   a) Yes
   b) No

3. Is dengue infection a dangerous disease because it causes death and infects other family members?
   a) Yes
   b) No

4. does dengue infection spread Through the bite of a mosquito that has previously bitten a fever sufferer bleeding?
   a) Yes
   b) No

5. the abate powder is use for Killing mosquito larvae?
   a) Yes
   b) No

6. Do water reservoirs (jars) that are not closed, bathtubs, used cans filled with water, and their kinds constitute the places that have the potential to be a breeding ground for dengue infection mosquitoes?
   a) Yes
   b) No

7. Do you know the term 2HS (In Tetum language) in the prevention dengue infection?
   a) Know which stands for ……………………..
   b) Don’t know

8. Are burying or cleaning used items that can hold water (used cans, used bottles, used plastic containers, used tires, etc.) the actions to prevent dengue infection?
   a) Yes
   b) No

9. Do you think that the ministry of health is program to eradicate dengue infections such as 2HS, Larva supervisor, Fogging (fumigation) Spread of abate powder, Reporting and monitoring residents affected dengue infection is important?

a) Yes
b) No

10. Is knowledge about dengue disease and the transmission of it for a housewife very important?

a) Yes
b) No

II. ATITUDE

1. According to you Mrs. Is prevention of dengue infection a community need that must be done immediately?

a) Yes, (reason)……………
b) No (reason) ………………

2. In your opinion, the only government or program manager who will be involved in dealing with dengue infections?

a) Yes
b) No (All components of society, including housewives)

3. Do you agree if there is an effort to prevent dengue infection on a regular basis in your neighborhood?

a) Yes (agree)
b) No

4. If an effort is made to prevent dengue disease in the environment you live in, are you willing to actively participate in carrying it out?

a) Yes
b) No

5. Do you think it is necessary to clean or drain the bathtub?

a) Yes
b) No

6. Do you agree with the 2HS efforts promoted by the government?

a) Yes
b) No

7. Do you think it's okay to keep clothes hanging?

a) Yes

b) No

8. In your opinion, is it necessary to control mosquito larvae?

a) Yes

b) No

9. In your opinion, is fogging alone enough and effective in preventing dengue infection?

a) Yes

b) Not

10. In your opinion, is it important to pay attention to your own health, family, and do 2HS to prevent dengue infection?

a) Yes

b) No

III. PRACTICE

1. Does your family drain and clean the bath/water reservoir at home at least once per week?

a) Yes

b) No

2. Does your family use a water storage/reservoir for daily needs at home with the condition that it be closed after use?

a) Yes

b) No

3. Does your family regularly clean/bury/burn used items that can be a breeding ground for mosquitoes?

a) Yes

b) No

4. Does your family use abate in the water reservoir at home more frequently than once every three months?

a) Yes

b) No

5. Does your family cover the windows, vents, or doors with mosquito nets?

a) Yes

b) No

6. Has your family ever monitored mosquito larvae at home?

a) Yes

b) Not

If so, when and how were the results of the examination?

Date month.................. .... years................................Results.
....

7. Is your family's practice of storing worn-out clothes strewn about the room?

a) Yes

b) No

8. Does your family use protection against mosquito bites when resting in the morning and evening (e.g., using mosquito repellent lotion/mosquito repellent spray/burning/electrical, using mosquito nets)?

a) Yes

b) No

9. Has your family participated in the prevention or control of dengue fever in the area where you live?

a) Yes (Ever)

b) No (Never)

10. What is your garbage disposal habit; routinely transporting and collecting by cleaning personnel or regularly burning or burying in the environment around the house? a)

b) Yes

c) No (Thrown into the river, thrown around the house or neighbors etc.)

Appendix 5

a. The Form of Questionnaires for Evaluation (Tetun)

Evaluasaun Ba Questionare konaba Konhesemento, Attitude no pratica iha Prevensaun no controlo Moras Dengue husi Dona da Casa (Evaluation of Questionaire)

I	Dadus Geral (General Data)	SPC. I		SPC. II	
	Carimbo de data/hora: Municipio, Posto Administrativu no Suco: Naran: Edade:	**Aceita (Agree)**	**La aseita (Disagree)**	**Aceita (Agree)**	**La aseita (Disagree)**
	Karik iha membru famila ruma sofre moras dengue durante periodu husi fulan janeiru 2016, 2017, 2018, 2019, 2020, 2021, 2022 no agora?				
	karik sim, oinsa ho ninia kondisaun agora?				
II	**Konhesementu (Knowledge)**				
1	Ita bot hatene konaba moras dengue, saida maka kauza hamosu moras dengue?				
2	Sinal no sintoma saida deit maka sei mosu ba ema ida, karik ema ne sofree moras dengue?				
3	Tuir ita bot nia hanoin moras Dengue perigu tebes?				
4	Tuir ita nia hanoin oinsa moras dengue transmite/ hadaet liu husi saida?				
5	Ita bot hatene funsaun husi aimoruk ho naran Abate?				
6	Fatin saida deit maka diak ba susuk moras dengue ninia atu moris ba?				
7	Ita bot hatene susuk Moras dengue ninia bele tata ou afecta se ?				

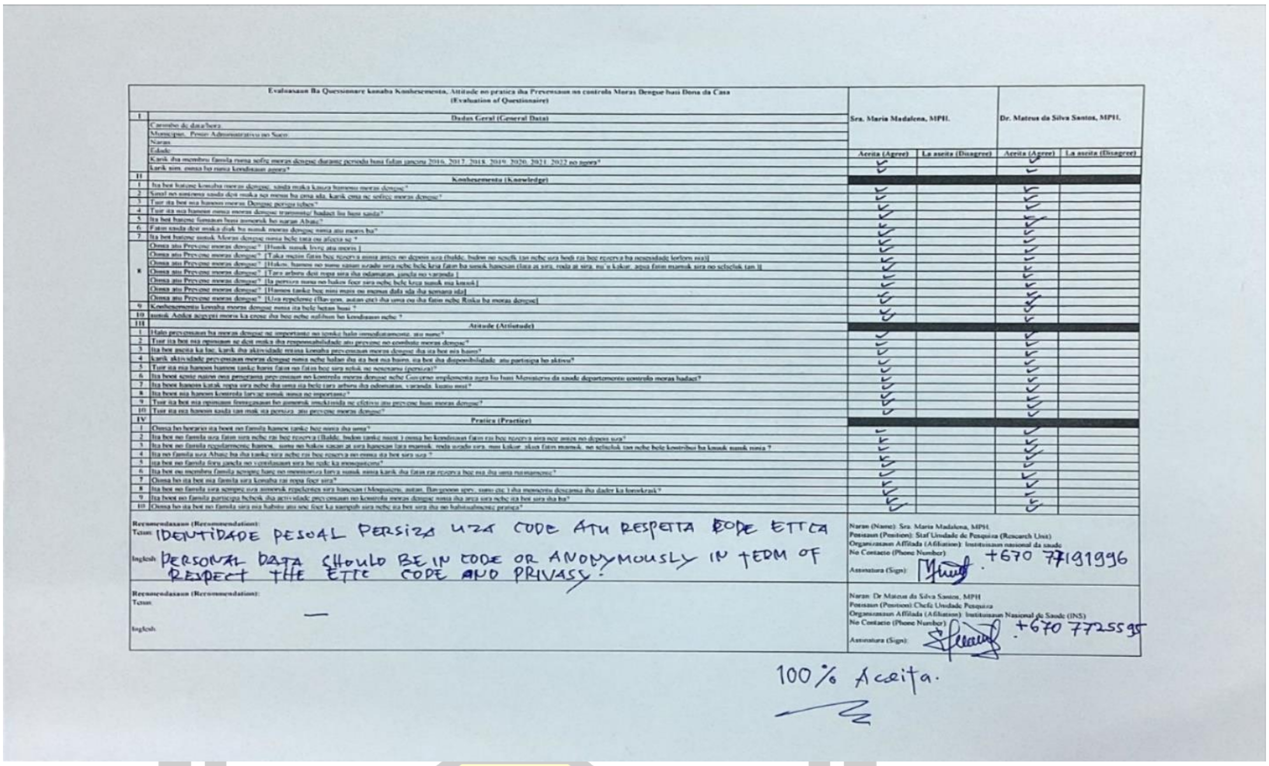
	Oinsa atu Prevene moras dengue? [Husik susuk livre atu moris]
	Oinsa atu Prevene moras dengue? [Taka metin fatin bee rezerva ninia antes no depois uza (balde, bidon no seselk tan nebe uza hodi rai bee rezerva ba nesesidade lorlorn nia)]
	Oinsa atu Prevene moras dengue? [Hakoi, hamos no sunu sasan uzadu sira nebe bele kria fatin ba susuk hanesan (lata at sira, roda at sira, nu'u kakur, aqua fatin mamuk sira no selseluk tan.)]
8	Oinsa atu Prevene moras dengue? [Tara arbiru deit rupa sira iha odamatan, janela no varanda]
	Oinsa atu Prevene moras dengue? [la persiza sunu no hakoi foer sira nebe bele krea susuk nia knuuk]
	Oinsa atu Prevene moras dengue? [Hamos tanke bee nini mais ou menus dala ida iha semana ida]
	Oinsa atu Prevene moras dengue? [Uza repelente (Baygon, autan etc) iha uma ou iha fatin nebe Risku ba moras dengue]
9	Konhesementu konaba moras dengue ninia ita bele hetan husi ?
10	susuk Aedes aegypti moris ka crese iha bee nebe nalihun ho kondisaun nebe ?
III	**Atitude (Attiutude)**
1	Halo prevensaun ba moras dengue ne importante no temke halo inmediatamente, atu nune?
2	Tuir ita bot nia opiniaun se deit maka iha responsabilidade atu prevene no combate moras dengue?
3	Ita bot aseita ka lae, karik iha aktividade rotina konaba prevensaun moras dengue iha ita bot nia bairo?
4	karik aktividade prevensaun moras dengue ninia nebe halao iha ita bot nia bairo, ita bot iha disponibilidade atu partisipa ho aktivu?
5	Tuir ita nia hanoin hamos tanke haris fatin no fatin bee sira

	seluk ne nesesariu (persiza)?
6	Ita boot sente naton ona programa prevensaun no kontrolu moras dengue nebe Guverno implementa agra liu husi Menisteriu da saude departementu controlo moras hadaet?
7	Ita boot hanoin katak ropa sira nebe iha uma ita bele tara arbiru iha odomatan, varanda, kuatu nsst?
8	Ita boot nia hanoin kontrola larvae susuk ninia ne inportante?
9	Tuir ita bot nia opiniaun fomigasaun ho aimoruk insektisida ne efetivu atu prevene husi moras dengue?
10	Tuir ita nia hanoin saida tan mak ita persiza atu prevene moras dengue?
IV	**Pratica (Practice)**
1	Oinsa ho horario ita boot no famila hamos tanke bee ninia iha uma?
2	Ita bot no famila uza fatin sira nebe rai bee rezerva (Balde, bidon tanke nssst.) oinsa ho kondisaun fatin rai bee rezerva sira nee antes no depois uza?
3	Ita bot no famila regularmente hamos, sunu no hakoi sasan at sira hanesan lata mamuk, roda uzadu sira, nuu kakur, akua fatin mamuk, no selseluk tan nebe bele kontribui ba knuuk susuk ninia ?
4	Ita no famila uza Abate ba iha tanke sira nebe rai bee reserva no oinsa ita bot sira uza ?
5	ita bot no famila foru janela no ventilasaun sira ho rede ka mosquiteiru?
6	Ita bot ou membru famila sempre hare no monitoriza larva susuk ninia karik iha fatin rai rezerva bee nia iha uma rutinamente?
7	Oinsa ho ita bot nia famila sira konaba rai ropa foer sira?
8	Ita bot no famila sira sempre uza aimoruk repelentes sira

	hanesan (Moquiteru, autan, Baygooon spry, sunu etc.) iha momentu descansa iha dader ka lororkraik?
9	Ita boot no famila participa bebeik iha actividade prevensaun no kontrolu moras dengue ninia iha area sira nebe ita bot sira iha ba?
10	Oinsa ho ita bot no famila sira nia habitu atu soe foer ka sampah sira nebe ita bot sira iha no habitualmente pratica?

Recomendasaun (Recommendation): Tetun: Inglesh:	Naran (Name): Posisaun (Position): Organizasaun Affilada (Afiliation): Numero Contacto (Phone Number): Assinatura (Sign):
Recomendasaun (Recommendation): Tetun: Inglesh:	Naran: Posisaun (Position): Organizasaun Affilada (Afiliation): Numero Contacto (Phone Number): Assinatura (Sign):

b. Approved Result for Questionaries Evaluation



Evaluasaun Ba Quessionare konaba Koñesementu, Attitude no pratica iha Prevensaun no controla Moras Dengue husi Dona da Casa
(Evaluation of Questionnaire)

No	Item	Sra. Maria Madalena, MPH. Aceita (Agree)	Sra. Maria Madalena, MPH. La aseita (Disagree)	Dr. Mateus da Silva Santos, MPH. Aceita (Agree)	Dr. Mateus da Silva Santos, MPH. La aseita (Disagree)
I	**Dadus Geral (General Data)**				
	Carimbo de data/hora				
	Municipio, Posto Administrativo no Suco				
	Naran				
	Idade				
	Karik iha membru famila nebe sofre moras dengue durante periodu husi fulan janeiru 2016, 2017, 2018, 2019, 2020, 2021, 2022 no agora?	✓		✓	
	karik sim, ema ho nia kondisaun agora?	✓		✓	
II	**Koñesementu (Knowledge)**				
1	[illegible]	✓		✓	
2	[illegible]	✓		✓	
3	[illegible]	✓		✓	
4	[illegible]	✓		✓	
5	[illegible]	✓		✓	
6	[illegible]	✓		✓	
7	[illegible]	✓		✓	
8	Oinsa atu Prevene moras dengue? [illegible]	✓		✓	
	Oinsa atu Prevene moras dengue? [illegible]	✓		✓	
	Oinsa atu Prevene moras dengue? [illegible]	✓		✓	
	Oinsa atu Prevene moras dengue? [illegible]	✓		✓	
	Oinsa atu Prevene moras dengue? [illegible]	✓		✓	
	Oinsa atu Prevene moras dengue? [illegible]	✓		✓	
	Oinsa atu Prevene moras dengue? [illegible]	✓		✓	
9	[illegible]	✓		✓	
10	[illegible]	✓		✓	
III	**Atitude (Attitude)**				
1	[illegible]	✓		✓	
2	[illegible]	✓		✓	
3	[illegible]	✓		✓	
4	[illegible]	✓		✓	
5	[illegible]	✓		✓	
6	[illegible]	✓		✓	
7	[illegible]	✓		✓	
8	[illegible]	✓		✓	
9	[illegible]	✓		✓	
10	[illegible]	✓		✓	
IV	**Pratica (Practice)**				
1	[illegible]	✓		✓	
2	[illegible]	✓		✓	
3	[illegible]	✓		✓	
4	[illegible]	✓		✓	
5	[illegible]	✓		✓	
6	[illegible]	✓		✓	
7	[illegible]	✓		✓	
8	[illegible]	✓		✓	
9	[illegible]	✓		✓	
10	[illegible]	✓		✓	

Recomendasaun (Recommendation):
Tetum: IDENTIDADE PESOAL PERSIZA UZA CODE ATU RESPEITA KODE ETTCA
Inglesh: PERSONAL DATA SHOULD BE IN CODE OR ANONYMOUSLY IN TERM OF RESPECT THE ETIC CODE AND PRIVASY.

Naran (Name): Sra. Maria Madalena, MPH
Posisaun (Position): Staf Unidade de Pesquisa (Research Unit)
Organizasaun Afiliada (Afiliation): Institusaun nasional da saude
No Contacto (Phone Number): +670 77191996
Assinatura (Sign): [signature]

Recomendasaun (Recommendation):
Tetum: —
Inglesh:

Naran: Dr Mateus da Silva Santos, MPH
Posisaun (Position): Chefe Unidade Pesquisa
Organizasaun Afiliada (Afiliation): Institusaun Nasional de Saude (INS)
No Contacto (Phone Number): +670 77255595
Assinatura (Sign): [signature]

100 % Aceita.

Appendix 6

a. The first reliability questioners test (10 questions per item) (*n* = 20 housewives)

No. Resp	Total Score Knowledge (X1)	Total Score Attitude (X2)	Total Score Practice (X3)
1	9	8	8
2	10	9	9
3	10	9	9
4	4	3	3
5	6	8	5
6	8	6	5
7	7	7	4
8	9	5	4
9	5	6	2
10	8	6	5
11	7	7	4
12	9	9	8
13	4	5	2
14	7	5	4
15	8	8	7
16	8	6	5
17	7	8	6
18	6	4	2
19	6	9	6
20	8	5	4

Reliability Statistics

Cronbach's Alpha	N of Items
.883	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
K (Knowledge)	11.75	14.724	.701	.897
A (Attitude)	12.40	13.937	.737	.867
P (Practice)	13.95	9.734	.922	.694

b. The second reliability questioners Test (10 questions per item) (*n*= 20 Housewives)

No. Resp	Total Score Knowledge (X1)	Total Score Attitude (X2)	Total Score Practice (X3)
1	9	8	8
2	10	9	9
3	10	9	9
4	4	3	3
5	6	8	5
6	8	6	5
7	7	7	4
8	9	5	4
9	5	6	2
10	8	6	5
11	7	7	4
12	9	9	8
13	4	5	2
14	7	5	4
15	8	8	7
16	8	6	5
17	7	8	6
18	6	4	2
19	6	9	6
20	8	7	4

Reliability Statistics

Cronbach's Alpha	N of Items
.886	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
K (Knowledge)	11.85	14.345	.722	.888
A (Attitude)	12.40	13.937	.747	.867
P (Practice)	14.05	9.734	.905	.725

Appendix 7

a. The data (KAP survey: n = 70 housewives) of Dom Aleixo Administrative Post

			Knowledge										Attitude										Practice											
Timestamp	**Name**	**Age**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**Total Score**	**%**
1/4/2023 13:26:33	#	28	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	26	86.7
1/4/2023 14:16:02	#	32	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	27	90.0
1/4/2023 20:01:41	#	31	0	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	25	83.3
1/4/2023 21:17:04	#	32	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	13	**43.3**
1/4/2023 21:22:36	#	31	0	0	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	1	0	1	19	63.3
1/4/2023 21:27:13	#	25	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	14	**46.7**
1/4/2023 21:32:13	#	23	0	0	1	0	1	1	1	1	1	0	1	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0	14	**46.7**
1/4/2023 21:36:50	#	32	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	15	**50.0**
1/4/2023 21:59:43	#	49	0	0	1	1	1	0	0	1	1	0	1	0	0	1	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	14	**46.7**
1/4/2023 22:03:02	#	30	0	1	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	13	**43.3**
1/4/2023 22:18:36	#	49	0	0	1	1	1	0	1	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	13	**43.3**
1/5/2023 0:42:21	#	25	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	14	**46.7**
1/5/2023 1:15:18	#	30	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	11	**36.7**
1/7/2023 10:56:24	#	23	0	0	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	1	1	0	0	16	53.3
1/7/2023 10:59:38	#	33	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	1	0	0	0	1	1	0	1	20	66.7
1/7/2023 11:03:16	#	29	0	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0	13	**43.3**
1/7/2023 11:06:42	#	32	0	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	0	1	1	0	0	18	60.0

Timestamp	Name	Age	Knowledge a	b	c	d	e	f	g	h	i	j	Attitude a	b	c	d	e	f	g	h	i	j	Practice a	b	c	d	e	f	g	h	i	j	Total Score	%
1/7/2023 11:15:53	#	24	0	1	1	1	1	0	0	0	1	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	13	**43.3**
1/7/2023 19:39:40	#	38	0	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	15	**50.0**
1/7/2023 19:40:46	#	27	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	8	**26.7**
1/8/2023 9:34:30	#	23	0	0	1	1	1	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	9	**30.0**
1/8/2023 9:37:18	#	23	0	0	1	1	1	0	0	1	1	0	1	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	0	1	14	**46.7**
1/8/2023 9:40:27	#	33	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	14	**46.7**
1/8/2023 9:44:45	#	53	0	1	1	1	1	0	1	1	1	0	1	1	1	0	1	0	1	1	0	1	0	1	0	0	0	0	1	1	0	1	19	63.3
1/8/2023 16:05:42	#	28	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	1	0	1	1	0	11	**36.7**
1/8/2023 20:17:33	#	29	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	23	76.7
1/9/2023 5:30:25	#	27	0	0	1	0	1	0	1	0	1	0	1	0	0	1	1	0	1	0	0	1	0	1	0	0	0	0	1	0	0	1	12	**40.0**
1/9/2023 6:29:45	#	34	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	1	8	**26.7**
1/9/2023 13:40:54	#	56	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	0	0	19	63.3
1/9/2023 13:45:45	#	42	1	0	1	1	1	1	0	0	1	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	12	**40.0**
1/12/2023 17:13:08	#	48	0	1	1	1	1	0	0	1	1	1	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	13	**43.3**
1/4/2023 11:34:09	#	29	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	0	0	25	83.3
1/16/2023 11:12:51	#	50	0	1	1	1	0	1	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	0	1	0	0	1	0	1	0	0	15	**50.0**
1/17/2023 18:34:48	#	38	0	0	1	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	0	1	20	66.7
1/18/2023 8:10:33	#	28	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
1/20/2023 8:55:54	#	30	0	0	1	1	1	1	1	0	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	11	**36.7**
1/20/2023 9:30:40	#	25	0	1	1	1	1	0	1	1	1	1	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	13	**43.3**

			Knowledge										Attitude										Practice											
Timestamp	**Name**	**Age**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**Total Score**	**%**
1/20/2023 9:41:21	#	36	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	13	**43.3**
1/20/2023 9:45:47	#	45	0	0	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	0	0	1	1	0	0	0	1	0	1	1	0	1	19	63.3
1/20/2023 9:49:22	#	37	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	12	**40.0**
1/20/2023 9:52:26	#	42	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	12	**40.0**
1/20/2023 12:58:01	#	57	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	14	**46.7**
1/20/2023 13:00:29	#	56	0	0	1	1	1	1	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	11	**36.7**
1/20/2023 13:02:37	#	37	0	0	1	1	1	1	1	0	1	1	1	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	13	**43.3**
1/20/2023 14:36:31	#	34	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	13	**43.3**
1/24/2023 14:41:27	#	44	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	13	**43.3**
1/24/2023 14:45:05	#	41	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	13	**43.3**
1/24/2023 19:54:03	#	38	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	1	0	0	0	0	0	1	0	1	0	0	1	15	**50.0**
3/10/2023 7:48:12	#	25	0	0	1	1	1	0	1	1	1	0	1	0	1	1	1	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	15	**50.0**
3/10/2023 7:59:42	#	32	0	1	1	1	1	0	0	0	1	1	1	0	1	1	1	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	15	**50.0**
3/10/2023 8:27:24	#	52	0	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	13	**43.3**
3/10/2023 8:31:30	#	56	0	0	1	1	1	0	0	1	1	0	1	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	1	0	0	1	14	**46.7**
3/10/2023 8:36:42	#	41	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	0	1	0	0	0	0	1	0	1	1	0	1	19	63.3
3/10/2023 8:46:19	#	25	0	0	1	0	1	0	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	1	15	**50.0**
3/10/2023 8:54:31	#	30	0	1	1	1	1	0	1	0	1	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	11	**36.7**
23/4/2023 9:08:15	#	24	0	0	1	1	1	0	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	0	0	0	1	0	1	1	0	1	17	56.7
23/4/2023 9:21:17	#	25	0	0	1	1	1	1	1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	12	**40.0**

Timestamp	Name	Age	Knowledge										Attitude										Practice										Total Score	%
			a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j		
3/10/2023 9:28:30	#	21	0	1	1	1	1	0	0	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	12	**40.0**
3/10/2023 13:02:38	#	32	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	14	**46.7**
3/11/2023 12:52:23	#	45	0	0	1	0	0	0	0	0	1	1	0	0	1	1	1	1	0	1	0	0	0	1	1	0	1	1	1	0	1	1	15	**50.0**
3/11/2023 12:54:45	#	34	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	1	10	**33.3**
3/11/2023 12:58:09	#	45	0	1	0	0	0	0	1	0	1	1	0	1	1	0	0	1	0	1	0	1	0	1	0	0	0	0	0	1	0	1	12	**40.0**
3/11/2023 13:01:22	#	37	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	0	0	1	0	0	0	0	0	1	0	0	1	1	1	10	**33.3**
3/11/2023 13:04:04	#	28	1	0	0	0	1	0	0	0	1	1	0	0	1	1	0	1	0	0	1	0	1	1	1	0	1	1	0	0	1	0	14	**46.7**
4/23/2023 13:26:33	#	32	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	26	86.7
4/4/2023 14:16:02	#	31	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	27	90.0
1/4/2023 0:00:00	#	32	0	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	25	83.3
5/4/2023 21:17:04	#	31	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	20	66.7
5/4/2023 21:22:36	#	25	0	0	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	1	0	1	19	63.3
5/4/2023 21:27:13	#	37	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	26	86.7

b. The data (KAP survey: n = 68 housewives) of Cristo Rei Administrative Post

			Knowledge										Attitude										Practice											
Timestamp	**Name**	**Age**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**Total Score**	**%**
1/5/2023 0:01:56	#	35	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	12	**40.0**
1/6/2023 2:12:14	#	55	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	12	**40.0**
1/6/2023 3:00:30	#	31	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	14	**46.7**
1/6/2023 3:05:34	#	35	0	0	1	1	1	1	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	11	**36.7**
1/6/2023 4:28:56	#	29	0	0	1	1	1	1	1	0	1	1	1	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	13	**43.3**
1/6/2023 5:16:09	#	30	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	13	**43.3**
1/6/2023 10:26:45	#	28	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	23	76.7
1/6/2023 12:25:59	#	27	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0
1/6/2023 12:59:07	#	27	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	13	**43.3**
1/6/2023 13:31:27	#	26	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	13	**43.3**
1/9/2023 5:18:35	#	31	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
1/9/2023 5:31:47	#	25	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	0	0	24	80.0
1/9/2023 11:37:21	#	34	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	25	83.3
1/14/2023 1:27:13	#	31	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	1	24	80.0
1/14/2023 9:32:41	#	29	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	22	73.3
1/16/2023 8:15:44	#	26	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/18/2023 3:22:14	#	47	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
1/20/2023 9:41:21	#	25	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	14	**46.7**
1/20/2023 9:45:47	#	45	0	0	1	0	1	1	1	1	1	0	1	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0	14	**46.7**

Timestamp	Name	Age	Knowledge a	b	c	d	e	f	g	h	i	j	Attitude a	b	c	d	e	f	g	h	i	j	Practice a	b	c	d	e	f	g	h	i	j	Total Score	%
1/20/2023 9:49:22	#	47	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	15	**50.0**
1/20/2023 9:52:26	#	37	0	0	1	1	1	0	0	1	1	0	1	0	0	1	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	14	**46.7**
1/20/2023 12:58:01	#	38	0	1	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	1	0	1	0	0	0	1	0	0	1	0	0	1	16	53.3
1/20/2023 13:00:29	#	25	0	0	1	1	1	0	1	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	1	1	0	1	16	53.3
1/20/2023 13:02:37	#	26	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	14	**46.7**
1/20/2023 14:36:31	#	23	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	11	**36.7**
1/24/2023 14:41:27	#	26	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	11	**36.7**
1/24/2023 14:45:05	#	29	0	0	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	1	1	0	0	16	53.3
1/24/2023 19:54:03	#	31	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	1	0	0	0	1	1	0	1	20	66.7
3/10/2023 7:48:12	#	30	0	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0	13	**43.3**
3/10/2023 7:59:42	#	28	0	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	0	1	1	0	0	18	60.0
3/10/2023 8:27:24	#	41	0	1	1	1	1	0	0	0	1	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	13	**43.3**
3/10/2023 8:31:30	#	29	0	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	15	**50.0**
3/10/2023 8:36:42	#	44	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	8	**26.7**
3/10/2023 8:46:19	#	44	0	0	1	1	1	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	9	**30.0**
3/10/2023 8:54:31	#	43	0	0	1	1	1	0	0	1	1	0	1	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	0	1	14	**46.7**
3/10/2023 9:08:15	#	22	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	14	**46.7**
3/10/2023 9:21:17	#	26	0	1	1	1	1	0	1	1	1	0	1	1	1	0	1	0	1	1	0	1	0	1	0	0	0	0	1	1	0	1	19	63.3
3/10/2023 9:28:30	#	29	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	1	0	1	1	0	11	**36.7**
3/10/2023 13:02:38	#	41	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	23	76.7

Timestamp	Name	Age	Knowledge a	b	c	d	e	f	g	h	i	j	Attitude a	b	c	d	e	f	g	h	i	j	Practice a	b	c	d	e	f	g	h	i	j	Total Score	%
3/11/2023 12:52:23	#	26	0	0	1	0	1	0	1	0	1	0	1	0	0	1	1	0	1	0	0	1	0	1	0	0	0	0	1	0	0	1	12	**40.0**
3/11/2023 12:54:45	#	19	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	1	8	**26.7**
3/11/2023 12:58:09	#	38	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	0	0	19	63.3
3/11/2023 13:01:22	#	33	1	0	1	1	1	1	0	0	1	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	12	**40.0**
3/11/2023 13:04:04	#	31	0	1	1	1	1	0	0	1	1	1	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	13	**43.3**
1/6/2023 4:28:56	#	28	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
1/6/2023 5:16:09	#	29	0	1	1	1	0	1	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	0	1	0	0	1	0	1	0	0	15	**50.0**
1/6/2023 10:26:45	#	28	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
1/6/2023 12:25:59	#	27	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
1/6/2023 12:59:07	#	28	0	0	1	1	1	1	1	0	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	11	**36.7**
1/6/2023 13:31:27	#	29	0	1	1	1	1	0	1	1	1	1	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	13	**43.3**
1/9/2023 5:18:35	#	34	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	13	**43.3**
1/9/2023 5:31:47	#	45	0	0	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	0	0	1	1	0	0	0	1	0	1	1	0	1	19	63.3
1/9/2023 11:37:21	#	44	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	12	**40.0**
1/14/2023 1:27:13	#	41	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	12	**40.0**
1/14/2023 9:32:41	#	26	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	14	**46.7**
1/16/2023 8:15:44	#	35	0	0	1	1	1	1	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	11	**36.7**
1/18/2023 3:22:14	#	34	0	0	1	1	1	1	1	0	1	1	1	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	13	**43.3**
1/20/2023 9:41:21	#	23	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	13	**43.3**
1/20/2023 9:45:47	#	19	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	13	**43.3**

			Knowledge										Attitude										Practice											
Timestamp	Name	Age	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	Total Score	%
1/20/2023 9:49:22	#	51	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	13	**43.3**
1/24/2023 19:54:03	#	31	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	1	0	0	0	1	1	0	1	20	66.7
3/10/2023 7:48:12	#	30	0	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1	1	1	1	1	1	1	1	19	63.3
5/5/2023 7:59:42	#	28	0	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	0	1	1	0	0	18	60.0
5/3/2023 8:27:24	#	41	0	1	1	1	1	0	0	0	1	0	1	0	0	1	1	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	17	56.7
3/10/2023 8:31:30	#	29	0	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	25	83.3
3/10/2023 8:36:42	#	44	0	1	0	0	0	0	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	21	70.0
3/10/2023 8:46:19	#	44	0	0	1	1	1	0	0	0	1	0	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	21	70.0
3/10/2023 8:54:31	#	43	0	0	1	1	1	0	0	1	1	0	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	23	76.7

c. The data (KAP survey: n = 66 housewives) of Vera Cruz Administrative Post

			Knowledge										Attitude										Practice											
Timestamp	**Name**	**Age**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**Total Score**	**%**
44931.00134	#	35	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	12	**40.0**
44932.09183	#	55	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	12	**40.0**
44932.12535	#	29	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	22	73.3
44932.12887	#	26	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
44932.18676	#	47	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
44932.21955	#	30	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	13	**43.3**
44932.43524	#	28	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	23	76.7
44932.51804	#	27	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0
44932.54105	#	27	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	13	**43.3**
44932.56351	#	26	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	13	**43.3**
44935.22124	#	31	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	20	66.7
44935.23041	#	31	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	14	**46.7**
44935.48427	#	35	0	0	1	1	1	1	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	11	**36.7**
44940.06057	#	29	0	0	1	1	1	1	1	0	1	1	1	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	13	**43.3**
44940.3977	#	29	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	22	73.3
44942.34425	#	26	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
44944.14044	#	47	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
44946.40372	#	25	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	14	**46.7**
44946.40679	#	45	0	0	1	0	1	1	1	1	1	0	1	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0	14	**46.7**
44946.40929	#	47	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	15	**50.0**
44946.41141	#	37	0	0	1	1	1	0	0	1	1	0	1	0	0	1	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	14	**46.7**
44946.54029	#	38	0	1	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	1	0	1	0	0	0	1	0	0	1	0	0	1	16	53.3
44946.54201	#	25	0	0	1	1	1	0	1	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	1	1	0	1	16	53.3
44946.54348	#	26	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	14	**46.7**

			Knowledge										Attitude										Practice											
Timestamp	Name	Age	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	Total Score	%
44946.6087	#	23	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	11	**36.7**
44950.61212	#	26	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	11	**36.7**
44950.61464	#	29	0	0	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	1	1	0	0	16	53.3
44950.8292	#	31	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	1	0	0	0	1	1	0	1	20	66.7
44995.32514	#	30	0	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0	13	**43.3**
44995.33313	#	28	0	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	0	1	1	0	0	18	60.0
44995.35236	#	41	0	1	1	1	1	0	0	0	1	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	13	**43.3**
44995.35521	#	29	0	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	15	**50.0**
44995.35882	#	44	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	8	**26.7**
44995.3655	#	44	0	0	1	1	1	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	9	**30.0**
44995.37119	#	43	0	0	1	1	1	0	0	1	1	0	1	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	0	1	14	**46.7**
44995.38073	#	22	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	14	**46.7**
44995.38978	#	26	0	1	1	1	1	0	1	1	1	0	1	1	1	0	1	0	1	1	0	1	0	1	0	0	0	0	1	1	0	1	19	63.3
44995.39479	#	29	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	1	0	1	1	0	11	36.7
44995.54349	#	41	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	23	76.7
44996.53638	#	26	0	0	1	0	1	0	1	0	1	0	1	0	0	1	1	0	1	0	0	1	0	1	0	0	0	0	1	0	0	1	12	**40.0**
44996.53803	#	19	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	1	8	**26.7**
44996.54038	#	38	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	0	0	19	63.3
44996.54262	#	33	1	0	1	1	1	1	0	0	1	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	12	**40.0**
44996.54449	#	31	0	1	1	1	1	0	0	1	1	1	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	13	**43.3**
44932.18676	#	28	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	0	0	25	83.3
44932.21955	#	29	0	1	1	1	0	1	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	0	1	0	0	1	0	1	0	0	15	**50.0**
44932.43524	#	28	0	0	1	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	0	1	20	66.7
44932.51804	#	27	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
44932.54105	#	28	0	0	1	1	1	1	1	0	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	11	**36.7**
44932.56351	#	29	0	1	1	1	1	0	1	1	1	1	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	13	**43.3**
44935.22124	#	34	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	13	**43.3**

Timestamp	Name	Age	Knowledge a	b	c	d	e	f	g	h	i	j	Attitude a	b	c	d	e	f	g	h	i	j	Practice a	b	c	d	e	f	g	h	i	j	Total Score	%
44935.23041	#	45	0	0	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	0	0	1	1	0	0	0	1	0	1	1	0	1	19	63.3
44935.48427	#	44	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	12	**40.0**
44995.3655	#	24	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	13	**43.3**
44995.37119	#	34	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	20	66.7
44995.38073	#	42	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	0	0	24	80.0
44995.3655	#	26	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	25	83.3
44932.54105	#	27	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	22	73.3
44932.56351	#	26	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	23	76.7
44935.22124	#	31	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	20	66.7
44935.23041	#	31	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	1	0	0	1	1	1	1	1	1	1	20	66.7
44935.48427	#	35	0	0	1	1	1	1	0	1	0	1	1	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	21	70.0
44940.06057	#	29	0	0	1	1	1	1	1	0	1	1	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	23	76.7
44940.3977	#	29	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	22	73.3
44942.34425	#	26	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
44944.14044	#	47	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0

d. The data (KAP survey: n = 64 housewives) of Nain Feto Administrative Post

			Knowledge										Attitude										Practice											
Timestamp	**Name**	**Age**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**Total Score**	**%**
1/5/2023 0:01:56	#	35	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	12	**40.0**
1/6/2023 2:12:14	#	55	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	12	**40.0**
1/6/2023 3:00:30	#	31	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	14	**46.7**
1/6/2023 3:05:34	#	35	0	0	1	1	1	1	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	11	**36.7**
1/6/2023 4:28:56	#	29	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	22	73.3
1/6/2023 5:16:09	#	26	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/6/2023 10:26:45	#	47	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
1/6/2023 12:25:59	#	27	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0
1/6/2023 12:59:07	#	27	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	13	**43.3**
1/6/2023 13:31:27	#	26	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	13	**43.3**
1/9/2023 5:18:35	#	31	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	20	66.7
1/9/2023 5:31:47	#	35	0	0	1	1	1	1	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	11	**36.7**
1/9/2023 11:37:21	#	29	0	0	1	1	1	1	1	0	1	1	1	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	13	**43.3**
1/14/2023 1:27:13	#	30	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	13	**43.3**
1/14/2023 9:32:41	#	29	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	22	73.3
1/16/2023 8:15:44	#	26	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/18/2023 3:22:14	#	47	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
1/20/2023 9:41:21	#	25	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	14	**46.7**
1/20/2023 9:45:47	#	45	0	0	1	0	1	1	1	1	1	0	1	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0	14	**46.7**

Timestamp	Name	Age	Knowledge										Attitude										Practice											
			a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	Total Score	%
1/20/2023 9:49:22	#	47	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	15	**50.0**
1/20/2023 9:52:26	#	37	0	0	1	1	1	0	0	1	1	0	1	0	0	1	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	14	**46.7**
1/20/2023 12:58:01	#	38	0	1	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	1	0	1	0	0	0	1	0	0	1	0	0	1	16	53.3
1/20/2023 13:00:29	#	25	0	0	1	1	1	0	1	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	1	1	0	1	16	53.3
1/20/2023 13:02:37	#	26	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	14	**46.7**
1/20/2023 14:36:31	#	23	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	11	**36.7**
1/24/2023 14:41:27	#	26	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	11	**36.7**
1/24/2023 14:45:05	#	29	0	0	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	1	1	0	0	16	53.3
1/24/2023 19:54:03	#	31	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	1	0	0	0	1	1	0	1	20	66.7
3/10/2023 7:48:12	#	30	0	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0	13	**43.3**
3/10/2023 7:59:42	#	28	0	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	0	1	1	0	0	18	60.0
3/10/2023 8:27:24	#	41	0	1	1	1	1	0	0	0	1	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	13	**43.3**
3/10/2023 8:31:30	#	29	0	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	15	**50.0**
3/10/2023 8:36:42	#	44	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	8	**26.7**
3/10/2023 8:46:19	#	44	0	0	1	1	1	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	9	**30.0**
3/10/2023 8:54:31	#	43	0	0	1	1	1	0	0	1	1	0	1	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	0	1	14	**46.7**
3/10/2023 9:08:15	#	22	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	14	**46.7**
3/10/2023 9:21:17	#	26	0	1	1	1	1	0	1	1	1	0	1	1	1	0	1	0	1	1	0	1	0	1	0	0	0	0	1	1	0	1	19	63.3
3/10/2023 9:28:30	#	29	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	1	0	1	1	0	11	**36.7**
3/10/2023 13:02:38	#	41	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	23	76.7

			Knowledge										Attitude										Practice											
Timestamp	**Name**	**Age**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**Total Score**	**%**
3/11/2023 12:52:23	#	26	0	0	1	0	1	0	1	0	1	0	1	0	0	1	1	0	1	0	0	1	0	1	0	0	0	0	1	0	0	1	12	**40.0**
3/11/2023 12:54:45	#	19	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	1	8	**26.7**
3/11/2023 12:58:09	#	38	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	0	0	19	63.3
3/11/2023 13:01:22	#	33	1	0	1	1	1	1	0	0	1	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	12	**40.0**
3/11/2023 13:04:04	#	31	0	1	1	1	1	0	0	1	1	1	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	13	**43.3**
1/6/2023 4:28:56	#	28	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	0	0	25	83.3
1/6/2023 5:16:09	#	29	0	1	1	1	0	1	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	0	1	0	0	1	0	1	0	0	15	**50.0**
1/6/2023 10:26:45	#	28	0	0	1	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	0	1	20	66.7
1/6/2023 12:25:59	#	27	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
1/6/2023 12:59:07	#	41	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	1	24	80.0
1/6/2023 13:31:27	#	29	0	1	1	1	1	0	1	1	1	1	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	13	**43.3**
1/9/2023 5:18:35	#	34	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	20	66.7
1/9/2023 5:31:47	#	45	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	0	0	24	80.0
1/9/2023 11:37:21	#	44	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	25	83.3
1/14/2023 1:27:13	#	41	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	1	24	80.0
1/14/2023 9:32:41	#	26	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	22	73.3
1/16/2023 8:15:44	#	35	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
44940.06057	#	23	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	27	90.0
1/5/2023 0:01:56	#	35	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	22	73.3
1/6/2023 2:12:14	#	55	0	0	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	25	83.3
1/6/2023	#	31	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	23	76.7

Timestamp	Name	Age	Knowledge										Attitude										Practice										Total Score	%
			a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j		
3:00:30																																		
1/6/2023 3:05:34	#	35	0	0	1	1	1	1	0	1	0	1	1	0	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	22	73.3
1/6/2023 4:28:56	#	29	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	22	73.3

e. The data (KAP survey: n = 61 housewives) of Metinaro Administrative Post

Timestamp	Name	Age	Knowledge										Attitude										Practice										Total Score	%
			a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j		
1/5/2023 0:01:56	#	44	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
1/6/2023 2:12:14	#	43	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	23	76.7
1/6/2023 3:00:30	#	22	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0
1/6/2023 3:05:34	#	26	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/6/2023 4:28:56	#	29	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
1/6/2023 5:16:09	#	41	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	23	76.7
1/6/2023 10:26:45	#	26	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0
1/6/2023 12:25:59	#	19	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/6/2023 12:59:07	#	38	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/6/2023 13:31:27	#	33	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
1/9/2023 5:18:35	#	31	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	23	76.7
1/9/2023 5:31:47	#	28	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0

Timestamp	Name	Age	Knowledge										Attitude										Practice										Total Score	%
			a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j		
1/9/2023 11:37:21	#	29	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/14/2023 1:27:13	#	31	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	1	24	80.0
1/14/2023 9:32:41	#	29	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	22	73.3
1/16/2023 8:15:44	#	26	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/18/2023 3:22:14	#	47	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
1/20/2023 9:41:21	#	28	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	23	76.7
1/20/2023 9:45:47	#	27	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0
1/20/2023 9:49:22	#	26	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/20/2023 9:52:26	#	37	0	0	1	1	1	0	0	1	1	0	1	0	0	1	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	14	**46.7**
1/20/2023 12:58:01	#	38	0	1	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	1	0	1	0	0	0	1	0	0	1	0	0	1	16	53.3
1/20/2023 13:00:29	#	25	0	0	1	1	1	0	1	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	1	1	0	1	16	53.3
1/20/2023 13:02:37	#	26	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	14	**46.7**
1/20/2023 14:36:31	#	23	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	11	**36.7**
1/24/2023 14:41:27	#	26	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	11	**36.7**
1/24/2023 14:45:05	#	29	0	0	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	1	1	0	0	16	53.3
1/24/2023 19:54:03	#	31	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	1	0	0	0	1	1	0	1	20	66.7
3/10/2023 7:48:12	#	30	0	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0	13	**43.3**
3/10/2023 7:59:42	#	28	0	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	0	1	1	0	0	18	60.0
3/10/2023 8:27:24	#	41	0	1	1	1	1	0	0	0	1	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	13	**43.3**
3/10/2023 8:31:30	#	29	0	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	15	**50.0**
3/10/2023	#	44	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	8	**26.7**

Timestamp	Name	Age	Knowledge a	b	c	d	e	f	g	h	i	j	Attitude a	b	c	d	e	f	g	h	i	j	Practice a	b	c	d	e	f	g	h	i	j	Total Score	%
8:36:42 3/10/2023	#	44	0	0	1	1	1	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	9	**30.0**
8:46:19 3/10/2023	#	43	0	0	1	1	1	0	0	1	1	0	1	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	0	1	14	**46.7**
8:54:31 3/10/2023	#	22	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	14	**46.7**
9:08:15 3/10/2023	#	26	0	1	1	1	1	0	1	1	1	0	1	1	1	0	1	0	1	1	0	1	0	1	0	0	0	0	1	1	0	1	19	63.3
9:21:17 3/10/2023	#	29	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	1	0	1	1	0	11	**36.7**
9:28:30 3/10/2023	#	41	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	23	76.7
13:02:38 3/11/2023	#	26	0	0	1	0	1	0	1	0	1	0	1	0	0	1	1	0	1	0	0	1	0	1	0	0	0	0	1	0	0	1	12	**40.0**
12:52:23 3/11/2023	#	19	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	1	8	**26.7**
12:54:45 3/11/2023	#	38	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	0	0	19	63.3
12:58:09 3/11/2023	#	33	1	0	1	1	1	1	0	0	1	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	12	**40.0**
13:01:22 3/11/2023	#	31	0	1	1	1	1	0	0	1	1	1	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	13	**43.3**
13:04:04 1/6/2023	#	28	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
4:28:56 1/6/2023	#	29	0	1	1	1	0	1	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	0	1	0	0	1	0	1	0	0	15	**50.0**
5:16:09 1/6/2023	#	28	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
10:26:45 1/6/2023	#	27	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
12:25:59 1/6/2023	#	28	0	0	1	1	1	1	1	0	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	11	**36.7**
12:59:07 1/6/2023	#	29	0	1	1	1	1	0	1	1	1	1	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	13	**43.3**
13:31:27 1/9/2023	#	34	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	13	**43.3**
5:18:35 1/9/2023	#	45	0	0	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	0	0	1	1	0	0	0	1	0	1	1	0	1	19	63.3
5:31:47 1/9/2023 11:37:21	#	44	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	12	**40.0**

Timestamp	Name	Age	Knowledge a	b	c	d	e	f	g	h	i	j	Attitude a	b	c	d	e	f	g	h	i	j	Practice a	b	c	d	e	f	g	h	i	j	Total Score	%
1/14/2023 1:27:13	#	41	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	12	**40.0**
3/6/2023 3:05:34	#	26	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/3/1900 0:00:00	#	29	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
1/3/1900 0:00:00	#	41	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	23	76.7
1/3/1900 0:00:00	#	26	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0
1/3/1900 0:00:00	#	19	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/5/1900 0:00:00	#	38	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/6/1900 0:00:00	#	33	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0

f. The data (KAP survey: n = 60 housewives) of Atauro Administrative Post

Timestamp	Name	Age	Knowledge a	b	c	d	e	f	g	h	i	j	Attitude a	b	c	d	e	f	g	h	i	j	Practice a	b	c	d	e	f	g	h	i	j	Total Score	%
1/5/2023 0:01:56	#	25	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	0	0	24	80.0
1/6/2023 2:12:14	#	26	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	25	83.3
1/6/2023 3:00:30	#	23	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	1	24	80.0
1/6/2023 3:05:34	#	26	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	22	73.3
1/6/2023 4:28:56	#	29	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
1/6/2023 5:16:09	#	31	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
1/6/2023 10:26:45	#	25	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	23	76.7
1/6/2023 12:25:59	#	45	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0
1/6/2023 12:59:07	#	47	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	13	**43.3**
1/6/2023 13:31:27	#	26	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	25	83.3
1/9/2023 5:18:35	#	38	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
1/9/2023 5:31:47	#	25	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	0	0	24	80.0
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1/14/2023 1:27:13	#	23	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	1	24	80.0
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1/16/2023 8:15:44	#	29	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	21	70.0
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1/20/2023 9:41:21	#	31	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
1/20/2023 9:45:47	#	25	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	23	76.7

			Knowledge										Attitude										Practice											
Timestamp	Name	Age	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	Total Score	%
1/20/2023 9:49:22	#	45	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0
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1/20/2023 13:02:37	#	43	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	14	**46.7**
1/20/2023 14:36:31	#	41	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	1	0	0	0	1	1	0	1	20	66.7
1/24/2023 14:41:27	#	26	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	11	**36.7**
1/24/2023 14:45:05	#	29	0	0	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	1	1	0	0	16	53.3
1/24/2023 19:54:03	#	41	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	1	0	0	0	1	1	0	1	20	66.7
3/10/2023 7:48:12	#	31	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
3/10/2023 7:59:42	#	25	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	23	76.7
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3/10/2023 8:31:30	#	33	0	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	15	**50.0**
3/10/2023 8:36:42	#	45	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0
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Timestamp	Name	Age	Knowledge										Attitude										Practice										Total Score	%
			a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j	a	b	c	d	e	f	g	h	i	j		
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12:58:09 3/11/2023	#	33	1	0	1	1	1	1	0	0	1	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	12	**40.0**
13:01:22 3/11/2023	#	31	0	1	1	1	1	0	0	1	1	1	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	13	**43.3**
13:04:04 1/6/2023	#	31	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
4:28:56 1/6/2023	#	29	0	1	1	1	0	1	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	0	1	0	0	1	0	1	0	0	15	**50.0**
5:16:09 1/6/2023	#	31	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
10:26:45 1/6/2023	#	27	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0	15	**50.0**
12:25:59 1/6/2023	#	26	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	25	83.3
12:59:07 1/6/2023	#	23	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	1	24	80.0
13:31:27 1/9/2023	#	34	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	13	**43.3**
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5:31:47 1/9/2023	#	44	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	12	**40.0**
11:37:21 1/6/2023	#	31	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	21	70.0
5:16:09 1/6/2023	#	25	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	23	76.7
10:26:45 1/6/2023	#	45	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80.0
12:25:59 1/6/2023	#	47	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	21	70.0
12:59:07 1/6/2023	#	26	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	25	83.3
13:31:27 1/9/2023	#	38	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	23	76.7
5:18:35 1/9/2023 5:31:47	#	25	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	0	0	24	80.0

Appendix 8

The Data of Container surveyed in each of Six Administrative Post

1. Dom Aleixo Administrative Post

Mosquito larvae survey in the container in Dom Aleixo's administrative post (sub-district)						
No.	Type of container	Number of Container inspected	Number of Positive Container	Household Inspected	Household Positive based on Container Type	Number of Household Positive
	Recognized containers					
1	Concrete water storage tanks for bathrooms	63	59		21	
2	Discarded tires	50	49		5	
3	Discarded bottles and tin cans	42	31		4	
4	Metal drums for water storage	36	28		3	
5	Buckets	82	27		3	
6	Plastic containers	29	22	64	3	41
7	Water trays of refrigerators	20	12		2	
8	Pots	28	21		3	
9	Animal water container	44	40		3	
	Unrecognized containers					
1	Water trays of dispenser	3	0		0	
2	Aquarium	2	0		0	
3	Pan	1	0		0	
	Total	400	289			

2. Cristo Rei Administrative Post

No.	Type of container	Number of Container inspected	Number of Positive Container	Household Inspected	Household Positive based on Container Type	Number of Household Positive
	Mosquito Larvae survey in the container in Cristo Rei administrative post (sub-district)					
	Recognized containers					
1	Concrete water storage tanks for bathrooms	65	41		31	
2	Discarded tires	49	31		5	
3	Discarded bottles and tin cans	38	20		3	
4	Metal drums for water storage	30	18		3	
5	Buckets	30	16		3	
6	Plastic containers	29	12	64	3	35
7	Water trays of refrigerators	4	0		2	
8	Pots	29	9		3	
9	Animal water container	4	0		3	
	Unrecognized containers					
1	Water trays of dispenser	0	0		0	
2	Aquarium	0	0		0	
3	Pan	1	0		0	
	Total	246	147			

3. Vera Cruz Administrative Post

No.	Type of container	Number of Container inspected	Number of Positive Container	Household Inspected	Household Positive based on Container Type	Number of Household Positive
	Mosquito larvae survey in the container in Vera Cruz administrative post (sub-district)					
	Recognized containers					
1	Concrete water storage tanks for bathrooms	53	41		34	
2	Discarded tires	34	31		5	
3	Discarded bottles and tin cans	34	21		5	
4	Metal drums for water storage	26	0		3	
5	Buckets	82	30		3	
6	Plastic containers	29	16	63	3	35
7	Water trays of refrigerators	0	0		2	
8	Pots	15	2		3	
9	Animal water container	7	2		3	
	Unrecognized containers					
1	Water trays of dispenser	0	0		0	
2	Aquarium	0	0		0	
3	Pan	1	0		0	
	Total	281	143			

4. Nain Feto Administrative Post

Mosquito larvae survey in the container in Nain Feto administrative post (sub-district)						
No.	Type of container	Number of Container inspected	Number of Positive Container	Household Inspected	Household Positive based on Container Type	Number of Household Positive
	Recognized containers					
1	Concrete water storage tanks for bathrooms	73	32		33	
2	Discarded tires	24	21		5	
3	Discarded bottles and tin cans	35	25		5	
4	Metal drums for water storage	25	0		3	
5	Buckets	60	3		3	
6	Plastic containers	10	0	63	3	33
7	Water trays of refrigerators	3	1		2	
8	Pots	35	2		3	
9	Animal water container	8	0		3	
	Unrecognized containers					
1	Water trays of dispenser	17	0		0	
2	Aquarium	0	0		0	
3	Pan	7	0		0	
	Total	287	84			

5. Metinaro Administrative Post

No.	Type of container	Number of Container inspected	Number of Positive Container	Household Inspected	Household Positive based on Container Type	Number of Household Positive
	Mosquito larvae survey in the container in Metinaro administrative post (sub-district)					
	Recognized containers					
1	Concrete water storage tanks for bathrooms	65	17		28	
2	Discarded tires	5	1		5	
3	Discarded bottles and tin cans	37	2		5	
4	Metal drums for water storage	36	0		3	
5	Buckets	82	14		3	
6	Plastic containers	18	8	63	3	28
7	Water trays of refrigerators	2	0		2	
8	Pots	10	1		3	
9	Animal water container	9	3		3	
	Unrecognized containers					
1	Water trays of dispenser	0	0		0	
2	Aquarium	0	0		0	
3	Pan	1	0		0	
	Total	265	46			

6. Atauro Administrative Post

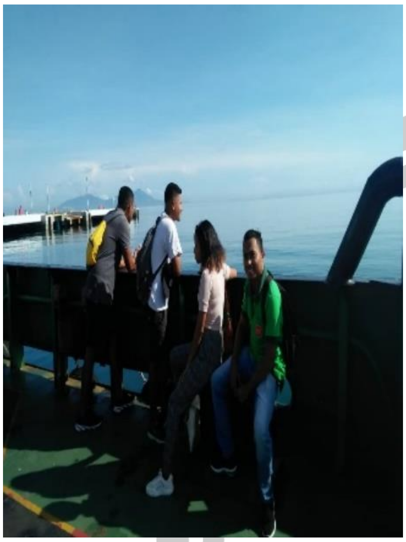
Mosquito larvae survey in the container in Atauro administrative post (sub-district)						
No.	Type of container	Number of Container inspected	Number of Positive Container	Household Inspected	Household Positive based on Container Type	Number of Household Positive
	Recognized containers					
1	Concrete water storage tanks for bathrooms	66	26		23	
2	Discarded tires	5	0		5	
3	Discarded bottles and tin cans	20	5		5	
4	Metal drums for water storage	30	0		3	
5	Buckets	65	7		3	
6	Plastic containers	15	4	63	3	23
7	Water trays of refrigerators	1	0		2	
8	Pots	9	1		3	
9	Animal water container	3	0		3	
	Unrecognized containers					
1	Water trays of dispenser	5	0		0	
2	Aquarium	0	0		0	
3	Pan	0	0		0	
	Total	219	43			

Appendix 9

Container survey by research team in each study area (Recognize and Unrecognize Containers)

The Team Conducted Research in each study Area.

The team trip to Atauro Administrative Post (An Island)



Appendix 10

MINISTERIO DA SAÚDE

Gabinete de Politica, Planeamento e Cooperação em Saúde

Department of Health Statistics Information

Ref° : MS-GPPCS/Dept.EIS/00/2022/315
Dili, 22 , 08 , 2022

Subject: To Facilitate Dengue Data from MoH TL

Respectfully, Sir or Madam,

Regarding the request from Dr. Zito Viegas da Cruz, from Thailand, Mahasarakham University Faculty of Medicine, majoring in Master Program in Tropical Health Innovation, appropriate for his thesis proposal title, **"Spatial Analysis of Dengue Infection Using Geographic Information Systems in Dili, Timor Leste."** To fulfill his research, he required the Department of Health Statistics Information (EIS) on August 17, 2022, to collect data on dengue cases according to the six administrative post levels, such as Vera-Cruz, Comoro (Dom Aleixo), Becora (Cristo Rei), Bairo-Formosa (Nain Feto), Metinaro, and Atauro. with a period of time from 2016 to 2022.

Due to the program of dengue control, the Department of Health Statistics, MoH Timor Leste, made available to support the data collection.

Distribution of Dengue Cases according to Six Administrative Post Levels in Dili Municipality, Timor Leste from 2016 to August 17, 2022.

No.	Administrative Post (Subdistricts)	2016	2017	2018	2019	2020	2021	Aug. 17, 2022	Total
1	Dom Aleixo	78	136	101	222	382	395	2.208	3522
2	Vera- Cruz	24	57	31	116	118	79	449	874
3	Cristo Rei	54	118	65	126	172	103	626	1264
4	Nain Feto	30	67	12	109	99	73	429	819
5	Atauro	5	11	4	18	16	9	32	95
6	Metinaro	21	19	10	29	25	13	70	187
7	**Total**	**212**	**408**	**223**	**620**	**812**	**672**	**3814**	**6.761**

That's all our department of health statistics information in collaboration with all of the students in their success.

Thank you and best regards.

Prepared By:
(Mr. Calistro da C. Pasheco)
Official. EIS

Approved By:
(Mr. Afonso Lima Araujo, Lic.SP)
Chief of the health information statistical department, MoH.TL

Copy to the:

1. Dr. Zito Viegas da Cruz
2. Mahasarakham University (MSU)

BIOGRAPHY

NAME	Mr. Zito Viegas da Cruz
DATE OF BIRTH	29 January 1990
PLACE OF BIRTH	Ai-assa, Bobonaro, Timor Leste
ADDRESS	Country: Timor Leste Administrative Post: Maliana Village: Odomao Sub-Village: Roccon Email: zitoviegas6@gmail.com Actual Adress: Karaket Dorm Mahasarakham University (MSU), Talad, Muang, Thailand, 44000
POSITION	As a student at the Master Science Program in Tropical Health Innovation, Faculty of Medicine, Mahasarakham University's (MSU), Thailand.
PLACE OF WORK	Student
EDUCATION	Bachelor Degree in Medical Doctor (2009-2016), M.Sc. Tropical Health Innovation, Faculty of Medicine, Mahasarakham University, Thailand (2021-2023)
Research grants & awards	The Thailand International Postgraduate Program (TIPP) and Thailand International Cooperation Agency (TICA) Scholarship Awards.
Research output	32,000.00 Thai Baht THB