CAREGIVERS' MALARIA PREVENTIVE PRACTICE FOR UNDER FIVE CHILDREN AND ITS ASSOCIATION IN NGAPUDAW HIGH-RISK TOWNSHIP, AYEYARWADY REGION-MYANMAR

Miss Ei Phyu Htwe

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พฤติกรรมการป้องกัน และปัจจัยที่เกี่ยวข้อง ต่อการป้องกันโรคมาลาเรีย ในผู้ดูแลเด็กอายุต่ำ
กว่า 5 ปีใ นเมือง เมียบิดอ เขตอิรวดี ประเทศเมียนมา

นางสาวอิ พยู ทเว

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต
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อิ พยู ทเว : พฤติกรรมการป้องกัน และปัจจัยที่เกี่ยวข้อง ต่อการป้องกันโรคมาลาเรีย ในผู้ดูแลเด็กอายุต่ำกว่า 5 ปี ในเมือง เมียปีดอ เขตอิรวดี ประเทศเมียนมา (CAREGIVERS' MALARIA PREVENTIVE PRACTICE FOR UNDER FIVE CHILDREN AND ITS ASSOCIATION IN NGAPUDAW HIGH-RISK TOWNSHIP, AYEYARWADY REGION-MYANMAR) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: นพ. อเลซซิโอ พัน ซ่า, 179 หน้า.

มาลาเรียเป็นโรคติดต่อนำโดยแมลงที่สามารถนำไปสู่การเสียชีวิตได้ เด็กอายุต่ำกว่า 5 ปี เป็นกลุ่มที่มีความ เสี่ยงในการติดเชื้อ เจ็บป่วย จนถึงเสียชีวิตเนื่องจากความรุนแรงของโรคมาลาเรียในพื้นที่ที่มีการระบาดสูงได้มากกว่า ประชากรกลุ่มเสี่ยงอื่นๆ การศึกษาครั้งนี้มีวัตถุประสงค์เพื่ออธิบายลักษณะทั่วไปและพฤติกรรมในการป้องกันโรค มาลาเรียของผู้ดูแลเด็กอายุต่ำกว่า 5 ปี และหาความสัมพันธ์ระหว่างลักษณะดังกล่าวในพื้นที่ที่มีความเสี่ยงในการเกิดโรค สูงในเมืองเนปีดอร์ เขตอิรวดี ประเทศเมียนมา การศึกษาเชิงสำรวจภาคตัดขวางโดยเก็บข้อมูลจากการสัมภาษณ์ผู้ดูแลเด็ก อายุต่ำกว่า 5 ปีในชุมชน จำนวน 422 คน ในเดือนเมษายน พ.ศ. 2561 และวิเคราะห์ข้อมูลโดยใช้โปรแกรม excel และ SPSS version 22 ในการวิเคราะห์ความสัมพันธ์ของตัวแปร 2 ตัวด้วยสถิติ Chi-square และ Fisher Exact 's test และ วิเคราะห์ข้อมูลหลายตัวแปรด้วยการวิเคราะห์ความถดถอยโลจิสติคเชิงพหุ พบว่าผู้ให้ข้อมูลส่วนใหญ่มีพฤติกรรมการ ป้องกันโรคที่ดีในเรื่องวิธีการป้องกันโรคส่วนบุคคล คิดเป็นร้อยละ 70.6 และการแสวงหาการรักษาที่ดี คิดเป็นร้อยละ 80.5 อย่างไรก็ตามผู้ให้ข้อมูลส่วนใหญ่มีพฤติกรรมในการป้องกันมาลาเรียด้านการควบคุมสิ่งแวดล้อมภายในบ้านที่ไม่ดี คิดเป็นร้อยละ 57.4 มากกว่าร้อยละ 60 มีการบำรุงรักษามุ้งหรือมุ้งชุบสารเคมีที่ไม่ดี และมีการใช้ยาทากันยุง ยาจุดไล่ยุง คิดเป็นร้อยละ 98 และ 97 ตามลำดับ พฤติกรรมส่วนบุคคลในการป้องกันโรคมาลาเรียมีความสัมพันธ์อย่างมีนัยสำคัญทาง สถิติกับสถานะทางเศรษฐกิจ (p value=0.033) จำนวนสมาชิกในครอบครัว (p value=0.005) ระดับความรู้ (p value=0.011) ระดับการรับรู้โอกาสเสี่ยงในการเป็นโรค (p value=0.002) ระดับการรับรู้ความรุนแรงของโรค (p value<0.001) และการรับรู้ต่ออุปสรรค (p value<0.001) ในการหาความสัมพันธ์ระหว่างตัวแปร 2 ตัว และเมื่อวิเคราะห์ ความถดถอยโลจิสติคเชิงพหุพบว่ามีเพียงจำนวนสมาชิกในครอบครัว (p value=0.010) และการรับรู้ความรุนแรงของโรค (p value<0.001) ที่มีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติ เมื่อพิจารณาการควบคุมสิ่งแวดล้อมภายในบ้าน ระดับการ รับรู้ความรุนแรงของโรคและการรับรู้ต่ออุปสรรคมีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 จากการวิเคราะห์ ทั้งสองวิธี เมื่อพิจารณาด้านพฤติกรรมการป้องกันที่เกี่ยวเนื่องกับการแสวงหาการรักษา พบว่า สถานะทางเศรษฐกิจ (p value= 0.032) ระดับการรับรู้ความรุนแรงของโรค (p value<0.001) การรับรู้ถึงประโยชน์ของการรักษาและป้องกันโรค (p value<0.001) และการรับรู้ความสามารถตนเอง (p value=0.042) มีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติเมื่อวิเคราะห์ ความสัมพันธ์ของตัวแปร 2 ตัว แต่เมื่อวิเคราะห์ความถดถอยโลจิสติคเชิงพหุ มีเพียงระดับการรับรู้ความรุนแรงของโรคที่ ยังคงมีความสัมพันธ์ (p value<0.001) และพบว่าการรับรู้ต่ออุปสรรคกลับมีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติ (p value=0.039) เนื่องจากพฤติกรรมการป้องกันในการควบคุมสภาพแวดล้อมภายในบ้านที่ไม่ดี ขาดการบำรุงรักษามุ้งหรือ มุ้งชุบสารเคมีและการใช้ยาจุดไล่ยุง ยาทากันยุง การมีความรู้ในการใช้ยาทากันยุงและยาจุดไล่ยุงต่ำของผู้ดูแลเด็กอายุต่ำ กว่า 5 ปี และการรับรู้ความรุนแรงของโรคต่ำเป็นปัจจัยที่ส่งผลต่อการพฤติกรรมการป้องกันโรคทั้งสามด้าน ด้วยเหตุนี้ โปรแกรมการวิเคราะห์ชุมชนแบบมีส่วนร่วมจึงมีความจำเป็นสำหรับนำมาใช้ในพื้นที่นี้

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EI PHYU HTWE: CAREGIVERS' MALARIA PREVENTIVE PRACTICE FOR UNDER FIVE CHILDREN AND ITS ASSOCIATION IN NGAPUDAW HIGH-RISK TOWNSHIP, AYEYARWADY REGION-MYANMAR. ADVISOR: ALESSIO PANZA, M.D., 179 pp.

Malaria is a life-threatening disease. Among children under 5 have more chance to get infection, illness and death due to severe malaria in high transmission areas of malaria. This study aimed to describe the characteristics and malaria preventive practices among caregivers of under-five children and to find out the associations between them in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar. A community based cross-sectional study was conducted among 422 caregivers of children under five in April 2018. Data was collected using interviewer-administered questionnaires and entered by double entry. Data analysis was done using excel and SPSS version 22 by Chi-square test and Fisher Exact's test for bivariate analysis and multiple logistic regression for multivariate analysis. Majority of the respondents had good malaria preventive practices for overall personal protective measures (70.6%), and treatment seeking practice (80.5%). However, most of the respondents had poor malaria preventive practices for environmental control practice (57.4%), maintenance of bed nets or LLINs (over 60%), and use of mosquito repellents (98%) and coils (97%). With personal protective measures, economic status (p value= 0.033), number of household members (p value= 0.005), level of knowledge (p value = 0.011), level of perceived susceptibility (p value = 0.002), level of perceived severity (p value < 0.001) and barriers (p value < 0.001) showed statistically significant association at bivariate level and only number of household members (p value= 0.010) and perceived severity (p value < 0.001) maintained their associations at multivariate analysis. With environmental control measures, level of perceived severity and barriers showed statistically significant associations at 0.05 level in both levels of analysis. With malaria preventive practice regarding treatment seeking practice, economic status (p value= 0.032), level of perceived severity (p value <0.001), perceived benefits (p value <0.001) and perceived self-efficacy (p value = 0.042) revealed statistically significant associations in bivariate analysis and only level of perceived severity (p value <0.001) maintained its significance and levels of perceived barriers (p value= 0.039) become significant. As there were poor preventive practices of environmental control measures, maintaining bednets or LLINs, use of mosquito coils and repellents, poor knowledge of use of mosquito repellent and coil among caregivers of under-five children and perceived severity could statistically significantly influence on all three kinds of malaria preventive practices in our study, community based program like participatory ruaral appraisal (PRA) should be implemented in that region.

Field of Study: Public Health	Student's Signature	....
Academic Year: 2017	Advisor's Signature	....

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ACT	Artemisinin-based Combination Therapy
API	Annual Parasite Incidence
BCC	Behavioral Change Communication Materials
DHS	Demographic Health Surveys
GFATM	The Global Fund to Fight for AIDS, TB and Malaria
GMS	Greater Mekong Sub-region
GTS	Global Technical Strategy for Malaria
HBM	Health Belief Model
ICEMR	International Centers of Excellence for Malaria Research
IPTp	Intermittent Preventive Treatment of Malaria in Pregnancy
IRS	Indoor Residual Spraying
ITN	Insecticide-Treated Bed Nets
LLINs	Long-Lasting Insecticide-Treated Nets
MCEE	Maternal and Child Epidemiology Estimation Group
MICS	Multiple Indicator Cluster Surveys
MIS	Malaria Indicator Survey
MMA-QDSTM	Myanmar Medical Association-Quality Diagnosis and Standard Treatment of Malaria Project
MOHS	Ministry of Health and Sport in Myanmar
NMCP	National Malaria Control Program
RDT	Rapid Diagnostic Test
SMC	Seasonal Malaria Chemoprevention in Under Five Children
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations International Children's Emergency Fund
VBDC	Vector Borne Disease Control Program in Myanmar
WHO	World Health Organization

CHAPTER I
INTRODUCTION

1.1.Background and Rationale

Malaria is a life-threatening vector-borne disease which is caused by transmission of malaria parasite through the bite of infected female Anopheles mosquitoes. High-risk populations of malaria infections are pregnant women, under-five children, forest workers and other immune-compromised people in Myanmar. Among them, children under 5 have more chance to get infection, illness, and death due to severe malaria in high transmission areas of malaria (WHO, 2017a). Although there has been an enormous reduction of malaria burden due to extensive prevention and control measures all over the world, within the past few years, malaria is still a priority public health problem in the world and one of the leading cause of death among under-five children(WHO, 2017b),especially in low and middle-income countries. Also, in Myanmar, it is still a major public health problem in malaria-endemic areas and also the fourth leading cause of death among under-five children(M. UNICEF, 2012).

According to WHO, nearly half of the world populations are living in malaria at-risk areas and estimated 216 million malaria cases occurred globally in 2016 (WHO, 2017c).In South East Asia, 1.35 billion people are living in malaria-endemic areas, and there were 1.3 million reported malaria cases and 14.6 billion estimated malaria cases by WHO in 2016 (WHO, 2017c). In Myanmar, among 52 million people, 43% are living in malaria-endemic areas, and among 330 townships, 291 were at malaria-endemic areas, and out of these, only 120 Townships had Annual Parasite Incidence (API) <1 per 1,000 at-risk population and total 182,616 malaria cases occurred in 2015(MOHS 2016).

There were 445,000 malaria deaths globally, and 91% and 6% of global malaria deaths were attributed by Africa and South East Asia (reported 557 malaria death, estimated 26600 malaria deaths by WHO in 2016) respectively according to WHO 2017 report(WHO, 2017c). In addition, estimated 303,000 malaria deaths had occurred among children under five years which were accounted for 70% of the global total malaria deaths in 2015(WHO, 2016)and every 2 children per 1000 live births had to die

due to malaria globally according to WHO and Maternal and Child Epidemiology Estimation Group (MCEE)'s estimated 2015 data((MCEE), 2015). In Myanmar, there were and 37 reported malaria deaths in 2015(MOHS 2016), and WHO and MCEE estimated that every 1 per 1000 live births had to die due to malaria data in Myanmar ((MCEE), 2015). Also, malaria was accounted for 7.6 % of total deaths in children aged between 1 month and 5 years in 2012 (M. UNICEF, 2012).

It was also costly disease as according to WHO data, approximately US$ 2.7 billion had been totally expensed for malaria control and elimination activities worldwide, and 31% of funding was contributed by the government of malaria-endemic countries in 2016(WHO, 2017a). However, it is less than half of the actual need and to achieve a malaria-free goal, and yearly spending requirements need to increase to $6.4 billion by 2020(UNICEF, 2017). In Myanmar, according to the estimated budget plan of National Malaria Control Program (NMCP) in 2015, a total of US$ 461,751,565 will be cost to accomplish the national malaria control strategy 2016-2020 for Intensifying Malaria Control and Accelerating Progress towards Malaria Elimination. Furthermore, the disease causes a huge economic loss in countries not only by health-care costs but also in terms of lost in productivity, especially in poor countries (Henok, 2015).

The study area, Ngapudaw Township is located in the northeast part of Ayeyarwady Region of Myanmar. Ayeyarwady region is a delta region, and there is a Rakhine mountain range in west part of the region. It is the area where API is high and more than 1 in 2015 and one of the highest under-five mortality region(MIPM, 2015a). Moreover, according to the national malaria elimination plan, it is one of the areas which need to achieve API less than one at the end of 2018. However, in 2017, 0.6 million out of a total of 6.3 million people were residing in heterogeneous malaria risk areas. Malaria positivity rate in Ayeyarwady Region is 1.71%, and malaria morbidity rate and mortality rates are 0.28 per 1000 populations and 0.016 per 100,000 populations, respectively. Moreover, 1771 malaria cases were found in Ayeyarwady region, and 66 malaria cases (3.91% of total cases) were occurred in under five children according to 2017 VBDC data. In Ayeyarwady Region, there are 20 non-endemic malaria townships and six malaria endemic townships such as Pathein, Yegyi, Tharbaung, Ingapu, Myaunmya, and Ngapudaw.

Ngapudaw was the highest malaria burden (2001-2435 malaria cases) among malaria endemic townships in Ayeyarwady Region in 2016 and 26,665 under five children populations are living there. Annual Parasite Incidence (API) in that area (16.52 per 1000 population at risk) in 2016 which was more than five and malaria positivity rate in 2015 is 4.67%. According to one of the geographical study in Ayeyarwady Region, Ngapudaw was one of three townships with high malaria morbidity rate (42.65) and high malaria mortality rate (2.3) in 2013 in Ayeyarwady region, and it also had favorable physical and demographic condition for malaria incidence (Khine, 2013).

Due to preventable and curable nature of malaria, practicing preventive measures as primary prevention and receiving early diagnosis and effective treatment as secondary prevention of malaria in public health intervention is important in reducing malaria burden in community and children under five years. WHO recommends to use long-lasting insecticide-treated net (LLINs), seasonal malaria chemoprevention (SMC) for children aged between three and fifty-nine months in high seasonal transmission areas of sub-Sahara Africa and intermittent preventive therapy for infants in areas of moderate to high transmission areas of sub-Sahara Africa Region except where SMC is recommended and early diagnosis and treatment as interventions for malaria prevention and treatment in children under five years. Moreover, full antimalarial treatment course to give to infants and children was recommended by WHO to prevent the consequences of malaria infection(WHO, 2017d).

In Myanmar, the use of LLINs is a core malaria preventive measure (Shafique, 2014). According to National Strategic Plan 2016, to achieve maximum coverage of insecticide-treated net, LLINs are distributing using multi-delivery strategies. If the budget is limited, LLIN distribution will be targeted to the divided areas such as absolute (3a), high (3b), medium (3c), and low priority (2) depending on malaria-endemic areas according to updated micro-stratification of malaria. Since 2001, LLINs distribution has been started to achieve target coverage 1.8 people per net (WHO standard) and mass distribution of LLINs has been done in malaria-endemic areas in 2015 and continuous distribution of LLINs was done in 2016 and 2017 and are still doing for the high-risk population to achieve 100% coverage. One LLIN for 2 people must be covered, and it is applied to all population at risk, not differentiated among

areas (i.e. regardless of the level of malaria risk)(MOHS, 2009). Moreover, LLIN distributions are couple with Behavior Change Communication(BCC) materials to ensure high and correct LLINs usage (MOHS 2016). The other commonly used methods in Myanmar are burning mosquito coils, wearing long clothing and cleaning environment. Also, even though using mosquito repellents was uncommon in the community, it was frequently cited methods as prevention in forest worker and migrant worker(Shafique, 2014).

However, misconceptions, knowledge, individual perceptions regarding malaria prevention, their behavior, and availability of bed net and other preventive measure tools are also barriers to perform successful malaria control and prevention strategy in Myanmar. Also, these barriers to caregivers are most important for malaria situation and malaria prevention in under five children as caregivers have much influence on their children health. This is supported by the results of Myanmar Demographic Health Survey in 2015-2016 which is showing that 21% of the household population has access to insecticide-treated bed net(ITN),which means every two persons have one ITN to sleep under and among them, only 55% slept under an ITN and only 19% of children under five years slept under ITN previous night before the survey was done(MOHS, 2017).

Health Belief Model (HBM) is one of the models in health behavior theory which explains about individual health behaviors(Karen Glanz, 2008). The central concept of health belief model is to predict why people will take action to prevent illness conditions and is composed of perceived susceptibility, severity, benefits and barriers to a preventive behavior, self-efficacy, and cues to actions. If individual knows the chance they can get a certain condition or illness (perceived susceptibility), the potential serious consequence of that conditions(perceived severity), believe that a certain action or practice available to them would have benefits to reduce their susceptibility to that condition or severity of illness, and believe the forsee benefits of taking action outbalance the barriers to perform the action , they probably to perform that action to prevent illness or getting certain condition(Karen Glanz, 2008). This model will be used as the main construction for construct validity in our study to explain malaria preventive behavior of caregivers of under-five children.

Two cross-sectional studies such as the study in Ise-Orun Nigeria(Orimadegun & Ilesanmi, 2015), the study in Ingapu Township, Myanmar(Han, 2017) revealed that good malaria preventive practices among caregivers of under-five children. However, the qualitative and quantitative study in Ethiopia (Deressa & Ali, 2009) and Myanmar demographic Health Survey in 2015-2016(MOHS, 2017) revealed that poor malaria preventive practices among mother and caregivers of under-five children.

Poor knowledge of malaria prevention has already been found out in some cross-sectional studies among caregivers of under-five children in South West Nigeria (Adebayo, Akinyemi, & Cadmus, 2015), in South East Nigeria (Orimadegun & Ilesanmi, 2015), and in Ekiti State Estrjkl(Oluwasogo AO1, 2015). In contrast, some studies such as the qualitative and quantitative study among caregivers of under-five children in rural Ethiopia(Deressa & Ali, 2009), two cross-sectional studies among caregivers of under-five children in Ingapu Township, Myanmar(Han, 2017; Moe Moe Thandar, 2015) revealed that good knowledge of malaria prevention practices. Furthermore, some studies such as the cross-sectional study among caregivers of under-five children in Nigeria(al., 2011) , the cross-sectional study among caregivers of children aged 2-9 year in Ethiopia (Zewdie Birhanu, 2017)and the national malaria indicator survey in Ethiopia(Jimee Hwang 2010) revealed that knowledge of mother and caregivers was statistically significantly associated with the use of ITN for the under-five children while one study in rural southwestern Nigeria(Dr. Mobolaji M. Salawu*, 2013) proved that knowledge is a determinant of malaria preventive practices among caregivers of under-five children.

Perception including perceived susceptibility, perceived severity, perceived barriers, perceived benefits and perceived self-efficacy have been studied in some international studies among caregivers of under-five children such as the qualitative study in Tanzania (Beer et al., 2012),both quantitative study and qualitative study in rural Ethiopia (Deressa & Ali, 2009) and the quantitative study in Ghana(Opare, 2013) but the association between perception and malaria preventive practice was not studied. In Myanmar, the association between perception and malaria preventive practices was studied among community members in Theinni Township, Shan State (Min, 2014)and Palaw Township, Tanintharyi Region(Linn, 2016) and caregivers in Ingapu Township(Han, 2017). However, a statistically significant association between

perceptions and malaria preventive practices among caregivers of under-five children have not been proven yet.

Some studies such as the cross-sectional study in Ghana(Opare, 2013), the cross-sectional study in South West Nigeria(Adebayo et al., 2015) ,the cross-sectional study in Equatorial Guinea(Romay-Barja et al., 2016) had been revealed that socio-demographic such as age, sex, marital status, occupation, education and economic factors, wealth status can statistically influence on knowledge among caregivers of under-five children while some studies such as the systematic review study in national health surveys among three African countries(Adams, 2015), four cross-sectional studies in Nigeria(Charles Ibiene Tobin-West, 2016),(al., 2011),(P Okafor & Odeyemi, 2012) and (Adaobi I Bisi-Onyemaechi, 2017), showed that socio-demographic such as sex, marital status, education, number of under-five children, age of under-five children and economic factor, wealth status have influence on use of insecticide-treated net among caregivers for under-five children. In addition, even though there are some studies such as the cross-sectional study in Uganda(FELLOW, 2013), the cross-sectional study in Tanzania (Mazigo, 2010) found out the associations between socio-demographic factors such as age and education and preventive practices among community members, little is known about the association between socio-demographic and economic characteristic and malaria preventive practices among caregivers of under-five children.

After searching articles via google scholar, Pub Med, Pro Quest, Science direct and electronic library of College of Public Health Sciences with keywords "malaria preventive practices" "caregivers" "under five children" "Ngapudaw Township" "Ayeyarwady Region" "Myanmar", there were thirteen-studies that have been carried out assessment of knowledge and perception among caregivers of under-five children and knowledge, perception and preventive practice regarding malaria among community. There were only two cross-sectional studies and one quantitative and qualitative study which assessed the malaria preventive practice among caregivers for under-five children. Also, all quantitative studies were descriptive studies, and none of them finds out the associations between other characteristics and malaria preventive practices among caregivers of under-five children using the health belief model. In Myanmar, there were limited number of studies among caregivers for under-five

children regarding malaria as there were only two studies in Ingapu Township, Ayeyarwady Region, Myanmar such as one cross-sectional study which was assessing caregivers treatment seeking practice for under-five children and one descriptive and analytic cross-sectional thesis study by Mahidol University student which was assessing malaria preventive practice among caregivers of under-five children in Ingapu Township in Ayeyarwady Region in Myanmar but no statistically significant association was found between other characteristics and malaria preventive practice except enough bed net per family members as many weaknesses was found in methodology part and measurement tools. Moreover, there were many independent variables such as condition of bed nets, ownership and availability of mosquito repellents, ownership and availability of mosquito coils, ownership of long sleeves, presence of breeding sites, availability of health facility explored as possible factors that can influence on malaria preventive practice among caregivers and community members in previous qualitative studies and one dependent variable, treatment seeking practice among caregivers when their children get fever as secondary prevention practice in public health intervention. However, these independent variables and dependent variables were not assessed in a previous quantitative study in Myanmar in relation with malaria preventive practice among caregivers. In addition, to my knowledge, there is no study using health belief model to evaluate malaria preventive practices among caregivers for their under-five children and find out its associations among caregivers of under-five children in Myanmar and the study about malaria preventive practices and association between other characteristics and malaria preventive practices among caregivers of under-five children has not been studied in Ngapudaw Township though it is one of malaria-endemic areas in Myanmar.

For all these reasons, this study will be carried about malaria preventive practice and other characteristics and finds out the association between them using health belief model among caregivers for their under-five children in Ngapudaw Township, Ayeyarwady Region in Myanmar In additions to, the study will also assess the new knowledge regarding specific preventive measurement tools mentioned in above as components of one of the independent variables, cues to malaria preventive practices and treatment seeking practice of caregivers for under-five children when their children get fever as part of malaria preventive practice, dependent variable. The finding of this

study will not only increase the availability of data necessary to support but also guide effective malaria control policies and will be helpful for the institute to provide appropriate intervention programs for under-five children and caregivers of under-five children.

1.2. Research Questions

1.2.1. What are the modifying factors of socio-demographic and economic characteristics, household characteristics, knowledge level regarding malaria among caregivers of under-five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar?

1.2.2. What are perceptions toward malaria prevention practices including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy among caregivers for their under-five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar?

1.2.3. What are cues to malaria preventive practices among caregivers for under five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar?

1.2.4. What are malaria preventive practices among caregivers for under five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar?

1.2.5. Is there any association between modifying factors, perceptions toward malaria prevention, and cues to malaria preventive practices and malaria preventive practices among caregivers for under five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar?

1.3. Research Objectives

1.3.1 General Objective

To describe characteristics and preventive practice regarding malaria among caregivers for under-five children and to find out the associations between these characteristics, independent variables and malaria preventive practice among caregivers for under five children, dependent variable, in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar.

1.3.2. Specific Objectives

1.3.2.1. To determine the modifying factors of socio-demographic and economic characteristics, household characteristics, knowledge level regarding malaria among caregivers of under-five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar

1.3.2.2. To identify perception towards malaria prevention practices including levels of perceived susceptibility, level of perceived severity, level of perceived benefits, level of perceived barriers, level of perceived self-efficacy regarding malaria preventive practice among caregivers for their under-five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar

1.3.2.3. To determine the level of cues to malaria preventive practices among caregivers for under five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar

1.3.2.4. To assess the levels of malaria preventive practices among caregivers for under five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar

1.3.2.5. To find out the associations between modifying factors, levels of perceptions toward malaria, level of cues to malaria preventive practices and levels of malaria preventive practices among caregivers for under five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar

1.4. Research Hypothesis

Null Hypothesis

There is no association between modifying factors, levels of perceptions toward malaria, level of cues to malaria preventive practices and levels of malaria preventive practices among caregivers for under five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar.

Alternative Hypothesis

There are associations between modifying factors, levels of perceptions toward malaria, level of cues to malaria preventive practices and levels of malaria preventive

practice among caregivers for under five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar.

1.5.Conceptual Framework
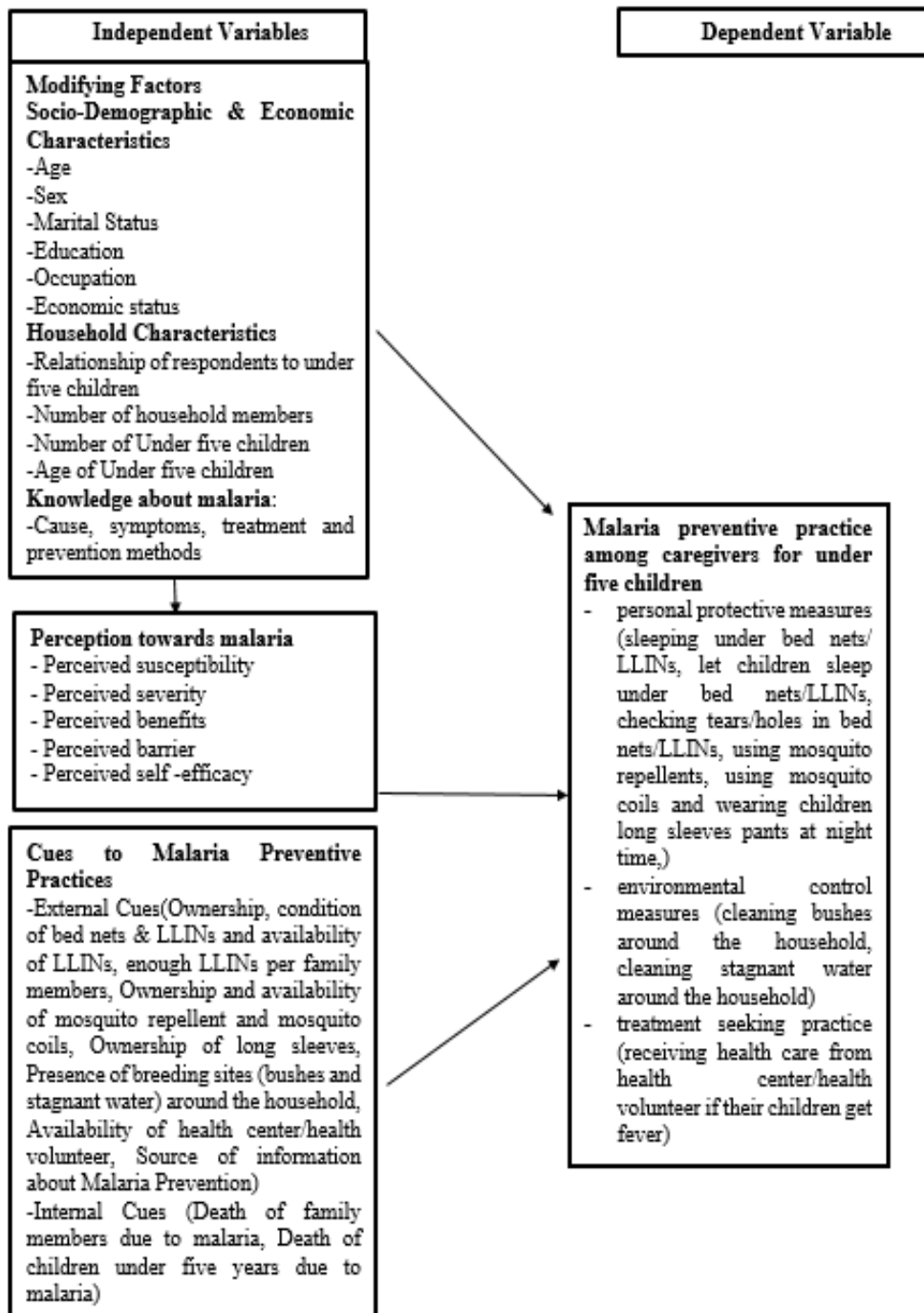
Figure 1. Conceptual Framework

1.6.   Operational Definitions

1.6.1. Modifying Factors
1.6.1.1.   Socio-Demographic and Economic Characteristics

1.6.1.1.1.   **Age** refers to the self-reported completed age of caregivers at the time of last birthday. It will be divided into two group; age equal to and less than 30 years and more than 30 years.

1.6.1.1.2.   **Sex** refers to caregivers' sex characteristics observed by the interviewer at the time of interview. It will be divided into two groups; male and female.

1.6.1.1.3.   **Marital Status** will be self-reported and classified into four groups; single, married, divorced/separated and widow/ widower.

1.6.1.1.4.   **Education** refers to the self-reported highest formal education attainment by respondents and classified into illiterate, primary school (Grade 1 to Grade 4), middle school (Grade 5 to Grade 8), high school (Grade9-10), higher education level (University and above).

1.6.1.1.5.   **Occupation status** will be self-reported by respondents regarding their current occupation status which they work mainly at the time of the survey and classified into employee (government), employee (private organization), self-employee, employer, housewife, unemployed, student and other(MIPM, 2015b).

1.6.1.1.6.   **Economic status** will be measured by wealth index. According to Myanmar Equity Tool(MOLIP, 2014), it refers to the tool to measure the community's wealth status which consisted of two parts: (1) ownership of seven assets (possession of housing unit in house hold, tap water as main source of non-drinking water, toilet, TV, internet, motorcycle / moped/ tuk tuk, bicycle), (2) six housing characteristics (main source of lighting, main source of drinking water, main types of cooking fuel, main construction material of housing walls, main construction material of housing roofs, main construction material of housing floors).These components will be self-reported by respondents.

The wealth status of respondents will be categorized into five quintiles; poorest, second, middle, fourth and richest.

1.6.1.2.   Household characteristics

1.6.1.2.1.   **Relationship of respondents to under five children** refers to the relationship of caregivers to under five children which will be categorized as mother, father, grandparents and other by self-reported method.

1.6.1.2.2.   **Number of household members** refers to total number of household members who are usually residing in the household and live, share sleeping space and eating together with children under five years in the same household. It will be categorized into two groups: four and less than four group and more than four group by the self-report method.

1.6.1.2.3.   **Number of children under five years** refers to total number of children under five years who live together with youngest under-five children, including youngest under-five children and are taken care by caregivers (respondents) at same household. It will be categorized into three groups: one, two and more than two group by the self-report method.

1.6.1.2.4.   **Age of children** refers to completed age (in months) of the youngest under-five children who were taken care by caregivers in the household. It will be categorized into five groups; less than 12 months, 12months-23 months, 24-35 months, 35-47 months and 48months-59months.

1.6.1.3. Knowledge about malaria

It refers to the ability of a person to understand and respond correctly to questions about malaria in terms of cause of malaria, biting time of malaria, vulnerable group of malaria, symptoms, treatment and, prevention methods of malaria. The level of knowledge will be classified into three groups; poor level of knowledge, moderate and good level of knowledge. Cut off points and other details will be mentioned in methodology part.

1.6.2. Perception towards malaria

It refers to respondent's perception for his/her under-five child regarding malaria from a variety of perspectives. It is composed of five components; perceived susceptibility, perceived severity, perceived benefits, perceived barriers and perceived self-efficacy. Each component will be classified into two groups; low level of perception, moderate and high level of perception. The cutoff points and details will be mentioned in methodology part.

1.6.2.1. **Perceived susceptibility:** refers to respondent's perception about the chance of and his/her child under five years to get malaria infection.

1.6.2.2. **Perceived severity** refers to the perception of respondents about the severity of malaria disease if his/her child under five years do not get proper treatment.

1.6.2.3. **Perceived benefits** refer to the perception of respondents about the positive consequences of adopting of prevention practices regarding malaria for their children under five years.

1.6.2.4. **Perceived barriers refer to the** perception of respondents about difficulties to perform malaria preventive practices for his/her under-five child.

1.6.2.5. **Perceived self-efficacy refers to** perception or confidence of respondents that they can perform certain malaria preventive practices for his/her under-five child**.**

1.6.3. Cues to malaria preventive practices

It refers to cues or readiness to initiate malaria preventive practices. These include external cues(ownership, condition of bed nets and LLINs, availability of long lasting insecticide treated nets (LLINs), enough LLINs per family members(2 people per LLIN), ownership and availability of mosquito repellents, ownership and availability of mosquito coils, ownership of long sleeves, presence of bushes around the household to clean, presence of stagnant water around the household to clean, availability of health facilities or volunteer to seek treatment for under five children and source of information about malaria prevention) and internal cues(death of family members due to malaria, death of children under five year due to malaria). Cues to

malaria preventive practices will be self-reported by respondents and will be categorized into low and high. The cutoff point and details will be mentioned in methodology part.

1.6.4   Malaria preventive practices among caregivers of children under five years

1.6.4.1.   Malaria preventive practices– refers to routine activities or actions of respondents to prevent his/her children getting malaria infection. In this study, preventive practices of respondent are practicing personal protective measures (sleeping under bed nets/ LLINs, let children sleep under bed nets/ LLINs, checking tears/holes in bed nets/LLINs, wearing children long sleeves and pants at night time, using mosquito repellents, using mosquito coils), practicing environmental control measures (cleaning bushes around the household and cleaning stagnant water around the household) and treatment seeking practice (receiving health care from health center (station health center, sub center)/health volunteer if their children get fever). Treatment seeking practice adopted from WHO will be included as preventive practices even though it will not be recognized as preventive practices among respondents. The level of malaria preventive practices will be classified into poor,moderate and good level of practice. The cutoff points and details will be mentioned in methodology part.

1.6.4.2.   Caregivers refer to primary caregivers who take care of youngest under-five child in the household for most of the time and will be the child's father, mother, grandparents, or others.

CHAPTER II
LITERATURE REVIEW

2.1. Malaria

2.1.1. Etiology of Malaria

Malaria is a life-threatening vector-borne disease and most cases are transmitted by the bite of infected female Anopheles mosquitoes. Malaria in human is mainly caused by five species of malaria parasites such as *Plasmodium vivax*, *Plasmodium ovale*, *Plasmodium malariae* and *Plasmodium knowlesi.* Among them, two malaria species such as *P. falciparum* and *P. vivax* can cause the greater amount of threat as the first is most occurred parasite in African region and most malaria-related deaths in global context is caused by that falciparum species and the latter is more prevalent in most of the countries apart from sub-Saharan Africa(WHO, 2017a).

2.1.2. Vector of Malaria

There are only 30-40 species of Anopheles mosquitoes which can cause malaria among total 430 species(Centres for Disease Control and Prevention, 2017c). Anopheles mosquito species can be differentiated from other mosquitoes with their pulps which have the same length with their proboscis and their black and white color wings. Furthermore, their forty-five degrees resting position is also significant to distinguish from other mosquitoes(Centres for Disease Control and Prevention, 2017c). Their preferred habitats are different depending on their types of species(WHO, 2017a). They lay their egg in fresh and salt water (Centres for Disease Control and Prevention, 2017c)and also breed in small shallow water pool such as puddle fields and hoof prints which are plentiful during the rainy season(WHO, 2017a). Like other mosquito species, there are four stages in their life cycle such as larva stage pupa stage, and adult stage. In the first three stages, they live in aquatic and these stages take 5-14 days according to the nature of each species and ambient temperature of the environment. The adult females can survive up to a month but most probably die before one or two weeks in nature. Most of them are found in plantation areas and in a forested area(Centres for

Disease Control and Prevention, 2017c). They usually bite people between dusk and dawn and only female mosquitoes can bite human as they take a blood meal to develop their fertile eggs and not for feeding(WHO, 2017a). As malaria can be prevented by vector control measures such using insecticides treated net and indoor residual spray, we use these measurements to prevent biting from Anopheles mosquitoes(Centres for Disease Control and Prevention, 2017c).But, mosquitoes with insecticide resistance has been found and reported on account of repeated exposure to these insecticides. 125 mosquitoes' species has been reported with insecticide-resistant strain and they can pass their resistance strain to their off-springs via gene. So, insecticide resistance in mosquitoes must be continuously monitored for the effectiveness of the use of insecticides(Centres for Disease Control and Prevention, 2017c).

2.1.3. Life cycle of Malaria

As shown in Figure 2, there are two types of host or reservoir where the life cycle of malaria parasite is going on. They are the human host and female Anopheles mosquito. When an infected mosquito bites human, sporozoites from salivary glands of mosquito are entered and injected into human blood together with mosquito saliva during their bloodsucking via the human skin. Then, sporozoites reach into the liver where they grow and multiply rapidly and become schizonts. After some schizonts rupture, they release merozoites which enter into the red blood cells (RBC) in bloodstream (exo-erythrocytic cycle). They become immature trophozoites within RBC. Hence, some transform into mature trophozoites, then into schizonts which release merozoites again (erythrocytic cycle) while others change into sexual erythrocytic stage (gametocytes) which is infectious blood stage of parasites.

The gametocytes in human blood are taken up by a mosquito during their blood meal. Within mosquito, they differentiate into male and female gametocytes. Within mosquito's stomach, macrogametes and microgametes fertilize with each other and undergo formation of zygotes. Then, Zygotes transform into ookinetes and they invade into mid-gut walls where they become oocysts. When oocysts rupture into sporozoites, they go into salivary glands. Hence, infected mosquito bites human again and

undergone another life cycle in human(Centres for Disease Control and Prevention, 2017a).
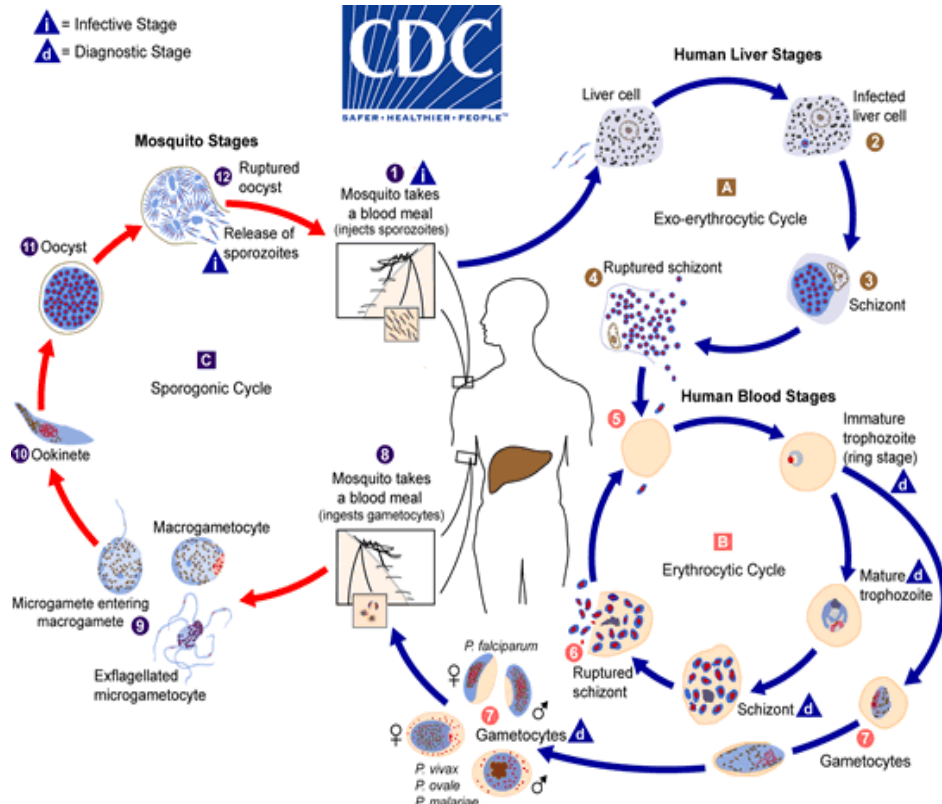
Figure 2. Life cycle of Malaria

Source:(Centres for Disease Control and Prevention, 2017a)

2.1.4. Transmission of Malaria

Most human malaria cases are transmitted by the bite of infected Anopheles female mosquitoes to human. However, there are several uncommon means of malaria transmission such as transfusion of malaria-infected blood, receiving an organ from malaria-infected donor during organ transplant , sharing of the needle with infected person and transmission of malaria from mother to child during delivery and pregnancy(Srinivas, 2015).

In vector-borne transmission, transmission intensity depends on many factors such as parasite density, the lifespan of the vector, the immunity of human host, and the environmental factors such as climatic conditions or breeding sites of vectors(WHO, 2017a).

2.1.5. Vulnerable Populations for Malaria

Some people such as infants (under 1 year age children), under-five children, women with pregnancy and HIV/AIDS infected people, as well as migrant people with non-immunity to malaria, travelers and mobile populations are high-risk people of malaria(WHO, 2017a).

Children under five years of age (including infants) living in endemic areas are vulnerable to get malaria as the children have no longer immunity since three months of age, when immunity received from mothers during pregnancy via placenta start diminish. Pregnant women with malaria are high-risk people as they have more risk of maternal anemia and spontaneous abortion and more chance to born child with anemia, stillbirth child, and child with low birth weight as well as more chance of neonatal death in children. As HIV infection can increase the risk of getting malaria, severe malaria and death due to malaria and malaria can also cause worsening of the condition of clinical AIDS, there is co-infection and interaction between these diseases and HIV people become vulnerable people. Migrants, refugees and other mobile population groups such as temporary forest worker and rubber plantation worker and road construction worker etc. are also vulnerable to malaria as they are lack of partial immunity to malaria due to absent of previous exposure with malaria infections. Moreover, they are a less controllable group and they rarely access to malaria services.

2.1.6. Symptoms of Malaria

Malaria is an acute infection and first symptoms may appear during 10-15 days after infective mosquito bites the people without immunity(WHO, 2017a). Malaria disease can be categorized into uncomplicated malaria and complicated malaria (severe malaria)(Centres for Disease Control and Prevention, 2017b).

In uncomplicated malaria, common symptoms are fever with chills and rigors, sweating, headache, nausea and vomiting, muscle ache and lassitude and weakness and classical malaria attacks such cold stage, hot stage and sweating stage will occur every second day in *Plasmodium Falciparum*, *Plasmodium Vivax* and *Plasmodium Ovale* infections and every third day in *Plasmodium Malariae* infection (quartan malaria)(Centres for Disease Control and Prevention, 2017b).

In complicated (severe) malaria, complications such as failure of organs, abnormal blood metabolism occur (Centres for Disease Control and Prevention, 2017b). A most common form of severe malaria in children is severe anemia, respiratory distress in relation to metabolic acidosis, or cerebral malaria(WHO, 2017a) and the symptoms of cerebral malaria are reduce consciousness, fits and coma(Centres for Disease Control and Prevention, 2017b). In another form of severe malaria such as anemia, splenic rupture and Nephrotic Syndrome, the patient may complain with pallor, fainting attack, abdominal pain, reduced urine output and black color urine. If severe malaria symptoms occur, patients should be immediately hospitalized. Severe malaria mostly occurs in *Plasmodium Falciparum* infection while relapse of malaria is frequently found in *Plasmodium Vivax* and *Ovale* infections(Centres for Disease Control and Prevention, 2017b). People in malaria endemic area can have asymptomatic malaria as they have been developed partial immunity to malaria(WHO, 2017a).

2.1.7. Treatment of Malaria

Early diagnosis and effective treatment of malaria are important for reduction of disease burden and prevention of death due to malaria as well as reduction of malaria transmission(WHO, 2017a). Without treatment, uncomplicated malaria can progress quickly into severe malaria especially in vulnerable people(WHO, 2017c). According to WHO, every case that has been suspected as malaria must be confirmed by rapid diagnostic test or microscopy (parasitological tests) and antimalarial treatment should be given to people after confirmation of malaria except the condition with no possible availability of parasitological test(WHO, 2017c). WHO also recommends that all patients with fever, especially vulnerable groups in malaria endemic countries should take treatment at the health facility and must be tested with malaria diagnostic test(WHO, 2017c). Hence, the measure for patients with fever received treatment at health facility has been assumed as the extent to which patient is seeking treatment for malaria(WHO, 2017c). These all are intending to reduce malaria drug resistance and combination therapy of antimalarial drugs (Artemether- Lumefantrine) is also recommended to prevent drug resistance, particularly in falciparum malaria infection(WHO, 2017c). The primary aim is also to make sure that the patient gets

complete cure of malaria disease, that means get rid of malaria parasites from patient's blood, on account of preventing severe illness or death, and chronic infection that can cause malaria-related anemia(WHO, 2017e). In a public health point of view, treatment is intended to reduce onward transmission of malaria, by reducing the infectious host as well as preventing the development and distribution of antimalarial drug resistance(WHO, 2017e).

2.1.8. Prevention of Malaria

According to WHO, vector control measures such as using insecticide-treated nets (ITNs) and Indoor residual spraying are most effective ways to prevent and control malaria transmission(WHO, 2017a). In highly endemic countries or areas, these two measures are supplemented by less effective preventive measures such as larva control measures, other environmental control measures and personal protective measures such as sleeping under bed nets, wearing long sleeves, using mosquito repellents, screening of windows and doors depending on country malaria prevention strategy(WHO, 2006). For high risk people and people living in elimination areas, WHO recommends vector control measures such as LLIN and IRS as well as chemoprevention such as intermittent preventive treatment of malaria in pregnancy (IPTp) and seasonal malaria chemoprevention in under five children(SMC)as most effective ways to reduce malaria transmission(WHO, 2017c).

In recent WHO malaria report, they mentioned that LLIN should be covered for all people at risk and equal access for all people must be achieved by providing LLIN with free of charge. To ensure that all high-risk people are sleeping under bed net as well as using and maintaining the net properly, distribution of behavior change communication materials such as pamphlets, posters and etc. about malaria still require together with the distribution of LLIN to the community. Among the community, LLIN is mostly preferred than other insecticide-treated nets (ITNs) because of their long-lasting effects up to 3 years. Its efficacy will be influenced by many factors such as intensity of transmission (the higher the more effective), vector behavior (in- or outdoor biting, time of maximum biting rates), human behavior (outdoor social and occupational activities) and other factors. Another, vector control measures, IRS is also a useful way to reduce malaria transmission and it is effective for three to six months

depending on contents and concentration of insecticide used and the kinds of the surface that it is sprayed. In some countries, many times of spraying procedure was done to prevent people from malaria during the whole malaria season(WHO, 2017a). However, fewer people at risk of malaria are being prevented from malaria by using indoor residual spraying (IRS) (WHO, 2017c). IRS protection has a decline of 2.9% in 2016 rather than 2010 worldwide in all WHO regions due to insecticide resistance.

2.2. Malaria and Malaria Prevention in Global and South East Asia

According to WHO, nearly half of world populations are living in malaria at-risk areas and estimated 216 million malaria cases occurred globally in 2016(WHO, 2017c). Among the global malaria cases and deaths, the WHO African Region was responsible for 90% of malaria cases as a great share of the global burden of malaria while South East Asia Region was responsible for 3% of malaria cases as the second burden of malaria in the world (WHO, 2017c).

In South East Asia, 1.35 billion people are living in malaria endemic areas and 1.3 million malaria cases and WHO estimated that there were 14.6 billion malaria cases in 2016. Most of the malaria burden in South East Asia occurred in India (90% of malaria cases) while Indonesia and Myanmar are responsible for 9% and 1% of malaria cases respectively (WHO, 2017c).

There were 445 000 malaria deaths globally and 91% and 6% of global malaria deaths are attributed by Africa and South East Asia (reported 557 malaria death, estimated 26600 malaria deaths by WHO in 2016) respectively according to WHO 2017 report(WHO, 2017c). In addition, estimated 303,000 malaria deaths have occurred among children under five years which are accounted for 70% of the global total malaria deaths in 2015(WHO, 2016)and every 2 children per 1000 live births have to die due to malaria globally according to WHO and Maternal and Child Epidemiology Estimation Group (MCEE)'s estimated 2015 data((MCEE), 2015). Moreover, malaria is one of the leading causes of death in under five children worldwide(WHO, 2017b).

According to WHO data, approximately US$ 2.7 billion has been totally expensed for malaria control and elimination activities worldwide and 31% of funding

was contributed by the government of malaria endemic countries in 2016. However, it is less than half of the actual need and to achieve a malaria free goal, yearly spending requirements need to increase to $6.4 billion by 2020(UNICEF, 2017).Furthermore, the disease causes huge economic losses in countries not only by health-care costs but also in terms of lost productivity, especially in poor countries(Henok, 2015).

However, there is a significant reduction of malaria all over the world due to extensive malaria prevention and control strategy. More than half of the 106 countries with malaria in 2000 had been successful at least 75% reduction of malaria and 17 countries had been eliminated malaria in 2015(WHO, 2015). In South East Asia, there are eight countries which are accomplishing to eliminate malaria such as Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Indonesia, Myanmar, Nepal and Thailand (WHO, 2017c). Moreover, WHO Global Technical Strategy (GTS) for malaria has already been a goal to eliminate malaria at least ten countries, at least twenty countries and at least thirty countries by 2020, 2025 and 2030 respectively. Therefore, preventing and control activities are accelerating and news tools for malaria preventive measures for high-risk groups are also developing and investigating for both control and elimination strategy, with the help of WHO and other funding agencies.

WHO recommends to use long-lasting insecticide-treated net (LLINs), seasonal malaria chemoprevention (SMC) for children aged between three and fifty-nine months in high seasonal transmission areas of sub-Sahara Africa and intermittent preventive therapy for infants in areas of moderate to high transmission areas of sub-Sahara Africa Region except where SMC is recommended and early diagnosis and treatment as interventions for malaria prevention and treatment in children under five years. Moreover, full antimalarial treatment course to give to infants and children was recommended by WHO to prevent the consequences of malaria infection(WHO, 2017d). In Africa region, an approximately one billions of insecticide-treated nets have been distributed since 2000(UNICEF, 2017). Nevertheless, ownership of ITNs/LLINs in the household is not equally distributed over the countries in the African region and average coverage in sub-Saharan Africa is only 66% and ranging from less than 30 percent to nearly 90 percent. Within past five years, access to ITNs and proportion of high-risk population at risk who sleep under ITNs have been increased in sub- Sahara

Africa(UNICEF, 2017). In 2017, the proportion of people at risk of malaria in Africa who are sleeping under an ITN was 54%, a rise of 24% from 2010(WHO, 2017c). In addition, 80% of household own at least one ITN in sub-Saharan Africa in 2016 that means household ownership had been increased by 50% from 2010.But, the proportion of households that have an insufficient number of nets (i.e. one bed net per two people) was still high and at 43% (WHO, 2017c).

2.3. Malaria and Malaria Prevention in Myanmar

In Myanmar, among 52 million people, 43% are living in malaria endemic areas and 41% are living in areas with vulnerability and receptivity of risk of malaria. Moreover, among 330 townships, 291 were at malaria-endemic areas, and out of these, 120 Townships had Annual Parasite Incidence (API) <1 per 1,000 at-risk population and 182,616 malaria cases were occurred in 2015(MOHS 2016).

There were only 37 reported malaria deaths in 2015(MOHS 2016) and WHO and Maternal and Child Epidemiology Estimation Group (MCEE) estimated that every 1 per 1000 live births has to die due to malaria data in Myanmar in 2015((MCEE), 2015). In addition, malaria is fourth leading causes of death in under five children in Myanmar as it is accounted for 7.6 % of deaths in children aged between 1 month and 5 years (M. UNICEF, 2012).

Moreover, it is also a costly disease in Myanmar. According to estimated budget plan of National Malaria Control Program (NMCP) in 2015, a total of US$ 461,751,565 will be cost to accomplish the national malaria control strategy 2016-2020 for Intensifying Malaria Control and Accelerating Progress towards Malaria Elimination and US$ 1.91 per capita at risk will be required each year (MOHS 2016).Therefore, it is a prioritize public health problem among under-five children in malaria high-risk areas.

However, there was a significant achievement within previous years due to extensive malaria control and prevention strategy in Myanmar. National Malaria control program together(NMCP) with Vector Borne Disease Control Program(VBDC) and other implementation partners are implementing the malaria control and elimination strategy according to National Plan with the support of WHO

since 2000.As a result of recent achievement in malaria control strategy and high political commitment in Greater Mekong Sub-region (GMS), elimination goal has been set up in 2030 by National health Plan in accordance with WHO GTS and Strategy for malaria elimination in GMS region(MOHS 2016). According to National Plan for Malaria elimination 2016-2030, Plasmodium falciparum will be eliminated in 2025 and free of malaria in Myanmar will be accomplished in 2030(MOHS 2016). To achieve elimination goal, townships are categorized into three categories;

- Category 1: States/Regions/Townships that are still in the transmission-reduction phase where API of 1 or above case per 1000 population at risk and elimination of malaria does not appear to be feasible at present;

- Category 2: States/Regions/Townships where a malaria incidence of less than 1 case per 1000 population at risk per year, where malaria elimination is recommended;

- Category 3: States/Regions/Townships that presently free from malaria, where prevention of malaria re-establishment of transmission is recommended.

National Strategic Plan for 2016 and 2020 also has established the objectives;

- To reduce reported the incidence of malaria to less than 1 case per 1,000 populations in all States/Regions by 2020

- To interrupt transmission of falciparum malaria in at least 5 States/Regions by 2020 (Target States/Regions: Bago, Magway, Yangon, Mon, Mandalay)

- To prevent the emergence of multi-ACT resistant P. falciparum in Myanmar

- To prevent the re-establishment of malaria in areas where transmission has been interrupted

Now, to achieve these objectives, a multi-sectoral approach and public-private partnership are accomplished by the Ministry of Health and other ministries, NMCP, VBDC and other international and local non-governmental organizations. Significant reduction of malaria burden during previous control strategy are due to many factors including increased investment in malaria control operations (prevention and control measures together with case management), the introduction of Artemisinin-based combination therapy (ACT), expansion of RDT-based diagnosis, the improving political situation (including the Nationwide Ceasefire Agreement - NCA) and advances in socioeconomic development(MOHS 2016).

In Myanmar, use of LLINs is core malaria preventive measure in Myanmar(Shafique, 2014) as WHO recommend an effective way to reduce and it is widely used to reduce transmission and provide personal protection among the community. According to National Strategic Plan 2016, to achieve maximum coverage of insecticide-treated net, LLINs are distributing using multi-delivery strategies. If the budget is limited, LLIN distribution will be targeted to the divided areas such as absolute (3a), high (3b), medium (3c), low (2) priorities depending on malaria-endemic areas according to updated micro-stratification of malaria. Since 2001, LLINs distribution has been started to achieve target coverage 1.8 people per net (WHO standard) and mass distribution of LLINs has been done in malaria-endemic areas in 2015 and continuous distribution of LLINs are doing targeted for high-risk populations in malaria-endemic areas in 2016 and 2017. According to a policy of distribution of LLIN in Myanmar, one LLIN for 2 people must be covered, and it is applied to all population at risk, not differentiated among areas (i.e., regardless of the level of malaria risk)(MOHS, 2009). Moreover, LLIN distributions are couple with Behavior Change Communication(BCC) materials to ensure high and correct LLINs usage (MOHS 2016). According to malaria consortium study, among individual preventive measures, using long lasting insecticide treated net was the main preventive measures in Myanmar. The other common used methods are burning mosquito coils, wearing long clothing and cleaning environment. Also, using mosquito repellents was uncommon in the community, but it was frequently cited methods as prevention in forest worker and migrant worker(Shafique, 2014).

However, as results of Myanmar Demographic Health Survey in 2015-2016, 21% of the household population has access to insecticide-treated bed net (ITN), which means every two persons have one ITN to sleep under and among them, only 55% slept under an ITN and only 19% of children under five years slept under ITN previous night before the survey was done(MOHS, 2017). These data showed that malaria preventive practices among community members and under-five children in Myanmar are still poor. As caregivers have much influence on under-five children health, lower net usage and preventive practice for malaria among under-five children may be due to poor malaria preventive behavior of caregivers. Misconceptions, individual knowledge, individual perceptions of malaria prevention, and availability of bed net and other

preventive measure tools and people behavior regarding malaria prevention are also barriers to achieve successful malaria control and elimination.

2.4. Malaria Stratification in Myanmar

According to vector-borne disease control program (VBDC)'s micro-stratification for malaria control and elimination, there are three stratums such as stratum 1, stratum 2 and stratum 3(among stratum 3 areas, there are three areas again 3a (high risk), 3b (moderate risk) and 3c (low risk). Stratum 1 areas mean areas, where there is no malaria risk or where malaria has never occurred, and the transmission of malaria is considered impossible for climatic or ecological reasons. Stratum 2 areas mean areas, where there is a risk of malaria, but there is no current transmission. Stratum 3 areas mean areas, where transmission is currently taking place. If pre-elimination can be achieved, stratum 3 areas will be active foci and second stratum will include some residual active foci and new potential foci. The first stratum will become clear up or no foci area.

2.5. Malaria in Ngapudaw Township and in Ayeyarwady Region

Ayeyarwady region is a delta region, and there is a Rakhine mountain range in west part of the region. It is the area where API is high and more than 1 in 2015 and one of the highest under-five mortality rate in 2014 according to census data(MIPM, 2015a). According to the national malaria elimination plan, it is one of the areas which need to achieve API less than one at the end of 2018. However, in 2017, 0.6 million out of a total of 6.3 million people are residing in heterogeneous malaria risk areas. Malaria positivity rate in Ayeyarwady Region is 1.71%, and malaria morbidity rate and mortality rates are 0.28 per 1000 populations and 0.016 per 100,000 populations, respectively. Moreover, 1771 malaria cases were found in Ayeyarwady region, and there are 66 malaria cases (3.91% of total cases) in under five children according to 2017 VBDC data. In Ayeyarwady Region, there are 20 non-endemic malaria townships and six malaria endemic townships such as Pathein, Yegyi, Tharbaung, Ingapu, Myaunmya, and Ngapudaw.

The study area, Ngapudaw Township is located in the northeast part of Ayeyarwady Region of Myanmar. It has 320843 estimated total population, and 26665 populations were represented by under-five children. It is one of malaria endemic areas in Ayeyarwady Region. In 2016, malaria case distribution was higher in Ngapudaw Township than any other endemic townships in Ayeyarwady region in 2016 and was within the range of 2001-2435 cases. Annual Parasite Incidence (API) in that area (16.52 per 1000 population at risk) in 2016 was more than five, and malaria positivity rate in 2015 is 4.67%. In addition to, according to one of the geographical study in Ayeyarwady Region, Ngapudaw was one of three townships with high malaria morbidity(42.65) and high malaria mortality rates(2.3) in 2013 in Ayeyarwady region and it also had a favorable physical and demographic condition of this township for malaria incidence (Khine, 2013). According to Vector Borne Disease Control Program's malaria stratification, there are three malaria stratum such as stratum 3a (high risk) with 117 villages, stratum 3b (moderate risk) with 69 villages, stratum 3c (low risk) with 17 villages, stratum 2 (potentially malarious) with 249 villages and stratum 1 (non-malarious) with 6 villages. Also, there are 12 station health center areas in stratum 3a,8 station health center areas in stratum 3b, 6 station health center areas in stratum 3c, 13 station health center areas in stratum 2 and one station health center area in stratum 1 respectively (VBDC, 2014). Therefore, this township still needs to do an intensive malaria control strategy. Now, Vector Borne Disease Control in Myanmar and Myanmar Medical Association project are providing malaria services and malaria control strategy according to NMCP guideline to reduce the malaria burden in 2018. In 2016, mass distribution of LLIN has been done, and in 2017 and 2018, continuous distribution of LLIN will be done by VBDC and implementation partners supported by the Global Fund.

2.6. Related Studies

2.6.1. Modifying Factors

2.6.1.1. Socio-Demographic and Economic Characteristics

Age of respondents

In the dissertation thesis of the University of Utah, systematic review and analysis were done over Demographic Health Surveys (DHS) in three African countries in two different time period (Demographic and Health Surveys. Angola: 2006-07 MIS Final Report, Demographic and Health Surveys. Angola: 2011 MIS Final Report, Demographic and Health Surveys. Liberia: 2009 MIS Final Report, Demographic and Health Surveys. Liberia: 2011 MIS Final Report, Demographic and Health Surveys. Tanzania: AIS 2007- 2008 Final Report and Demographic and Health Surveys. Tanzania: AIS 2011- 2012 Final Report) and predictors of malaria prevention were studied. Age of respondents was studied as possible predictors of malaria prevention method together with maternal education, socioeconomic status. However, it was not statistically associated with malaria prevention methods over six surveys of demographic health surveys(Adams, 2015).

The community cross-sectional study which was done on 140 households in Nasabwa Village, Uganda revealed that younger respondents had better malaria practices towards malaria prevention and controls in compared to older ones with statistically significant level(p value=0.024).76% of respondents were poor, and 34% of respondents were not poor in this study(FELLOW, 2013).

Sex

In Ghana, one of the studies was done on 616 caregivers of each household about knowledge, perception of malaria prevention and control.58.6% was female, and the results showed that there was a significant association between sex and knowledge of malaria prevention practices among caregivers(Opare, 2013).

In the dissertation thesis of the University of Utah, systematic review and analysis were done over Demographic Health Surveys (DHS) in three African countries in two different time period (Demographic and Health Surveys. Angola: 2006-07 MIS Final Report, Demographic and Health Surveys. Angola: 2011 MIS Final Report, Demographic and Health Surveys. Liberia: 2009 MIS Final Report (English), Demographic and Health Surveys. Liberia: 2011 MIS Final Report, Demographic and Health Surveys. Tanzania: AIS 2007- 2008 Final Report and Demographic and Health Surveys. Tanzania: AIS 2011- 2012 Final Report) and predictors of malaria prevention were studied. Only in univariate analysis of Tanzania survey, it found out that being female is a predictor of ITN net use among caregivers of under-five children, but it is not statistically significant(OR=1.38, CI=1-1.90, P value < 0.05)(Adams, 2015).

Marital Status

The cross-sectional study among pregnant women and female caregivers of under-five children in the rural community of southwest Nigeria revealed that knowledge of malaria prevention is statistically significantly associated with marital status with a p-value (<0.001). Marital status in this study was divided into never married or ever married, and most of the respondents (about 70%) were ever married(Adebayo et al., 2015).

A descriptive, cross-sectional study design among reproductive-age women in peri-urban communities of Port Harcourt City, Nigeria also showed that marital status was associated with ITN net usage. Married women had three times odds in the use of ITN compared with unmarried women, (OR = 2.69, 95% CI=1.56–4.62)(Charles Ibiene Tobin-West, 2016).

Occupation

The cross-sectional study among pregnant women and female caregivers of under-five children in the rural community of southwest Nigeria revealed that knowledge is statistically significantly associated with occupation with a statistically significant p-value (<0.001) and most of the respondents(60.2%) work as a trader(Adebayo et al., 2015).

The study about the caregivers' perception of malaria and treatment seeking behavior of under-five children in West Ethiopia revealed that occupation (Housewife) was associated with caregiver's treatment-seeking behavior, but it is not statistically significant(COR=2.02,95% CI=0.81-5.01)(Mitiku & Assefa, 2017).

Education

In a population-based cross-section study among caregivers of under-five Nigerian children, the findings show that there is a statistically significant positive association between education status and own and use of net with a p-value less than 0.0001. A higher level of education the respondents were, the more ITN use occurred among the respondents(al., 2011).

The cross-sectional study in Engu, South East Nigeria shows that there is a statistically significant association between education status of caregivers and use of ITN with the p-value of 0.0001. Most of the respondent (61.4%) who use ITN has tertiary education, and the respondents with education follow the second position in ITN use while Only 25% of caregivers with no formal education and 27.3% of respondents with primary education use ITN (P = 0.04)(Adaobi I Bisi-Onyemaechi, 2017).

In the dissertation thesis of the University of Utah, systematic review and analysis were done over Demographic Health Surveys (DHS) in three African countries in two different time period (Demographic and Health Surveys. Angola: 2006-07 MIS Final Report, Demographic and Health Surveys. Angola: 2011 MIS Final Report, Demographic and Health Surveys. Liberia: 2009 MIS Final Report, Demographic and Health Surveys. Liberia: 2011 MIS Final Report, Demographic and Health Surveys. Tanzania: AIS 2007- 2008 Final Report and Demographic and Health Surveys. Tanzania: AIS 2011- 2012 Final Report) and predictors of malaria prevention were studied. By using multi-nominal logistic regression, higher maternal education can predict using one of the malaria prevention methods (compared to using none), and it is statistically significant among two of the surveys: Angola DHS survey 2011

(OR=1.69, CI=1.40-2.04) and Tanzania DHS survey 2007-08 (OR=1.83, CI=1.27-2.65)(Adams, 2015).

The cross-sectional study among pregnant women and female caregivers of under-five children in the rural community of southwest Nigeria revealed that knowledge was statistically significantly associated with educational level. Respondents who had at least primary education had poor knowledge of malaria prevention practices with a statistically significant p-value (<0.001)(Adebayo et al., 2015).

The cross-sectional study among caregivers of under-five children was done in Bata district of Equatorial Guinea. The finding of this study shows that the education status of caregiver has a statistically significant effect on the caregiver's knowledge. The caregivers with primary education or less have 2.34 times odds of getting high knowledge of malaria in comparison with caregivers with secondary school or above education. (95% CI, OR=1.44-3.80)(Romay-Barja et al., 2016).

The community based cross-sectional study in Ise-Orun, Nigeria with 442 mothers of children less than five years showed that among the social demographic characteristics in the study, education was the factor that can only predict the poor perception of the mothers of under-five children (Orimadegun & Ilesanmi, 2015).

The cross-sectional study in rural northwest Tanzania done among the community about knowledge, attitudes, and practices regarding malaria showed 64.5% of respondents used bed net to prevent malaria. The results also showed that there was a statistically significant association between education level and bed net usage (p value<0.01)(Mazigo, 2010).Therefore, it can be a potential confounder for malaria preventive practice among caregivers of under-five children in our study.

Economic status

The use of wealth Index has been found in many studies as a measurable instrument and effective indicators to measure the economic status of low and middle-income countries since the late century of 1990. It is also widely available in

Demographic and Household Surveys (DHS) and UNICEF Multiple Indicator Cluster Survey (MICS). It also has an easy computing way. Also, it can measure the data more reliably than income as well as it gives visible results or benefits on measuring economic status in many studies. However, it has a weak point that its components cannot comparatively measure across over time and countries. So, the components of wealth index in different countries differ according to specific wealth distribution in the country at the year or time of the survey was done. It means that the wealth index of one country in this year cannot be used to study in other countries and other years(Steendijk, 2013). That is why the components of wealth index in our study was taken from Myanmar Equity Tool according to Myanmar Census2014(MOLIP, 2014). It has two components (1) ownership of seven assets (possession of housing unit in household, tap water as main source of non-drinking water, toilet, TV, internet, motorcycle / moped/ tuk-tuk, bicycle), (2) six housing characteristics (main source of lighting, main source of drinking water, main types of cooking fuel, main construction material of housing walls, main construction material of housing roofs, main construction material of housing floors).

Wealth Index scoring will be calculated into five quintiles using questionnaires and principal component analysis already validated in Myanmar Equity tool (MOLIP, 2014). Wealth Index scoring will be done according to coding and values depending on rural and urban areas used in Myanmar Equity Tool. The decision of rural and urban can be made by following ways;

-Asking directly to the respondent - 'is your home in an urban or rural area.'

-Determination by interviewer based on guidance provided such as if there is a market center in respondents' area which is operating daily or peri-urban areas which is closed to city, this area will be classified as urban

However, in our study, the interviewer will decide urban or rural areas of respondents. Coding will be ranged from 1-4 depending on respondents' choice according to option 1-4. Calculation and scoring of the respondents were shown in appendix F.

The cross-sectional study among caregivers of children less than 15 years of age was done in Bata district of Equatorial Guinea. The finding of this study shows that the wealth status of caregivers has a statistically significant effect on caregivers' knowledge. The household with the highest wealth status has 4.3 times the odds of getting high knowledge of malaria among caregivers in comparison with the lowest wealth status of the household. (95% CI, OR=1.37-7.77)(Romay-Barja et al., 2016).

The community cross-sectional study which was done on 140 households in Nsaabwa Village, Uganda revealed that poor tended to have more worst malaria practices than rich and there was a statistically significant association between respondent's poverty and malaria practices (P value=0.031)(FELLOW, 2013).

In the dissertation thesis of the University of Utah, systematic review and analysis were done over Demographic Health Surveys (DHS) in three African countries in two different time period (Demographic and Health Surveys. Angola: 2006-07 MIS Final Report, Demographic and Health Surveys. Angola: 2011 MIS Final Report, Demographic and Health Surveys. Liberia: 2009 MIS Final Report, Demographic and Health Surveys. Liberia: 2011 MIS Final Report, Demographic and Health Surveys. Tanzania: AIS 2007- 2008 Final Report and Demographic and Health Surveys. Tanzania: AIS 2011- 2012 Final Report) and predictors of malaria prevention and case management among children under five in these three African countries were studied. Economic status was defined in these DHS with wealth index variable. This variable was composed of specific assets of a household (e.g., drinking water source, possession of television, and so forth.) which were then standardized according to the specific countries and the scores were given to each household. These samples were categorized into quintiles (lowest, second, middle, fourth, highest) in that surveys. The findings that higher wealth index was associated with ITN use was found in two surveys of two different countries, both Angola 2011 (OR=1.33, CI=1.18-1.50) and Tanzania 2007-08 (OR=1.64, CI=1.40-1.92) in multivariate analysis(Adams, 2015).

2.6.1.2.   Household Characteristics

Relationship of Respondents to under five children

In thesis of Mahidol University student on malaria preventive practices among caregivers of under-five children in Ingapu Township of Myanmar, the findings revealed that 81.6% of respondents were a mother, and there was an association between the relationship of respondents to under five children, but it was not statistically significant (p value=0.064) (Han, 2017).

Number of household members

The study about the caregivers' perception of malaria and treatment seeking behavior of under-five children in West Ethiopia revealed that number of household members was associated with caregiver's treatment-seeking behavior, but it is not statistically significant(COR= 1.34 95% CI 0.57-3.16)(Mitiku & Assefa, 2017).

The caregiver treatment-seeking behavior for under five children study was also done in mobile villages and non–mobile clinic villages in Ingapu Township, Ayeyarwady Region. The findings revealed that number of household members between these two types of villages are statistically significantly different (P value=0.959) but not associated with care seeking behavior(Moe Moe Thandar, 2015).

Number of children under five years

A cross-sectional study among three hundred and forty caregivers of under-five children in Nigeria shows that 61.8 % of respondent used the insecticide-treated net for children and it is statistically significantly associated with number of children under five years in the household (P=0.006)(P Okafor & Odeyemi, 2012).

In thesis study of Mahidol University student among caregivers of under-five children in Myanmar, the findings show that among 125 respondents, 89.6% of women had only one child and 9.65% and 0.86% of respondents had only two children and one child respectively. However, there was no association between number of children and malaria preventive practices(Han, 2017).

Age of children under five years

In the dissertation thesis of the University of Utah, systematic review and analysis were done over Demographic Health Surveys (DHS) in three African countries in two different time period (Demographic and Health Surveys. Angola: 2006-07 MIS Final Report, Demographic and Health Surveys. Angola: 2011 MIS Final Report, Demographic and Health Surveys. Liberia: 2009 MIS Final Report, Demographic and Health Surveys. Liberia: 2011 MIS Final Report, Demographic and Health Surveys. Tanzania: AIS 2007- 2008 Final Report and Demographic and Health Surveys. Tanzania: AIS 2011- 2012 Final Report) and predictors of malaria prevention and case management among children under five in these three African countries were studied. Children age within 0-59 months were included in the analysis in that study. In multivariate analysis, lower child age was occurred as a statistically significant predictor of ITN use in four out of six surveys: Angola (DHS) 2011 (OR=0.74, CI=0.69-0.80), Liberia (DHS) 2009 (OR=0.88, CI=0.81-0.96), (DHS) Liberia 2011 (OR=0.87, CI=0.79-0.96), and Tanzania (DHS) 2007-08 (OR=0.78, CI=0.68-0.89)(Adams, 2015).

The study about caregivers' treatment-seeking behavior for under five children in malaria-endemic areas of Myanmar revealed that mean age of children under five year was 27.4 months and children's age (months) was associated with caregivers treatment-seeking behavior, but it is not statistically significant(AOR=0.70,0.44-1.09)(Moe Moe Thandar, 2015).

2.6.1.3. Knowledge about malaria

The cross-sectional study among pregnant women and female caregivers of under-five children in the rural community of southwest Nigeria shows that over half (57%) of respondents have poor knowledge of malaria prevention, and there is also a misconception about malaria prevention such as using herbal medicine and use of antibiotics(Adebayo et al., 2015).

In the study in Enugu, Southeast Nigeria, the findings revealed that most of both rural and urban respondents have heard of malaria (99% urban, 74% rural. Both groups

have little knowledge of a vulnerable group of malaria such as children and pregnant women and their susceptibility to the disease. Even though they know malaria preventive measures such using insecticide-treated nets (urban 32%, rural 56%), but their usage of the insecticide-treated net as malaria preventive practice was so poor in both urban (7%) and rural (2%)(Oguonu, Okafor, & Obu, 2005).

A community-based cross-sectional survey using ex-post-facto design and systematic random sampling among 50 caregivers of under-five children in Ekiti State Estrjkl revealed that most of the respondents know the cause of malaria as mosquito bites and only 28% of respondents know the use of insecticide-treated net as preventive measures (Oluwasogo AO1, 2015).

In contrast to above studies, both quantitative and qualitative study in rural Ethiopia revealed that most of the women (60%) with under five children knew the correct mode of transmission of malaria as mosquito bites, and the rest answered the wrong mode of transmission of malaria in the survey question. 94% of respondents knew that malaria is a preventable disease and only 5% answered it could not be preventable while 1 % answered don't know whether it is preventable or not(Deressa & Ali, 2009).

The findings in a population-based cross-sectional study among caregivers of under-five Nigerian children mentioned that knowledge on the cause of malaria and malaria prevention had been statistically significantly associated with the use of ITN (p-value < 0.0001)(al., 2011).

In the study in caretakers of children with 2-9 years of age in Ethiopia, among 709 respondents, overall knowledge of respondent regarding malaria was very low (51.2%, 95% ci: 49.6-52.8%) with statistically significant variations by locations (P=0.001). After adjusting for altitudes or locations, caretakers' knowledge was statistically significantly associated with an increased net used among children. The 53% of respondents who do not have knowledge that use of LLINs can prevent malaria is the statistically significantly low use of LLINs (AOR=0.47, 95% CI: 0.28-0.77, p=0.003)(Zewdie Birhanu, 2017).

In National Malaria Indicator Survey in Ethiopia, the results also showed that around 67% of women and mothers of under-five children have some knowledge of malaria, and there is a statistically significant association between knowledge of malaria and ITN use for their children U5 (AOR=1.6; 95% CI 1.1–2.4)(Jimee Hwang 2010).

The study in rural southwestern Nigeria was conducted among caregivers of under-fives and the results revealed that among 274 caregivers, only 78.1% had good knowledge of known malaria preventive measures and knowledge is a determinant of use of malaria preventive measures among respondents(OR= 9.3, 95% C.I- 1.35-64.3)(Dr. Mobolaji M. Salawu*, 2013).

In thesis of Mahidol University student on malaria preventive practices among caregivers of under-five children in Ingapu Township of Myanmar, the findings revealed that only 5.6% of respondents had good level of overall knowledge and among them, most known knowledge (70.4%) was prevention of malaria and only 2.4% of respondents had least knowledge of malaria causes. However, the results revealed that there was no association between knowledge and malaria preventive practices(Han, 2017).

A cross-sectional thesis study about malaria preventive behavior survey was carried out among community members in Theinni Township which is situated in the mountainous region of Northern Shan State in Myanmar. As a result, over 31.4% of people do not have a clear knowledge of the transmission of malaria. About 73.1% know well about the vector of malaria, and 81.4% answered correctly about malaria vector, Anopheles(Min, 2014).

The study about caregivers' treatment-seeking behavior for under five children in malaria-endemic areas of Myanmar revealed that more than 85% of the caregivers could answer the correct symptoms of malaria and about 50% knew that under-five children were vulnerable to malaria infection. In addition to 90% of respondents responded that malaria could be caused by mosquito bites and 80% of respondents said that malaria could be prevented by using mosquito nets or LLIN. This study did not

study the association between knowledge and malaria preventive practices and only the association between knowledge and treatment seeking behavior was found (AOR=1.90,95% CI=1.14-3.17)(Moe Moe Thandar, 2015).

2.6.2. Perception towards malaria

2.6.2.1. Perceived susceptibility

In a qualitative study in Zanzibar, Tanzania, caregivers have a low perception about susceptibility to malaria, especially in dry season. Caregivers believe that malaria has become an uncommon disease in their region and susceptibility is associated with malaria prevalence, but they assume children are the most susceptible group to malaria. Moreover, they assume that they cannot get malaria and have been protected for a long time as they never heard or experience of fever due to malaria since they were born(Beer et al., 2012). This study did not study the association between perceived susceptibility and malaria preventive practices.

Both quantitative and qualitative study in rural Ethiopia revealed that most of mothers of under-five children (67.1%) believe that children are vulnerable to malaria and they will develop a severe illness while only 29.3% respondents answered that both adults and children are equally susceptible to malaria (29.3%) in survey questions. In all focus group discussion and in-depth interview, mothers of under-five children answered that children are more common to malaria and it was more severe if children get malaria(Deressa & Ali, 2009).

In cross-sectional thesis of Mahidol University student on malaria preventive practices among caregivers of under-five children in Ingapu Township of Myanmar, the findings revealed that 80.2% of respondents had good level of perceived susceptibility, but there was no association between perceived susceptibility and preventive practices(Han, 2017).

The cross-sectional thesis study in Palaw Township in Myanmar was done among community members of 430 households, and the results revealed most of the respondents (65.1%) had good perceived susceptibility, and 21.9 % and 13% had moderate and poor perceived susceptibility respectively. Also, the findings showed that

perceived susceptibility was strongly associated with malaria prevention practices (P-value < 0.001)(Linn, 2016).

A cross-sectional thesis about malaria preventive behavior was carried out in Theinni Township which is situated in the mountainous region of Northern Shan State in Myanmar. For perception, most of the respondents had good level of with perceived susceptibility (64.3%) in that study(Min, 2014).

2.6.2.2.   Perceived severity

In a qualitative study in Zanzibar, Tanzania, caregivers believe that malaria is a severe disease and if they cannot get appropriate treatment in time and they can develop a mental problem and cerebral malaria, and their life can be threatened with this disease especially in children. Moreover, they believe that malaria can affect their social, economic condition as they cannot work if their children are sick and they have to pay to get diagnosis and treatment to cure that disease. They will also suffer emotional problem such as worrying and feeling sad about their children health due to the severity of malaria (Beer et al., 2012). This study did not study the association between perceived severity and malaria preventive practices.

Both quantitative and qualitative study in rural Ethiopia revealed that most of mothers of under-five children (67.1%) believe that children are vulnerable to malaria and will develop a severe illness while only 29.3% respondents answered that both adults and children are equally susceptible to malaria (29.3%) in survey questions. In all focus group discussion and in-depth interview, mothers of under-five children answered that malaria was more severe if children get malaria(Deressa & Ali, 2009).

In thesis of Mahidol University student on malaria preventive practices among caregivers of under-five children in Ingapu Township of Myanmar, the findings revealed that 94.4% of respondents had good level of perceived severity, but there was no association between perceived severity and preventive practices(Han, 2017).

A cross-sectional thesis about malaria preventive behavior was carried out in Theinni Township which is situated in the mountainous region of Northern Shan State

in Myanmar. The results revealed that 24.3% had a good level of perceived severity(Min, 2014).

2.6.2.3.   Perceived benefits

A qualitative study in Zanzibar, Tanzania revealed that caretakers believed that using bed-nets has the benefit of their family to get a happy life by preventing them and their children not to get malaria infection. Moreover, they get enough sleep by using mosquito net because it prevents not only mosquito bites but also noise made by fly mosquito around them. Also, the facts that LLINs can also prevent and kills other insects are also noted among caregivers (Beer et al., 2012). This study did not study the association between perceived benefits and malaria preventive practices.

In Ghana, one of the studies was done on 616 caregivers of each household about knowledge, the perception of malaria prevention and control.81% of caregivers have the perception that malaria is a preventable disease and among these, only 39% believes that use of insecticide-treated net can prevent malaria(Opare, 2013).

In thesis of Mahidol University student on malaria preventive practices among caregivers of under-five children in Ingapu Township of Myanmar, the findings revealed that 83.2% of respondents had good level of perceived benefits, but there was no association between perceived benefits and preventive practices(Han, 2017).

A cross-sectional thesis about malaria preventive behavior was carried out among community members in Theinni Township which is situated in the mountainous region of Northern Shan State in Myanmar. For perception, around half (50.9%) of the respondents had a good level of perceived benefits for protection(Min, 2014).

A cross-sectional study of knowledge, attitude, and practice about insecticide-treated net were carried out among 256 community members of Salin Township in Myanmar. Among them, 139 (54.3%) perceived that malaria could be prevented if one is sleeping inside mosquito net and 192(75%) of the respondents mentioned that they want to buy if they do not get bed net. However, the results showed that there was no statistically significant association between attitude and practice(San San Oo 1*, 2013).

2.6.2.4.   Perceived barrier

In a qualitative study in Zanzibar, Tanzania, the findings show that heat during the hot season and the high cost of ITN nets are barriers to usage of bed nets among caregivers. During the hot season, children cannot sleep under bed net as it is so hot and caregiver assume that malaria transmission is reduced during dry seasons. Caregivers also mentioned that when LLIN need to replace, they have to buy new. However, it cost high so they cannot afford to buy new ones after the effect of LLIN had been reducing after 4-5 years. However, in that study, the author did not found damage bed net or ineffective bed net as the study was carried out after the distribution of LLINs in that area (Beer et al., 2012). That study did not study the association between perceived barriers and malaria preventive practices.

In thesis of Mahidol University student on malaria preventive practices among caregivers of under-five children in Ingapu Township of Myanmar, the findings revealed that only 42.2% of respondents had good level of perceived barriers.66.4% of caregivers agreed on the statement that the spraying insecticides causes bad smell and harmful to the health of children. 47.2% of respondent beliefs that buying bed net is a waste of money while only 4.8% of caregivers agreed that it is very hot when children wear long clothes at night time. However, in that study, there was an association between perceived barriers and preventive practices, but it is not statistically significant (p value= 0.085)(Han, 2017).

A cross-sectional thesis about malaria preventive behavior was carried out among community members in Theinni Township which is situated in the mountainous region of Northern Shan State in Myanmar. For perception, most of the respondents had perceived a barrier to protection (51.1%)(Min, 2014).

2.6.2.5.   Perceived self-efficacy

A qualitative study in Zanzibar, Tanzania shows that perceived self-efficacy to use bed net among caregivers was high as female caregivers said that they do not have difficulty to use a bed net and covering their children with bed night at night time. Therefore, they have the confidence to do that practice every day (Beer et al., 2012).

The study about caregivers' treatment-seeking behavior for under five children in West Ethiopia revealed that 58.7% had low self-efficacy for treatment seeking and it is not statistically significantly associated with care seeking behavior (Mitiku & Assefa, 2017).

2.6.3.   Cues to Malaria Preventive Practices

Ownership, condition, and availability of bed nets

The study in caretakers of children in Ethiopia shows that 658 respondents (92.8%, 95%CI: 90.9–94.7) answered that they had at least one LLIN in their houses. However, only two hundred night nine (42.2%) of the households own enough or sufficient nets for every member of the household (i.e., one net for every two people)(Zewdie Birhanu, 2017).

In Myanmar Demographic Health Survey in 2015-2016, 21% of the household population has access to insecticide-treated bed net (ITN), which means every two persons have one ITN to sleep under and among them, only 55% slept under an ITN and only 19% of children under five years slept under ITN previous night before the survey was done(MOHS, 2017).

In thesis of Mahidol University student on malaria preventive practices among caregivers of under-five children in Ingapu Township of Myanmar, the findings show that 76% of caregivers owned 1 to 3 bed nets and out of these, 88% of respondents owned good condition and 79.2% of respondent households had enough bed net that means one bed net per two family members. Also, there is a statistically significant relationship between enough bed nets per family members and malaria preventive practices of caregivers (P-value <0.05)(Han, 2017).

A cross-sectional study among caregivers of under-five children in Makueni District, Kenya shows that only 46.2 % of respondents own mosquito net and only 3.2% had own treated net. More than half of treated nets were used by under-five children (52.2%). Most of the respondents (72.3%) respond that the main reason for non-use of

treated nets was due to lack of treated net in the household(Malusha, Mwanzo, Yitambe, & Mbugi, 2010).

A community-based cross-sectional survey using ex-post-facto design and systematic random sampling among 50 caregivers of under-five children in Ekiti State Estrjkl revealed that although 28% of respondents knew that use of insecticide-treated bed-net as preventive measures, there was low ownership, and usage of the bed nets among respondents as only 19% of respondents are available to insecticide-treated nets(Oluwasogo AO1, 2015).

Ownership and availability of mosquito repellents

A qualitative study to assess consumer preferences and barrier to use long-lasting insecticide-treated net was done using key informants interview and focus group discussion among migrant workers, rubber plantation workers, forest workers, community members, community leaders, health staffs from government and non-government sides, volunteers involved in LLIN distribution and shopkeepers/vendors of nets and personal protection products among three townships such as Sagaing , Kayah and Tannitharyi region in Myanmar. In that study, the findings revealed that most of the participants did not know about mosquito repellent price, and availability and most of them responded that they could not afford to buy repellent creams or sprays and however, most respondents in Sagaing region only knew the brand name and price of repellent and said that spray is more expensive than repellent cream. Also, they mentioned that they could afford to buy mosquito repellent even though they had less interest in repellent(Shafique, 2014).

Although many other quantitative studies had been studied the use of repellents as malaria preventive practices among community members and in caregivers, they did not study the association between availability of mosquito repellents and malaria preventive practices, according to our knowledge. Therefore, in this study, we will study about ownership and availability of mosquito repellent among caregivers of under-five children in Myanmar as one of the independent variables in cues to malaria preventive practices.

Ownership and availability of mosquito coil and ownership of long sleeves

A qualitative study to assess consumer preferences and barrier to use long-lasting insecticide-treated net was done using key informants interview and focus group discussion among migrant workers, rubber plantation workers, forest workers, community members, community leaders, health staffs from government and non-government sides, volunteers involved in LLIN distribution and shopkeepers/vendors of nets and personal protection products among three townships such as Sagaing , Kayah and Tannitharyi region in Myanmar. The study revealed that most of the community used mosquito coil as common malaria preventive practices. The respondents also mentioned that if they cannot access to bed nets, they will use mosquito coils and some mentioned that they would use mosquito when bed nets cannot be used. Most of the respondents mentioned that available brand names in the study are Godzilla, Jumbo, and other Thai brand names. They also mentioned that bad smells of mosquito coils and effect on children respiratory disease. In addition, most of the migrants and forest workers in the study mentioned that they wear long pants to prevent from mosquito bites when they go to the forest (Shafique, 2014).

Presence of bushes and stagnant water around the household

The study area, Ayeyarwady Region, is forested area and Ngapudaw region also has high in relative humidity percentage and Normalized Difference Vegetation Index (NDVI) according to the demographic study in Ayeyarwady region(Khine, 2013). It means our study areas had a favorable breeding site for Anopheles mosquitoes. Also, to reduce the mosquito breeding sites, most of the study in Myanmar revealed that community people do clean bushes and stagnant water as malaria preventive practices(Linn, 2016). Therefore, in our study, we will study about the presence of bushes and stagnant water around the household as one of the cues to malaria preventive practices.

Availability of Health facility/Health worker

The study about caregivers' treatment-seeking behavior for children under age five in Ingapu Township, Ayeyarwady region was done in 23 mobile clinic villages and

25 nonmobile clinic villages. The findings revealed that there is a statistically significant difference among nearest health facilities between mobile clinic villages and non-mobile clinic villages (P-value <0.001). Moreover, Close to the health facility is one of the determinant factors affecting the treatment-seeking behavior of caregivers for under five children (AOR=5.86,95%CI3.43-10.02)(Moe Moe Thandar, 2015).

The study area, Ngapudaw is now provided with malaria intervention services including health education, long-lasting insecticide-treated net distribution, passive malaria case detection via community health workers, midwife and active case detection via mobile clinics by vector-borne disease control program and Myanmar Medical Association(QDSTM) malaria project (NGO) under the supervision and guidance of National Malaria Control Program. Therefore, in this study, we will study the availability of health facility as one of the cues to do early health seeking from a health facility.

Source of information

A qualitative study among caretakers in Zanzibar, Tanzania shows that one of the cues to bed net use is that they were educated by community health workers and heard from the media to use bed net to prevent malaria (Beer et al., 2012). Another cue to bed net use in that study is the age of children. They said that the younger children were prioritized when there was not enough bed net in the house. As the caregiver know LLINs are distributed to them especially for younger children to prevent malaria, caregivers will share the bed net with children to sleep (Beer et al., 2012).

In the hospital base study in Ghana about caregivers of children, source of information is divided into five groups; radio, television, health workers, friends and immunization center and most frequent source of information that most of the respondents (64.2%) got information regarding malaria is from radio, and it is followed by television (61.3%). Those studies did not study about associations between cues to action and malaria preventive practices (Ameyaw, Dogbe, & Owusu, 2015).

Death of family members and death of under-five children due to malaria

The study among caregivers of under-five children in Ethiopia revealed that only 60 %of respondents have cues to malaria-related activities such as a malaria-related message from media, advise from health workers and advise from peers or health extension workers or family members, and experience of the death of a family member due to malaria. It was statistically significantly related to prompt treatment seeking behavior of malaria. However, that study was not studied about the relationship between cues to other malaria preventive practices and malaria preventive practices (Mitiku & Assefa, 2017).

Thesis study of Mahidol University student on malaria preventive practices among caregivers of under-five children in Ingapu Township of Myanmar studied the relationships of experience of losing family members and malaria preventive practices but no association was found between them as there are only 4 respondents who have experience of losing family member due to malaria and 3 out of them had poor preventive practices. Also, two of respondents answered in a survey they had experience of losing a child due to malaria(Han, 2017).

2.6.4. Malaria Preventive Practices

The community based cross-sectional study in Ise-Orun, Nigeria with 442 mother of children less than 5 years shows that majority (85%) of respondents have good preventive practices such as using insecticide-treated nets (70%), chemoprophylaxis (20.1%) and environmental sanitation (44.8%)(Orimadegun & Ilesanmi, 2015).

The hospital-based cross-sectional study in Ghana about caregivers of children shows that 55.9% of respondents use insecticide-treated nets, 20.6% use insecticide spraying method, and 8.3% of them practice environmental hygiene and only 4.9% use mosquito coil to prevent malaria. Among them, many caregivers (83.8%) practiced one or more methods of malaria prevention(Ameyaw et al., 2015).

In the study in Engu, Southeast Nigeria, 83% respondents used any form of malaria preventive measures, and among them, 76% used insecticide spray in their rooms at night, and 13% of them fired mosquito coils at night, and 65% have used screens for windows and doors at home. However, 65% of total respondents had never heard of insecticide-treated nets, and among the 32% who knew about insecticide-treated, only 7% used these bed nets(Oguonu et al., 2005).

Both quantitative and qualitative study among women with under five children in rural Ethiopia revealed that malaria preventive practice is very low as only 5.6% of women's household own the insecticide-treated nets and among these households, about 93% of the mothers reported that they slept under the nets at night before the survey, while 7% did not sleep under the net at night before the survey(Deressa & Ali, 2009).

The study about caregivers' treatment-seeking behavior for children under age five in Ingapu Township, Ayeyarwady region was done in 23 mobile clinic villages and 25 nonmobile clinic villages. The findings revealed that there is a statistically significant difference among using mosquito bed nets between mobile clinic villages and non-mobile clinic villages (P-value 0.028). Moreover, malaria preventive behavior is a statistically significant predictor for caretakers treatment-seeking behavior for children under five years(AOR=1.76,95%CI=1.13-2.76)(Moe Moe Thandar, 2015).

In thesis of Mahidol University student on malaria preventive practices among caregivers of under-five children in Ingapu Township of Myanmar, the findings revealed that 51.2% of caregivers had good level of preventive practices. Approximately 92. 8 % of respondents used mosquito coil and 92% of children, and 80.8% of respondents sleep under bed nets. However, only 21.6% used insecticide spray to prevent mosquito bites, and 12% of caregivers wore their children with long pants during night time(Han, 2017).

In Myanmar Demographic Health Survey in 2015-2016, 21% of the household population has access to insecticide-treated bed net (ITN), which means every two persons have one ITN to sleep under and among them, only 55% slept under an ITN

and only 19% of children under five years slept under ITN previous night before the survey was done(MOHS, 2017).

A cross-sectional thesis about malaria preventive behavior was carried out among community members in Theinni Township which is situated in the mountainous region of Northern Shan State in Myanmar. Most of the respondents 62.3% had a moderate level of preventive behavior while 23.4% had poor level of preventive behavior. For good preventive behavior, only 14.3% had achieved in that study(Min, 2014).

2.6.5. Methodology Related literature

2.6.5.1.   Likert Scale

Likert scale is mainly used psychometric response scale in questionnaires to get participant' opinion, attitude or agreement using a statement, Likert items. In 1932, Dr. Rensis Likert, a sociologist at the University of Michigan, developed these scales to measure attitudes scientifically and published the original report "A Technique or Measurement of Attitudes." There are several types of Likert scale. The most commonly used scale is 5point scale ranging from "Strongly Disagree" to "Strongly Agree with neutral one or uncertain in the middle. However, some researchers used 7 point scales, 9 point scales, and 10 point scales. Now, to avoid the situation that most of the respondents choose a neutral option and to get a particular response, most researchers use 4 points Likert scale. 4 point Likert scale is also called force Likert scale, and there is no neutral option. Nevertheless, there are advantages and disadvantages of 4 points Likert scale and 5 points Likert scale (Bertram, 2007).

In using a 4point Likert scale, one of the advantages is that there is no neutral option and people was forced to choose a specific response. Other advantages are that respondents may be more chance to discriminate and think to the statements as they cannot sit on the fence by answering neutral option and it is avoiding the misinterpretation of mid-point. As for disadvantages, this scale makes force to respondents to choose to certain respondents, and people would not like to answer some sensitive responses. In addition, as respondents could become frustrated if it is a

sensitive issue to answer and if they are confused, they will skip the statements without answering, especially in self-administered questions and more chance to get missing data(Jans Losby, 2012).

In using 5 points Likert scale, one of the advantages is that people can stay out by choosing the neutral option if they do not want to judge specific issues such as political situation. Moreover, if the topic is highly sensitive, it is better to keep neutral or mid-point option. As disadvantages, if the respondents are not clear the meaning of statements or their mind is confused, people will choose the neutral option, or if they are lazy to answer, they will choose neutral option, and it is difficult to get exact responses from respondents as people are less discrimination on specific statement or issues(Jans Losby, 2012) . Another reason is that when we use 5 or 7 points Likert scale, it takes a longer time to ask and get an answer.

According to statistic results, respondents' data using 4 point scale and 5 point scale were different, and the tools with 5 point scale had more accurate data and given a better picture. However, 4 points Likert scale is good to use in the statement that the respondents are already familiar with the issues. In choosing these two categories of Likert scale, it is important to think of a method of administration and categories meaningful to respondents.

In our study, the questionnaire is interviewer administered, and it is less chance to get missing data. Also, most of the statements in perception towards malaria are already familial one to respondents, and there is also the previous reference using 4 points Likert scale (Mitiku & Assefa, 2017). Therefore, 4 points Likert scale will be used in this study.

2.6.5.2. Selection Criteria

Caregivers in this study may be primary caregivers who take care of the youngest under-five child in the household most of the time. If there are two caregivers in the same household, only the primary caregiver of youngest children in the household will be interviewed. All the questions related to under five children are also asking about the youngest under-five child in the household. It is also important to note that

youngest child means youngest child in the household who are living together with other under-five children and is taken care by primary caregivers and it does not mean respondent's youngest child(WHO, 2002).

2.7.   Health belief model

Since the early 1950s, the Health Belief Model (HBM) has been noted since the early 1950s as a commonly used model in health behavior study as a useful guiding conceptual framework for individual health-related behavior. It was initially introduced and developed by social psychologists in the U.S to understand less participation of people in the program to prevent and investigate disease (Hochbaum, 1958; Rosenstock, Strecher, & Becker, 1988). After that, the use of this model extends not only to study reactions of people to symptoms of illness(Kirscht, 1974) and their behaviors related to diagnosis and treatment, especially adherence to treatment therapy(Becker, 1974).

The central concept of health belief model is to predict why people will take action to prevent illness conditions and is composed of perceived susceptibility, severity, benefits and barriers to a preventive behavior, self-efficacy, and cues to actions. If individual knows the chance they can get a certain condition or illness (perceived susceptibility), the potential serious consequence of that conditions(perceived severity), believe that a certain action or practice available to them would have benefits to reduce their susceptibility to that condition or severity of illness, and believe forsee benefits of taking action outbalance the barriers to perform the action , they probably to perform that action to prevent illness or getting specific condition(Karen Glanz, 2008).

Health belief model is constructed with three components; modifying factors such as knowledge and socio-demographic factors, individual health beliefs such as perceived susceptibility, perceived severity, perceived benefits and perceived barriers and perceived self-efficacy, and health action including health behavior and cues to action, and self-efficacy(Karen Glanz, 2008). According to the model shown in figure 3, modifying factors that influence individual beliefs, and the latter and cues to action

lead to the formation of individual health behavior. (Karen Glanz, 2008). Among the individual beliefs, perceived susceptibility and perceived severity are incorporated to form perceived threat which may have effects on individual behavior.
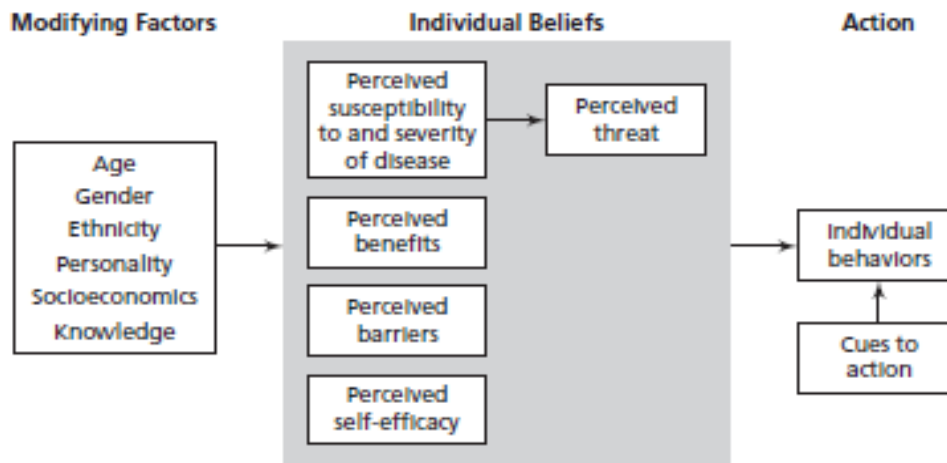
Figure 3. Health Belief Model Components and Linkage

Source: (Karen Glanz, 2008)

Perceived Susceptibility refers to perception about the chance of getting a certain illness or condition. It can be applied in the population at risk to assess the risk level depending on people's characteristics or behavior, and it is more consistent with people who have an actual risk of illness. For example, a woman must assure herself that she has a chance or probability to get breast cancer to do a mammogram, screening test for breast cancer.

Perceived Severity means perception of a person about the severity of illness if he or she does not receive proper treatment or if untreated including medical and clinical complications (such as death, disability, and pain) and probable social complications (as an example, potential effects of specific illness on job, daily life, and social interactions with others). Above two components; perceived susceptibility and perceived severity have been identified as a perceived threat.

Perceived Benefits means the perception of respondents about the positive consequences or positive benefits of adopting of certain actions to reduce the perceived threat which can cause changes in individual behavior. For instance, for non- health related perceptions, a personal belief that he or she can save more money if he or she

quit smoking or that he can make family member please by receiving a mammogram and these benefits may also have an effect on individual decision making about his/ her behavior. That is why perception about susceptibility and severity alone cannot achieve the behavior change without the action which has potential benefit by reducing the potential threat.

Perceived Barriers means the perception of individual about difficulties or inhabitants to perform a certain or advised health actions. Sometimes, these barriers may be psychological cost by balancing the pros and cons of these actions in mind. For example, even though people know that sleeping under long-lasting insecticide-treated net can prevent malaria infection, but they assume that LLINs is expensive to buy and it has unpleasant smell and inconvenient to use. Therefore, they do not want to buy and sleep under LLINs. Therefore, "combination of susceptibility and severity encourage to act, and the perceived benefits (excluding barriers) provide effects for preference of certain health action"(I. M. Rosenstock, 1974).

Cues to Action means cues or readiness to initiate certain actions. The concept of cues which can elicit actions has been included in the development of initial health belief model. Hochbaum (1958) thought that cues to initiate action, such as bodily phenomenon, or by environmental factors, such as information from media and another source of information could potentiate the readiness to act (perceived susceptibility and perceived benefits). Nevertheless, he did not clear the role of cues enormously by systematically studying. After many studies come out, cues to action mean that events, people, or things that cause the people to change their behavior. These include illness of family members or experiencing the death of family members due to a certain disease, media, posters, postcards and health warning signs on a product. As an example, familiar with or knowing a regular church member who has prostate cancer encourage other African American people to participate or attend health education program about prostate cancer(Weinrich & M., 1998).

Self-Efficacy means a perception or confidence of a person that they can perform a certain action. Self-efficacy was not included in the original model and 1988, Rosenstock, Strecher, and Becker brought the concept and added to original HBM as

another component (Rosenstock et al., 1988). To change behavior successfully, people need not only to feel perceived threat of illness (perceived susceptibility and severity) by their current behavior and possible benefits of certain health actions to reduce threats (perceived benefit) but also to have confidence (self-efficacious) themselves to perform that actions by overcoming perceived barriers(Karen Glanz, 2008).

Even though it is a useful model, there are many challenges and limitations to using this model in future. Firstly, the relationship between perceived susceptibility and severity in posing a threat is sometimes unclear. Before perceived susceptibility becomes a strengthen predictor, greater perceived severity is required. If it is like that, perceived susceptibility and severity would not need to be in separate construct, and it would be better if these two components are combined. The relationship between other components is also needed to examine thoroughly. For examples, perceived benefits and barriers become more intense predictor of condition when the perceived threat is higher than in that when it is low. However, this situation may be changed when perceived benefit is very high, and the barrier is so low. For examples, flu drugs are more available even in convenience stores. In this case, even though the threat is not high, people change their behavior as there is low or no perceived barrier(Karen Glanz, 2008).

There is also a limitation to the measurement of variables for central health belief model constructs. There has been a lot of important principles guiding the development of variables in HBM and measure need to be specific according to specific action or practice in the study and population among that these variables will be used. For examples, perceived barriers to mammography may be different from that of colonoscopy. It needs to measure the validity and reliability of the factors that may affect people behavior before conducting the study. Another limitation is that it does not take into account the emotional parts of behavior such as fear. Witte thought fear as a negative emotion accompanied by high state arousal(Witte, 1992) and experiments have been done and found out the association between fears and components of health belief models. If the emotional part is also constructed in models, people behavior can be more explained by models(Karen Glanz, 2008).

Finally, most of the research is missing to use and show the effects of cues to action as a component of the HBM. It has a significant influence on behavior in conditions that perceived barriers are low even though perceived threats and benefits are high. There is little information about cues to actions as it components has been clearly defined in most of the research(Karen Glanz, 2008). Cancer screening studies using postcards as an intervention has been shown that it is statistically significant. A postcard in this study may be a cue to do a cancer screening test, but it is hardly labeled. Researchers have pointed out that the reminder postcard may be all that is required for women who have already been tested with a mammogram or have been long waiting to get another mammogram test(Saywell, 2003).

In this study, this model is a major construct for construct validity and modifying factors, individual beliefs or perceptions including cues to malaria preventive actions will be applied and studied as independent variables and malaria preventive behavior of caregivers of under-five children in Ngapudaw Township, Ayeyarwady Region will also be studied as dependent variables by using this model. The study will also find out the correlation between these independent and dependent variables. By studying these associations, the influence of each component of HBM on malaria preventive behaviors of caregivers of under-five children may be identified.

CHAPTER III
RESEARCH METHODOLOGY

3.1.   Research Design

This study was designed as a community based-quantitative cross-sectional descriptive and analytic study.

3.2.   Study Population

The population in this study were primary caregivers of youngest under-five children in the household who are residing in a high-risk area (malaria stratum 3a) of Ngapudaw Township in Ayeyarwady Region, Myanmar.

3.3.   Study Area

This study was carried out in malaria high risk (stratum3a) areas in Ngapudaw townships of Ayeyarwady Region. Ngapudaw Township was one of malaria endemic areas with highest malaria cases according to 2016 VBDC data in Ayeyarwady Region in Myanmar as shown in Figure 4. There is a large forested area on the western part of the Township, and most of the villages are located near the hills in Ayeyarwady Regions.
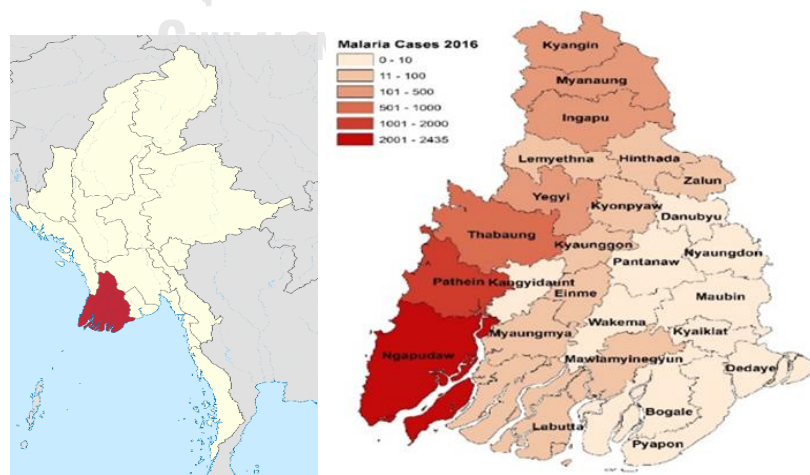
Figure 4. The Study Area, Ngapudaw Township Map

Source :(MOHS 2016)

3.4. Sample Size

The sample size was initially calculated by Cochran's formula(1977)(Association, 2013).

$$n = \frac{Z^2 p(1-p)}{d^2}$$

= $\underline{(1.96)^2 (0.5) (0.5)}$

$\quad$ $(0.05)^2$

=384

n= sample size

Z= standard value for 95% confidence interval=1.96

d= error allowance= 0.05

p= the proportion of caregivers of under-five children who have good level of practice on malaria practice (even though there was one previous thesis study in Myanmar, some weakness in methodology part in the previous study was found. Therefore, 0.5 is used for the values of p as assuming 50% of caregiver population will probably have good preventive practices)

1-p= 1-0.5= 0.5

10% for refusal and withdrawal to participate = 38

Therefore, the sample size= 384+38= 422

The 10% was added to sample size to avoid missing vital data, respondent's refusal to questionnaire or withdrawal during the interview, and incomplete answering the questionnaire.

3.5. Sampling Technique

Multistage sampling technique was used according to figure 5.

Step 1; Ayeyarwady region was purposively selected among 14 states and regions in Myanmar due to one of the highest malaria burden areas to achieve elimination according to national Strategic Plan 2015-2020 and one of the highest under-five mortality rate in Myanmar according to census data(MIPM, 2015a).

Step 2; there are twenty malaria non-endemic townships and six malaria endemic townships in Ayeyarwady Region. Among the latter, Ngapudaw Township was purposively selected due to highest malaria cases in 2016. In Ngapudaw Township, there are three malaria micro-stratifications; stratum 3a high-risk areas, stratum 3b moderate risk areas and stratum 3c low-risk areas in stratum 3, stratum 2 (potentially malarious) area and stratum 1 (non-malarious) area.

Step 3; among three stratifications, stratum 3a areas were purposively selected due to malaria high risk. There are 12 station health center areas with 117 villages in stratum 3a (high risk) areas.

Step 4; Hence, one station health center area was selected randomly using excel. Selected Station Health Center, Kwin Bat, had 14 villages, and 8499 total populations and 579 populations in Kwin Bat station health center were children under five years according to VBDC 2017 data.

Step 5: In Ngapudaw, all the children who born in a hospital, in sub-center, and with a midwife has been registered with birth certificate in immigration office via hospitals. All the records were yearly updated in general administrative office in Ngapudaw Township since 2014. Hence, the list of households with children under five years in the selected station health center area, Kwin Bat, was got from general administrative office and hospital in Ngapudaw Township. For sample size 422, number of households with under-five children from villages was selected randomly, in excel using the list from the local authority. The list was finally checked and selected with the help of village leader and community health workers from Myanmar Medical Association and data was collected using this list and with the help of local people and community health workers according to nature of setting of villages in Myanmar, the households to each other in each village are not too far and condensed in one village.
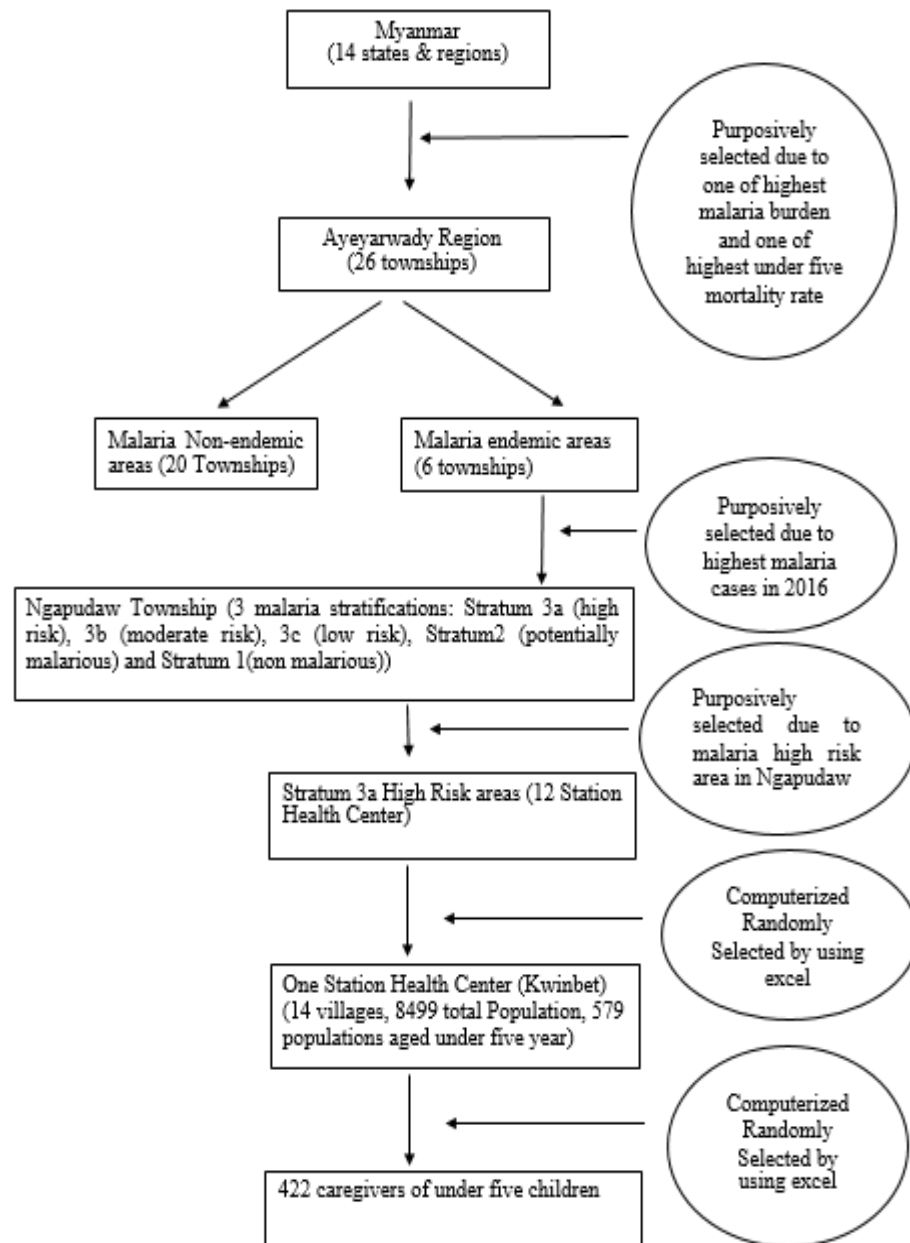
Figure 5. Sampling Flow Chart

3.5.1. Inclusion Criteria

- Male and female caregivers of youngest under-five children in the household (the child's father, mother, grandparents, or others) in high risk (stratum 3a) areas of Ngapudaw Township who are willing to participate and give oral and written consent were included. (The illiterate respondents will only need to give oral consent in front of the literate witness for taking oral consent)

3.5.2. Exclusion Criteria

- Male and female caregivers of under-five children whose age less than 18 years (legal age in Myanmar to give consent)
- Male and female caregivers of under-five children who have a mental health problem
- Male and female caregivers of under-five children who suffer from serious illness or cannot talk or speak at the time of interview were excluded

3.6. Measurement Tool

The data was collected using interviewer-administered structured questionnaires.

3.6.1. Data Validity and Reliability

3.6.1.1. Construct Validity

The questionnaires which were matched with the conceptual framework using theory, health belief model(Karen Glanz, 2008), objectives of the study and operational definitions were firstly prepared by literature reviewing questionnaires on previous literature which was already tested validity(Malaria, 2014; Mitiku & Assefa, 2017). After that, other questions which are structured to match with the conceptual framework using theory, health belief model (Karen Glanz, 2008) and operational definitions, but were not found in previous literature, were validated by three malaria experts and exam committee members (1. Dr. Alessio Panza, thesis advisor, 2. Dr. Ratana Somrongthong, Associate Professor, College of Public Health Sciences, Chulalongkorn University and 3. Dr. Nanta Auamkul, M.D, M.P.H). The questionnaire was revised according to exam committee members' comments and experts' comments.

3.6.1.2. Content Validity

The questionnaires for modifying factors were prepared by literature reviewing on Myanmar Census Report 2014, wealth index measurement in Myanmar Equity Tool according to Myanmar Census (MOLIP, 2014) and other studies relevant to this study. The questionnaires for knowledge and perception were prepared and modified by literature reviewing on previous studies relevant to this study (Mitiku & Assefa, 2017; Moe Moe Thandar, 2015; Opare, 2013; Orimadegun & Ilesanmi, 2015; San San Oo 1*,

2013)and using roll back malaria behavior change communication indicator guideline(Malaria, 2014). The questionnaires for cues to malaria preventive practices and malaria preventive practices were prepared and modified by literature reviewing on previous studies relevant to this study (Beer et al., 2012; FELLOW, 2013; Shafique, 2014)and using Roll Back Malaria Behavior Change Communication Indicator guideline(Malaria, 2014) and UNHCR Standardized Expanded Nutrition Survey (Sens) Guidelines for Refugee Populations Module 6, mosquito net coverage(Sarah Hoibak, 2012).

After that, the questionnaires which are structured and modified by the researcher using guideline and not taken from already validated questions in previous literature will be validated using item-objective congruence (IOC) by three malaria experts (1. Teradata Pumpaibool, Lecturer; Ph.D. (Biomedical Science), Chulalongkorn University; M.Sc. (Industrial Microbiology), Chulalongkorn University; B.Sc. (Microbiology), Chulalongkorn University and who research malaria parasites for more than ten years with the partnership of Malaria research unit, Department of Biology, Faculty of Science, Chulalongkorn University2. Malaria Expert-M.B,B.S(Ygn), M.P.H(Mahidol), Ph.D. candidate in Public Health, Chulalongkorn University who has five years working experience in malaria control in Myanmar and is working as Malaria investigator in the Southeast Asia International Centers of Excellence for Malaria Research (ICEMR) Program, INH/Myanmar and 3. Malaria Expert-M.B, B.S(Ygn), M.P.H (Chulalongkorn University) who is working as Malaria Project Manager, Myanmar Medical Association-Quality Diagnosis and Standard treatment of Malaria (MMA-QDSTM project). After validating the questionnaires, IOC scores by three experts was summed up and divided by three. The questions which were less than 0.75, were revised according to exam committee members and other experts' comments and advice. As IOC for each question was more than 0.75(Turner, 2003), a questionnaire was accepted.

3.6.1.3.Face Validity

Face validity of the questionnaire was checked during pre-test for reliability which was done among caregivers living in Nga Yoke Kaung station health center areas with similar characteristics to the study site (Kwin bet) in Ngapudaw Township of Ayeyarwady region for clarification and comprehension of each question.

3.6.1.4.Pre-test and Reliability

3.6.1.4.1. Pre-test

Pre-test (pilot test) for questionnaires was conducted in another station health center area (Nga Yoke Kaung) in Ngapudaw Township of Ayeyarwady region with similar characteristics and similar geographical location in study areas (Kwin bet). Moreover, caregivers from pretest area did not participate in the study and not contaminated to the study areas. The pretest was done by principal researcher among 10% of sample size, 38 caregivers of under-five children with age 18 years and above.

The purpose of pretest is to know the process of conducting research including the respondents' comprehension regarding each question in the questionnaire (face validity), the flow of questionnaire and duration of interview time, whether the contents of questionnaires are relevant for respondents to answer or not and to check the internal consistency of questionnaires.

3.6.1.4.2. Reliability

According to pilot test's results, some questions were revised or adjusted after the pilot test. Then, Cronbach's Alpha was used to test the internal consistency of perceptions and preventive practices in SPSS software. Cronbach's Alpha level with above cutoff point of 0.70 (J Martin Bland, 1997) was accepted because it means more than 70 percent of the measured variance is reliable and the remaining less than 30 percent is due to random error. For internal consistency of knowledge, Kuder-Richardson formula 20, or KR-20 with cutoff points of 0.7 was calculated in SPSS software(Sijtsma, 2009). The results from KR 20 showed 0.84 for 29 knowledge questions and from Cronbach's alpha showed 0.89 for 31 perceptions questions and 0.75 for ten practice questions for the pretest.

The reliability test was also done after collecting the data for the study population. The result of KR20 for knowledge, Cronbach's alphas for perceptions and preventive practices for sample population, were 0.84, 0.71 and 0.71, respectively.

3.6.2. Translation

After validating and doing reliability test, the questionnaires were translated into Myanmar Language by Malaria investigator in the Southeast Asia International Centers of Excellence for Malaria Research (ICEMR) Program, INH/Myanmar who has expert skills in malaria with the competency of English and Myanmar language. Then, translated Myanmar questionnaire was translated back to English questionnaires by another malaria expert, Deputy Project Manager from Myanmar Medical Association (Malaria Project), who do not know first English questionnaires with the competency of both language, Myanmar and English. As there was some discrepancy between the two translations, two translators met together to agree on a final wording and solve the problem of the discrepancy.

3.6.3. Components of Measurement Tool

The questionnaire was divided into three components such as modifying factors, perceptions towards malaria and cues to malaria preventive practices and malaria preventive practices.

3.6.3.1.Part 1. Modifying Factors

Socio-demographic and economic characteristics

This part included age (Mitiku & Assefa, 2017), sex (Opare, 2013), marital status(Charles Ibiene Tobin-West, 2016), education level(Adams, 2015; Mitiku & Assefa, 2017; Moe Moe Thandar, 2015), occupation(MIPM, 2015b; Mitiku & Assefa, 2017) and economic status, wealth index(Adams, 2015; MOLIP, 2014; Romay-Barja et al., 2016) with total 18 questions including sub-questions of wealth index.

Wealth Index contains two components such as seven assets of ownership and six housing characteristics questions. This part contained 13 questions. It was categorized into five quintiles using questions and principal component analysis which was already validated in Myanmar Equity Tool according to Myanmar Census (MOLIP, 2014).

Household characteristics

This part included relationship of respondents to under-five children (Moe Moe Thandar, 2015), number of household members (Adaobi I Bisi-Onyemaechi, 2017; Mitiku & Assefa, 2017; Moe Moe Thandar, 2015), number of under-five children(Adebayo et al., 2015; Moe Moe Thandar, 2015; P Okafor & Odeyemi, 2012), age of under-five children(Adams, 2015). This part constituted 4 questions.

Knowledge section

This part included 29 questions together with sub-questions. Questions No. 11-14 and 16 were taken from already validated literature (Moe Moe Thandar, 2015). Questions No.15 (15.1-15.5 was taken from thesis study (Han, 2017) and will need to be validated by experts. The answer was Yes, No and don't know. Only one correct answer got one score, and others got 0 scores. The scores ranged from 0-29 questions and categorized into three levels as follow by using Benjamine Bloom's criteria (Htay, 2011; Yimer, 2014);

Poor level (<60%) - <17 scores

Fair level (60-80%) - 17-23scores

Good level (>80%) - >23scores

3.6.3.2. Part 2. Perception towards malaria

Questionnaires for perception contain 31 questions and questions were prepared and modified by literature (Mitiku & Assefa, 2017) and using BCC malaria indicator reference guidelines from Roll Back Malaria (Malaria, 2014).

Perceived Susceptibility

This part contained 5questions with the statement used in Likert's Scale. Questions 17.1,17.4 and 17.5 were taken from BCC malaria indicator reference guidelines from Roll Back Malaria (Malaria, 2014) and Question number 17.2 was taken from a study in Ethiopia (Mitiku & Assefa, 2017) and question number 17.3 was based on literature and structured by researcher and was validated with experts.

Question numbers 17.2 and 17.3 were positive statements and questions 17.1, 17.4 and 17.5 were negative statements. For scoring of perceived susceptibility level,

responses to statements were ranged from strongly agree to strongly disagree and were be scored using 4 point Likert's scale as follow (Mitiku & Assefa, 2017);

Positive statements (3)		Negative statements (2)	
Choice	Scores	Choice	Scores
Strongly agree	4	Strongly agree	1
Agree	3	Agree	2
Disagree	2	Disagree	3
Strongly disagree	1	Strongly disagree	4

For calculating scores of perceived susceptibility, the cut-off point was mean scores±standard deviation. All individual's answers for perceived susceptibility was summed up and calculated mean and standard deviations. The score range from 5-20. The level of perceived susceptibility was classified as followed;

Low perception - Scores≤mean - standard deviations

Moderate perception - mean - standard deviations>scores< mean + standard deviations

High perception - Scores≥ mean scores + standard deviations

Perceived severity

This part contained four questions with the statement used on Likert's Scale. Questions 18.1-18.3 were positive statements and questions 18.4 was a negative statement. Questions 18.1,18.2 and 18.4 were taken from BCC malaria indicator reference guidelines from Roll Back Malaria (Malaria, 2014) and Question numbers 18.3 and 18.5 were taken from a study in Ethiopia (Mitiku & Assefa, 2017).

For scoring of perceived severity level, responds to statements were ranged from strongly agree to strongly disagree and was scored using 4 point Likert's scale as follow (Mitiku & Assefa, 2017);

Positive statements (3)		Negative statements (1)	
Choice	Scores	Choice	Scores
Strongly agree	4	Strongly agree	1
Agree	3	Agree	2
Disagree	2	Disagree	3
Strongly disagree	1	Strongly disagree	4

For calculating scores of perceived severity, the cut-off point was mean scores±standard deviation. All individual's answers for perceived severity was summed up and calculated mean and standard deviations. The score range from 4-16. The level of perceived severity was classified as follow:

Low perception   - Scores≤mean - standard deviations

Modearate perception - mean - standard deviations>scores< mean + standard deviations

High perception   - Scores≥ mean + standard deviations

Perceived benefits

This part contained 7questions with the statement used in Likert's Scale. Questions 19.2-19.4, 19.7 were positive statements and questions 19.1, 19.5 and 19.6 were negative statements. Questions 19.1 was taken from BCC malaria indicator reference guidelines from Roll Back Malaria (Malaria, 2014) and Question number 19.7 was taken from a study in Ethiopia (Mitiku & Assefa, 2017) and question numbers 19.2-19.6 were based on literature and structured by researcher and questions 19.2-19.6 was validated with experts.

For scoring of perceived benefits level, response to statements was ranged from strongly agree to disagree strongly and was scored using 4 points Likert's scale as follow (Mitiku & Assefa, 2017);

Positive statements (4)		Negative statements (3)	
Choice	Scores	Choice	Scores
Strongly agree	4	Strongly agree	1
Agree	3	Agree	2
Disagree	2	Disagree	3
Strongly disagree	1	Strongly disagree	4

For calculating scores of perceived benefits, the cut-off point was mean scores±standard deviation. All individual's answers for perceived benefits was summed up and calculated mean and standard deviations. The score range from 7-28. The level of perceived benefits was classified as follow;

Low perception   - Scores≤mean - standard deviations

Moderate perception - mean - standard deviations>scores< mean + standard
deviations

High perception   - Scores≥ mean scores + standard deviations

Perceived barriers

This part contained seven questions with the statement used on Likert's Scale.
All questions were positive statements. Questions 20.1-20.2 were taken from BCC
malaria indicator reference guidelines from Roll Back Malaria (Malaria, 2014).
Question numbers 20.3-20.7 were based on literature and structured by researcher and
was validated with experts. For scoring of perceived susceptibility level, response to
statements was ranged from strongly agree to strongly disagree and was scored 4 points
Likert's scale as follow;

Positive statements (7)

Choice   Scores

Strongly agree   4

Agree   3

Disagree   2

Strongly disagree   1

For calculating scores of perceived barriers, the cut-off point was mean
scores±standard deviation. All individual's answers for perceived barrier were summed
up and calculated mean and standard deviations. The score ranged from 7-28. The level
of perceived barriers was classified as follows.

Low perception   - Scores≤mean - standard deviations

Moderate perception - mean - standard deviations>scores< mean + standard
deviations

High perception   - Scores≥ mean scores + standard deviations

Perceived self-efficacy

This part contained eight questions with the statement used on Likert's Scale.
All questions were positive statements. Questions 21.1and 21.8 were taken from BCC
malaria indicator reference guidelines from Roll Back Malaria (Malaria, 2014) and
question number 21.2 was also taken from Roll back Malaria guideline, but it was
modified by the researcher. Question numbers 21.3-21.7 were based on literature and
structured by researcher and questions 21.3-21.7 was validated with experts.

For scoring of perceived self-efficacy level, response to statements were ranged from strongly agree to strongly disagree and was scored 4 points Likert's scale as follow;

Positive statements (8)

Choice	Scores
Strongly agree	4
Agree	3
Disagree	2
Strongly disagree	1

For calculating scores of perceived self-efficacy, the cut-off point was mean scores±standard deviation. All individual's answers for perceived self-efficacy was summed up and calculated mean and standard deviations. The score range from 8-32. The level of perceived self-efficacy was classified as follow;

Low perception   - Scores≤mean - standard deviations

Moderate perception   - mean - standard deviations>scores< mean + standard
                        deviations

High perception   - Scores≥ mean scores + standard deviations

3.6.3.3. Part 3. Cues to malaria preventive practices and Malaria Preventive Practices

It contains 31 questions for two components with skip patterns.

Cues to malaria preventive practices

For cues to malaria preventive practices, it contained 21 questions (Questions no22-30, no.35-36, no.38-39, no. 41, no. 43, no.45, no.47, no. 49-52). Questions 22 and 23 were taken from UNHCR Standardized Expanded Nutrition Survey (Sens) Guidelines for Refugee Populations Module 6, mosquito net coverage (Sarah Hoibak, 2012) and question number 24- 27 and 49-50were also translated back from Malaria Indicator Survey(MIS), Myanmar 2009(W. MOHS, 2009). Question numbers 28-30, 35-36, 38-39, 41, 43, 45, 47,51-52 were based on literature and structured by researcher and questions 24-30,35-36,38-39,41,43,45,47, 51-52 was validated with experts.

For scoring, the respondents who answered presence of cues of each variable got one score except the source of information which had 16 sub-responses in question

50 and the respondents who answered for each response got one score for each response. The presence of cues of each variable was calculated in excel sheet separately depending on respondent answers from questions regarding cues to actions. The scores were ranged from0-19scores. The mean scores for cues to malaria preventive practices were calculated, and level of cues to malaria preventive practices was categorized into two as follow by mean scores(Mitiku & Assefa, 2017);

Low   - Scores<mean score

High   - Scores≥ mean score

Malaria preventive practices

For malaria preventive practices, it contained seven questions for personal protective measures (Questions no.31-34, no.37, no.40 and no.42), two questions for environmental control measures (Questions no. 44 and no.46), one questions for treatment seeking practice (Questions no.48). Questions 31, 34, 44 and 46 were taken and modified from a study in Uganda(FELLOW, 2013). Question numbers 37, 40, 42, 48 were based on literature and structured by the researcher. All questions (Questions no.31-34, no.37, no.40, no.42, no.44, no.46 and no.48) were validated with experts. Practice questions had responded in three types such as always, sometimes, never and the respondents who answered always got two scores, who answered sometimes got one score and who answered never got 0 scores. The score range from 0-14 scores for personal protective measures and 0-4 scores for environmental control measures and 0-2 scores for treatment seeking practice. Then, the level of malaria preventive practice regarding each practice or component were classified into dichotomous as follow by using mean scores(MacCallum, Zhang, Preacher, & Rucker, 2002);

Poor level   - Scores<mean score

Good level   - Scores≥ mean score

3.7. Data Collection

Data collection was be performed by face to face interview method by the principal researcher and three research assistants.

Two research assistants who are a local person from Ngapudaw Township and had previous experience of data collection in Ngapudaw and one research assistant who

is from Yangon and who had previous experience of working as a research assistant was recruited for this study. The principal researcher trained research assistants for one day before data collection to reduce interviewer bias. Training topics were included in the purpose of research (research objectives), research methodology and detailed information about questionnaires and ethics about conducting research. The principal researcher will explain all training topics to research assistants with the related documents. At the end of training, research assistants asked the questions to the principal researcher what they are unclear or want to know more. After question sections, research assistants have to do role-play section as interviewer and interviewee to each other to assess their understanding about training as well as research conducting procedures and performance of research assistants. Every researcher has to practice as an interviewer with different interviewees at least two times in a role play to be familial and to minimize interviewer's bias. At the end of the training sections, they have to do field testing with three caregivers of under-five children by using the questionnaires on account of assessing their performance. Their performance was observed and correct by the principal researcher during their practices.

Data collection was carried out between the end of March and April 2018. Permission to conduct the study was obtained from village leaders of respective villages in respective station health center areas. Before the data collection date in respective villages, the researcher informed village leaders and confirmed the date that they would make the data collections. At the date of data collection, the principal researcher and research assistants went to the houses of caregivers with under five children who were randomly selected using the list of households with caregivers of under-five children, which was already prepared with the help of village leader and community health workers. Then, researcher and research assistants checked that the selected respondents whether they meet with inclusion criteria or not and only interview the selected who meet with inclusion criteria and not meet with exclusion criteria. Firstly, the researcher explained about the purpose of the study, the procedure of interview, their right to choose about participation, right to withdraw, and confidentiality, as well as that data, would not be used for other purposes using the consent form and participant information sheet which was already prepared. Then, the researcher took both oral and written

consent with a signature from participants if the participants want to participate. If a selected participant does not want to participate in this study, we excluded this participant. After getting both consents, the consent form was kept separately from questionnaires, and it cannot be traced back the participant's answer. If participants want to participate, the interview conducted using questionnaires which have been already translated in the Burmese language at the respondent's convenient place for their privacy. To prevent the influence of other elder's opinion during the interview, researcher requested to respondents to arrange separated from other household members and private area with the help of village leader before going to respondents' households. The interview place was any shady place at respondents' home depending upon the respondent's convenience and privacy. At the end of data collection in each village, the correct answer for knowledge part of the questionnaire was explained to respondents using correct answer sheets for knowledge part of the questionnaire.

After each interview, the researchers and research assistants checked the completeness of answers for each question in the questionnaire after each interview before leaving the field sites by researcher and research assistants. If something is missing, the research assistants had to interview again for missing questions before leaving the field sites. All the documents (questionnaires) was checked for completeness by the principal researcher to prevent losing documents during data collection before leaving each village. Data collection was done two days on weekdays, and two days on weekends, totally four days per week for four weeks. Therefore, data collection time was taken for about one month.

3.8. Data Entry and Data Analysis

Principal researcher checked the data, and the questions were coded before entering data into the computer. After that, data entry was done by double entry process. Data analysis was processed by using excel and SPSS software version 22 (licensed from Chulalongkorn University) for windows. Descriptive statistics were performed as shown in table 1.

Categories for analysis of data

Age was categorized into two groups; <30 and ≥30(Moe Moe Thandar, 2015)according to the general concept that caregivers with equal and more than 30 years age are more mature and can make a better decision regarding children health than those with age less than 30 years in both descriptive and analytic parts.

Sex characteristics were categorized into two groups; Male and Female according to general concepts and previous studies that female caregivers had more time to care and more concern about children health and more knowledge on prevention practices (Opare, 2013)and net use among caregivers of under-five children who are female was high(Adams, 2015) in both descriptive and analytic parts.

Marital Status was categorized into four groups; single, married, divorced/separated, widowed/widower in descriptive findings and into two groups; never married (single) and ever married (married, divorced/ separated, widowed/widower) in analytic findings according to general concept that each group will have different in giving care to children and according to literature review(Charles Ibiene Tobin-West, 2016).

Educational status was categorized into four groups; illiterate, primary school (Grade 1 to Grade 4), middle school (Grade 5 to Grade 8), high school (Grade9-10), higher education level (University and above) according to Malaria Indicator Survey in Myanmar(W. MOHS, 2009)in descriptive findings and into two groups in analytics; illiterate and primary school (Grade 1 to Grade 4)in one group, secondary school (Grade 5 to Grade 8), high school (Grade9-10) and higher education level (University and above) in one group according to general concept that illiterate and primary school has little knowledge than other groups according to previous literature(Adebayo et al., 2015).

Occupation was categorized into eight groups for descriptive results; employee (government), employee (private organization), self-employed, employer, student, housewife, unemployed and other which may be monk or religious leader, elderly people) according to previous literature (MIPM, 2015b) and Multiple Cluster Indicator

Survey, Myanmar(U. MOHS, MONPED, 2009-2010)in descriptive findings and into two groups for analysis; as employed including employee (government), employee (private organization), self-employed, employer and as unemployed group which includes student, housewife, unemployed and other which may be monk or religious leader, elderly people according to general concept, respondents' employment status may influence on income of the respondents which may affect on practicing malaria preventive practices.

Socioeconomic status; wealth index was categorized into five quintiles; poorest, second, middle, fourth and richest according to Myanmar Equity Tool(MOLIP, 2014) and Myanmar Demographic Health survey (MOHS, 2017)and according to literature (Adams, 2015) in descriptive findings. It combined into poorest and second into one group and middle, fourth and richest into one group to avoid redundant levels and to be fitted into multiple logistic regression to get meaningful results as poorest and second poor to have the same characteristic of the poor economy in comparing to other groups(RAY, 2015).

Relationship of respondents to under-five children was classified into four groups in descriptive findings; mother, father , grandparents and others according to literature review(Han, 2017)and into two groups in analytic findings namely mother and other groups, according to literature review (Htay, 2011) and according to general concepts that mother may have more concern with under five children health status than others group and may tend to do better preventive practice like in other communicable disease and to avoid redundant levels and be fitted into multiple logistic regression to get meaningful results.

Number of household members was categorized into four and less than four group and more than four group in both descriptive and analytic findings according to literature (Moe Moe Thandar, 2015) and according to the general concept that if they have multiple family members, caregivers was busy doing and taking care of other family members. The cutoff point for a minimum number of household member comes from general thinking of fertility rate in Myanmar which is 2.3, and if they only live with a minimum number of household members, it may be four.

Number of children under five years was categorized into one, two and more than two according to literature (Han, 2017) in descriptive findings and into two groups in analytic findings as one child and two or more than two children according to general concept that the more children caregiver had to take care before, the less care on each children as they already have experienced on adopting children. If they had one child, they will do concern more about child health and can give enough care to one child. Two or more is decided as a minimum number of children under five years of age in the household can be two according to fertility rate in Myanmar (2.3).

Age of children was categorized into five groups in descriptive findings; less than 12 months, 12months-23 months, 24-35 months and 36-47 months and 48months-59months according to vulnerable group of malaria (WHO, 2017a) (U. MOHS, MONPED, 2009-2010) and into two groups in analytic findings ; less than 12 months, more than 12months according to general concepts that malaria is more prevalent among more than 1 year age group of children due to partial immunity got from mother(WHO, 2017a) (M, W, M, E, & M, 2017) and caregivers or mother may probably practice more malaria preventive practices among children more than 1 year age group if they have knowledge regarding the immunity of malaria.

Knowledge was categorized into three groups in descriptive findings as poor, moderate and good knowledge using Bloom Criteria according to literature (Yimer, 2014) (Htay, 2011) and into two groups in analytic findings by combining poor and moderate into as poor and good into good knowledge to avoid redundant levels and to deal with the poor level which only have eight respondents in three levels category in fitting into multiple logistic regression(RAY, 2015).

Perceptions (perceived susceptibility, perceived severity, perceived benefits, perceived barriers and perceived self-efficacy) were categorized into low, moderate and high respectively using mean score±standard deviation in descriptive findings and re-categorized into low, and high respectively using mean score (Mitiku & Assefa, 2017) in analytic findings to avoid redundant levels and to fit in multiple logistic regression to get more meaningful and more straightforward results.

Cues to malaria preventive practices were categorized into low, and high respectively using mean score (Mitiku & Assefa, 2017) in both descriptive and analytic findings.

Malaria prevention practices were dichotomized into poor, and good in both descriptive and analytic findings respectively using mean scores (MacCallum et al., 2002) to be simpler analysis as well as simple results and to be fit into multiple logistic regression.

Table 1.Variables, Measurements and Descriptive Statistics

Variables	Measurement Scale	Descriptive Statistics
I. Modifying Factors		
a. Socio-demographic and Economic Characteristics		
Age of respondents(<30,≥30)	Discrete Scale	Number, Percentage, Mean ,S.D
Sex	Nominal Scale	Number, Percentage
Marital Status	Nominal Scale	Number, Percentage
Education	Nominal Scale	Number, Percentage
Occupation	Nominal Scale	Number, Percentage
Wealth Index	Ordinal Scale	Frequency, Percentage
b. Housing Characteristics		
-Relationship of respondents to under five children	Nominal Scale	Number, Percentage
-Number of household members (<4,≥4)	Discrete Scale	Number, Percentage, Mean, S.D
Number of under-five children (1, 2, >2)	Discrete Scale	Number, Percentage, Mean, S.D
Age of children under five years(<12months,12-23months,24-35months,36-47months,48-59months)	Discrete Scale	Number, Percentage, Mean, S.D
c. Knowledge about malaria		
Cause of malaria	Ordinal Scale	Frequency, Percentage
Vulnerable group of malaria		
Symptom of malaria		
Treatment of malaria		
Prevention method of malaria		

Table 1. Continued Variables, Measurements and Descriptive Statistics

II. Perception towards malaria		
a. Perceived susceptibility	Ordinal Scale	Frequency, Percentage, Mean, S.D
b. Perceived severity	Ordinal Scale	Frequency, Percentage, Mean, S.D
c. Perceived benefits	Ordinal Scale	Frequency, Percentage, Mean, S.D
d. Perceived barriers	Ordinal Scale	Frequency, Percentage, Mean, S.D
e. Perceived Self-efficacy	Ordinal Scale	Frequency, Percentage, Mean, S.D
III. **Cues to malaria preventive practices** -External Cues(Ownership, condition of bed nets and LLINs, availability of LLINs, enough LLINs per family members, Ownership and availability of mosquito repellents and mosquito coils, Ownership of long sleeves, Presence of breeding sites (bushes and stagnant water) around the household, Availability of health facility/health volunteer, Source of information about Malaria Prevention) -Internal Cues (Death of family members due to malaria, Death of children under five years due to malaria)	Ordinal Scale	Frequency, Percentage, Mean
IV. **Level of Malaria Preventive Practices Among Caregivers of Children Under Five Years**		
-Personal protective measures	Ordinal Scale	Frequency, Percentage, Mean
-Environmental control measures	Ordinal Scale	Frequency, Percentage, Mean
-Treatment seeking practice	Ordinal Scale	Frequency, Percentage, Mean

Inferential Statistics

Associations between independent variables and dependent variables were analyzed by bivariate analysis using Pearson's Chi-square test with P value level of 0.05. If cells whose frequencies less than 5 were more than 20%, Fisher's exact test was used with P value level of 0.05. After that, multiple logistic regression was used to find out the associations between multiple independent variables and dichotomous dependent variables. In multivariate analysis, the independent variables which were at

P value<0.25 in bivariate analysis and the variables which had been associations with dependent variables and were possible confounders for our study found in previous research (even p-value not less than 0.25 level in the bivariate analysis) were involved in multiple logistic regression. After that, variables with a p-value of greater than 0.05 in the analysis were excluded to construct the final model (Katz, 2007).

Table 2. Variables, Measurements and Inferential Statistics

Independent Variables	Dependent Variable	Bivariate Analysis	Multivariate Analysis
I. Modifying Factors **A. Socio-demographic and Economic Characteristics** -Age of respondents(<30,>30) -Sex(Male , Female) -Marital Status (Ever married, Never married) -Education (Primary/Secondary, Middle/High School/ Higher educational level) -Occupation status (Employed, Unemployed) -Economic Status: Wealth Index(Poorest/Second Poorest, Middle/Fourth/Richest) **B. Housing Characteristics** -Relationship of respondents to under five children(Mother , Others) -Number of household members (<4,≥4) -Number of under-five children (1 , ≥2) -Age of children under five years (<12months,≥12months) **C. Knowledge about malaria (Poor, Good)**	-Level of Malaria Preventive Practices regarding personal protective measures Among Caregivers of Children Under Five Years (Dichotomous Outcomes) (Poor, Good) **-Level of Malaria Preventive Practices regarding Environmental Control Measures Among Caregivers of Children Under Five Years** (Dichotomous Outcomes) (Poor, Good) **-Level of Malaria Preventive Practices regarding Treatment Seeking Practice Among Caregivers of Children Under Five Years** (Dichotomous Outcomes) (Poor, Good)	Chi-square test Fisher's exact test (If the cells whose frequencies are less than 5 were more than 20%)	Multiple Logistic Regression

Table 2. Continued Variables, Measurements and Inferential Statistics

Independent Variables	Dependent Variable	Bivariate Analysis	Multivariate Analysis
II. Perception towards malaria a. Perceived susceptibility (Low, High) b. Perceived severity (Low, High) c. Perceived benefits (Low, High) d. Perceived barriers (Low, High) e. Perceived Self-efficacy (Low, High) **III. Cues to malaria preventive practices** (Low, High)	-Level of Malaria Preventive Practices regarding personal protective measures Among Caregivers of Children Under Five Years (Dichotomous Outcomes) (Poor, Good) -Level of Malaria Preventive Practices regarding Environmental Control Measures Among Caregivers of Children Under Five Years (Dichotomous Outcomes) (Poor, Good) -Level of Malaria Preventive Practices regarding Treatment Seeking Practice Among Caregivers of Children Under Five Years (Dichotomous Outcomes) (Poor, Good)	Chi-square test Fisher's exact test (If the cells whose frequencies are less than 5 were more than 20%)	Multiple Logistic Regression

3.9. Ethical Consideration

Ethical approval to conduct the research was obtained from the Ethical Review Committee of Chulalongkorn University. Permission to conduct the research in selected villages was taken from respective village leaders by doing advocacy meeting in the respective villages and also from the general administrative office of Nga Yoke Kaung sub-township of Nga Pudaw Township. Then, both oral and written consents were taken from respondents who were caregivers of selected households and had willing to

participate in the study. The privacy of respondents and confidentiality with all information about respondents was accurately and carefully kept up. The participant had the right to withdraw from the study at any time. Interview time and place was chosen due to the convenience of the participants. Consents forms and answer sheets to questionnaires were kept separately after the interview so that, it could not be traced back the participant's answer. Personal information of respondents or participant's name was not included in any part of the study report. After completing all the reports, the questionnaires with respondents' answers were destroyed. As respondents' participation was voluntary, no special compensation in this study was done. Nevertheless, the researcher treated respondents with water and snacks for the long duration of interview time (30-35 minutes) and give respondents small presents as an incentive in kinds such as soaps and tooth paste as appreciation for their participation and participated time for the survey.

3.10. Expected Benefit & Application

This research was expected to be useful for the institute to provide appropriate intervention program such as health education or talk among caregivers of under-five children for malaria prevention as well as to provide baseline information to establish or guide effective malaria control policies community for children under five years. Moreover, it also provided the essential information for the researcher to develop the further study such as intervention study in malaria and under-five children in the future.

3.11. Limitation

There was some limitation as this study was only made in caregivers of under-five children in high-risk areas of Ngapudaw Township. Hence, it cannot represent malaria preventive practice of the whole population of caregivers of under-five children in Myanmar. Moreover, according to be a cross-sectional study, it had limitation for accessing the exact information among caregivers as well as it cannot provide information about the cause and effect of malaria in under five children. As the respondents' answer was only self-reported and no observation was done due to time and budget limitation, the real situation of bed net use and wealth status of respondents

cannot be represented by this study. As the interviewing method with three research assistants, who has considerable experience in conducting research, were used, there was the possibility of interviewer bias and participant bias. According to health belief model limitation, the model was not suitable for studying human behavior regarding treatment seeking and in our study, treatment seeking involved as secondary preventive behavior.

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CHAPTER IV
RESULTS

4.1 Background Information on the Study Area

This study aimed to describe independent variables, namely, modifying factors such as socio-demographic, economic and household characteristics and level of knowledge, levels of perceptions towards malaria including perceived susceptibility, perceived severity, perceived benefits, perceived barriers and perceived self-efficacy, level of cues to malaria preventive practice ,and dependent variables, namely, levels of malaria preventive practices regarding personal protective measures, environmental control measures and treatment seeking practice and to analyze the relationships between each of these independent variables and each of dependent variables among caregivers for under five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar. The study population consisted of 422 male and female caregivers of under-five children from 14 villages of one station health center, Kwinbet in Ngapudaw Township, Ayeyarwady Region-Myanmar.

The first section of the result parts contained descriptive statistical results of the independent variables and dependent variables which mentioned in above among caregivers for under-five children.

Then, the second section constituted analytic statistical results of bivariate analysis by chi-square or Fisher exact test and multivariate analysis by multiple logistic reactions among independent variables with each of dependent variables.

Part I Descriptive Findings

4.2 Modifying Factors

4.2.1 Socio-demographic and Economic Characteristics

As in table 3, the results reveal about some of descriptive statistics of socio-demographic and economic characteristics. The mean age of the respondents was 34 and minimum, and maximum age of respondents were 18 and 83. Over half (59.5%) of

respondents were included in above 30 age group, and the majority of the respondents were female (95.3%), married (91.9%) and did not work (74.9%). In addition, the highest number of respondents had secondary school level education (38.2%) and second poorest level regarding economic status while only 5.9% never learned under government education system and 19.2% of respondents were poorest among the community.

Table 3. Descriptive Statistics of Socio-Demographic and Economic Characteristics (n=422)

Socio-Demographic and Economic Characteristics	Number (n)	Percentage (%)
Age		
<30	171	40.5
≥30	251	59.5
Sex		
Male	20	4.7
Female	402	95.3
Marital Status		
single	10	2.4
married	388	91.9
divorce/separated	5	1.2
widow/widower	19	4.5
Education		
Illiterate	25	5.9
Primary School	112	26.5
Secondary School	161	38.2
High School	97	23.0
Higher Education Level(University and above)	27	6.4
Occupation		
Employee (Government)	11	2.6
Employee (Private)	3	0.7
Self-employee	64	15.2
Employer	28	6.6
Housewife	305	72.3
Unemployed	3	0.7
Student	3	0.7
others(monks or religious leaders or elderly people)	5	1.2
Economic status		
Poorest	81	19.2
Second	130	30.8
Middle	106	25.1
Fourth	45	10.7
Richest	60	14.2

4.2.2 Household Characteristics

Table 4 shows about some of descriptive statistics of household characteristics of caregivers of under-five children in Ngapudaw Township, Ayeyarwady Region-Myanmar. Most of the respondents were a mother (79.9%) and had more than four household members (53.1%). The average number of household members was 5 and ranged from 2 to 11. Majority (90.5%) of the respondents had to take care of only one under-five child while minimum number and maximum number of under-five children to take care were 1 and 3 respectively. Among five age groups of youngest under-five children who were taken care by caregivers, highest number was within 24-35month group (25.6%) and the proportion of youngest under-five children who were less than one year was 18.2%.

Table 4. Descriptive Statistics of Household Characteristics (n=422)

Household Characteristics	Number (n)	Percentage (%)
Relationship of respondents to U5 children		
Mother	337	79.9
Father	10	2.4
Grandparents	54	12.8
Others(sibling, aunt or uncle)	21	4.9
Number of household members		
≤4	198	46.9
>4	224	53.1
Number of children under five years		
1	382	90.5
2	37	8.8
>2	3	0.7
Age of under five children		
<12months	77	18.2
12-23months	64	15.2
24--35months	108	25.6
36-47months	84	19.9
48-59months	89	21.1

4.2.3 Knowledge about malaria

Table 5 shows about the number and percentage distribution of correct answer and wrong answer regarding knowledge about malaria by caregivers of under-five

children in Ngapudaw Township, Ayeyarwady Region, Myanmar. Among 422 respondents, majority of the respondents knew that malaria is caused due to mosquito bite (97.4%) and not due to coughing and sneezing (70.6%) and not due to contact with malaria patient (77.7%) and knew that vulnerable groups of malaria which were under five children (88.9%), pregnant mother (82.7%), farmers (97.6%) and forest workers (97.9%) as well as symptoms of malaria were fever(98.6%), chills and rigors (98.8%), headache(97.6%) and sweating(81.0%). Also, almost all respondents knew that use of mosquito bed nets(99.5 %), use of long-lasting insecticide-treated nets(99.5 %) and avoid mosquito bites(99.5 %) as prevention methods of malaria and taking the full course of antimalarial treatment from health facility as treatment methods of malaria (99.8%).In addition, majority of the respondents knew that wearing long-sleeved clothing (85.1%), cleaning environment (96.9%) and covering water containers (96.0%), respectively, can prevent malaria and self-taking traditional medicine (78.2%) and treating with traditional healer(74.2%) are not the correct treatment of malaria.

However, most of the respondents gave the wrong answer for the question "cause of malaria is due to eating bananas" (75.6%) and for biting time of malaria mosquito as night time (81.3%).In addition, 38.6% and 43.6% of the respondents also knew wrongly the biting time of malaria mosquito as daytime and both day and night time, respectively while (38.2%) and (40.3%) of the respondents did not know the use of mosquito coils and use of mosquito repellents, respectively as prevention methods of malaria.

Table 5. Number and Percentage distribution of correct answer and wrong answer regarding knowledge about malaria by respondents (n=422)

Statements of Knowledge	Number of correct answer	Percentage of correct answer (%)	Number of wrong answer	Percentage of wrong answer (%)
Cause of malaria				
due to mosquito bite	411	97.4	11	2.6
due to coughing and sneezing	298	70.6	124	29.4
due to contact with malaria patient	328	77.7	94	22.3
due to bathing in stream or dirty water	234	55.5	188	44.5
due to eating bananas	103	24.4	319	75.6
Biting time of malaria mosquito				
Day Time	259	61.4	163	38.6
Night Time	79	18.7	343	81.3
Both Day & Night Time	238	56.4	184	43.6
Vulnerable groups of malaria				
Under 5 children	375	88.9	47	11.1
Pregnant mothers	349	82.7	73	17.3
Forest workers	412	97.6	10	2.4
Farmers	413	97.9	9	2.1
Common symptoms of malaria				
Fever	416	98.6	6	1.4
Chills and rigors	417	98.8	5	1.2
Headache	412	97.6	10	2.4
Sweating	342	81.0	80	19.0
Treatment Methods				
Not treated by self-taking anti malaria drugs	301	71.3	121	28.7
Not treated by self-taking traditional medicine	330	78.2	92	21.8
Not treating by traditional healer	313	74.2	109	25.8
Not treating by means of pray for spirits	382	90.5	40	9.5
Taking full course of antimalarial treatment from health facility(sub-center or station health center)	421	99.8	1	0.2
Prevention Methods				
Use mosquito bed net	420	99.5	2	0.5
Use LLINs	420	99.5	2	0.5
Avoid mosquito bites	420	99.5	2	0.5
Use mosquito coil	261	61.8	161	38.2
Use mosquito repellent	252	59.7	170	40.3
Wear long-sleeved clothing	359	85.1	63	14.9
Clean environment	409	96.9	13	3.1
Cover water containers	405	96.0	17	4.0

Level of knowledge

As shown in table 6, among 422 respondents, over half of the respondents (50.7%) had good level of knowledge while (47.4%) of the respondents had moderate level of knowledge and only 8 respondents had poor knowledge. The mean score of

overall knowledge of the respondents was 23 and minimum, and maximum scores of overall knowledge of the respondents were 13 and 29.

Table 6. Level of knowledge regarding malaria (n=422)

Level of knowledge	Frequency(n)	Percent (%)
Poor level(<17scores)	8	1.9
Moderate level(17-23scores)	200	47.4
Good level(>23 scores)	214	50.7

4.3 Perceptions towards malaria

4.3.1 Perceived susceptibility

According to Table 7, majority of the respondents also agreed that children are always susceptible to be infected with malaria (80.5%) and children under five year who do not sleep under mosquito net at night time in malaria-endemic areas are prone to develop malaria (95.9%) as well as disagreed that their children would be able to recover from malaria without going to health facility as their children are so healthy (81.3%).

However, the majority (91.0%) of respondents and 41.0% of the respondents still agreed on a statement in which only weak children could die from malaria and they do not worry about malaria because it can be easily treated.

Table 7. Number and Percent Distribution of Perceived Susceptibility of Respondents on Four Point Likert's Scale (n=422)

Statements of Perceived susceptibility		Strongly agree	Agree	Disagree	Strongly disagree
I don't worry about malaria because it can be easily treated.*	n	62	111	123	126
	%	14.7%	26.3%	29.1%	29.9%
Children always have a chance to be infected with malaria	n	155	185	55	27
	%	36.7%	43.9%	13.0%	6.4%
Children under five year who do not sleep under bed net at night in malaria-endemic areas have more chance to develop malaria	n	250	155	10	7
	%	59.2%	36.7%	2.4%	1.7%
My children are so healthy that they would be able to recover from a case of malaria without going to health facility(sub-center or station health center or health worker)*	n	19	60	126	217
	%	4.5%	14.2%	29.9%	51.4%
Only weak children can die from malaria*	n	198	186	21	17
	%	46.9%	44.1%	5.0%	4.0%

*Negative Statement

Level of Perceived Susceptibility towards Malaria

As shown in table 8, among 422 respondents and three levels of perceived susceptibility, most of the respondents had moderate level (55.5%) while 18.7% and 25.8% had low and high level. Also, the mean scores and standard deviation regarding perceived susceptibility of the respondents were 14 and 2 while the maximum and minimum scores were 20 and 9 respectively.

Table 8. Level of Perceived Susceptibility towards Malaria (n=422)

Level of perceived susceptibility	Frequency(n)	Percentage (%)
Low level(≤12scores)	79	18.7
Moderate level(13-15scores)	234	55.5
High level(≥16 scores)	109	25.8

4.3.2 Perceived severity

As in table 9, among 422 respondents, majority of the respondents agreed that the risk of death from malaria is higher in children under five years compared to adults (96.5%), and complication of malaria are fatal and can result in death (97.1%) while most of the respondents (82.3%) agreed that they always worry that their children might have malaria when their children get fever. Nevertheless, 46.2% still agreed to wait a couple of days before going to a health provider.

Table 9. Number and Percent Distribution of Perceived Severity of Respondents on Four Point Likert's scale (n=422)

Statements of Perceived severity		Strongly agree	Agree	Disagree	Strongly disagree
Risk of death from malaria is higher in children compared to adults	n	246	161	11	4
	%	58.3%	38.2%	2.6%	0.9%
Complications of malaria are dangerous and result in death.	n	265	145	5	7
	%	62.8%	34.4%	1.2%	1.6%
When my child has a fever, I almost always worry that it might be malaria	n	180	167	70	5
	%	42.6%	39.6%	16.6%	1.2%
When my child has a fever, I usually wait a couple of days before going to a health provider*	n	58	137	108	119
	%	13.7%	32.5%	25.6%	28.2%

*Negative Statement

Level of Perceived Severity towards Malaria

As a result of table 10, among 422 respondents and three levels of perceived severity, most of the respondents had moderate level (51.9%) while only 25.1and 23% had high and low level, respectively. Also, the mean scores and standard deviations regarding perceived severity of the respondents were 13 and 2 while the maximum and minimum scores were 16 and 7 respectively.

Table 10.Level of Perceived Severity towards Malaria (n=422)

Level of perceived severity	Frequency(n)	Percentage (%)
Low level(≤11scores)	97	23.0
Moderate level(12-14scores)	219	51.9
High level(≥15 scores)	106	25.1

4.3.3 Perceived benefits

Table 4.9 shows about number and percent distribution of perceived benefits regarding malaria preventive practices of respondents on four points Likert' s scale. Among 422 patients, most of the respondents agreed that burning mosquito coil would drive away mosquito to protect under-five children (70.6%) and wear children long sleeves and pants will protect children from mosquito bites at night time when they are out of mosquito bed nets (81.3%). In addition, most of the respondents agreed that proper application of mosquito repellent in children skin can protect children from malaria mosquito bites (73.2%), to give correct perceptions regarding that cleaning bushes (75.8%) and cleaning stagnant water (84.1%) around the households and that children will get better as soon as they are taken to health facility when they get fever (93.6%).

Nevertheless, 45.8% of respondents still agreed that the chances of getting malaria are the same whether children sleep under a mosquito net or not.

Table 11. Number and Percent Distribution of Perceived Benefits of Respondents on Four Point Likert's Scale (n=422)

Statements of Perceived benefits		Strongly agree	Agree	Disagree	Strongly disagree
The chances of getting malaria are the same whether or not children sleep under a bed net*	n	53	140	125	104
	%	12.6%	33.2%	29.6%	24.6%
Burning mosquito coil will drive away mosquito from biting children	n	78	220	81	43
	%	18.5%	52.1%	19.2%	10.2%
Wearing children long sleeve and pants will protect children from mosquito bites when they are outside of bed nets at night time	n	124	218	58	22
	%	29.4%	51.7%	13.7%	5.2%
Proper application of mosquito repellent in children skin can protect children from mosquito bites and malaria	n	95	214	88	25
	%	22.5%	50.7%	20.9%	5.9%
Cleaning bushes around household is not effective way to reduce mosquito breeding sites and to protect children from malaria*	n	27	75	142	178
	%	6.4%	17.8%	33.6%	42.2%
Cleaning stagnant water around household cannot protect children from mosquito bites and malaria*	n	21	46	173	182
	%	5.0%	10.9%	41.0%	43.1%
Children will get better as soon as if taken to health facility.	n	229	166	16	11
	%	54.3%	39.3%	3.8%	2.6%

*Negative Statement

Level of Perceived Benefits regarding Malaria Preventive Practices

As shown in table 12, among 422 respondents of caregivers of under-five children, most of the respondents (64.2%) were under the group of moderate level of perceived benefits regarding malaria preventive practices while only 19.7% and 16.1% had high and low level of perceived benefits regarding malaria preventive practices, respectively as shown in table 12. The mean score and standard deviations of perceived

benefits of respondents are 21 and three while the maximum and minimum scores of the respondents are 28 and 15, respectively.

Table 12. Level of Perceived Benefits regarding Malaria Preventive Practices (n=422)

Level of perceived benefits	Frequency(n)	Percentage (%)
Low level(≤18scores)	68	16.1
Moderate level(19-23scores)	271	64.2
High level(≥24scores)	83	19.7

4.3.4 Perceived barriers

According to table 13, most of the respondents disagreed that it is difficult to clean breeding sites as there are multiple breeding sites around the household 69.4% and health facilities are too far to get treatment for children under five years when they get a fever (60.5%).

However, most of the respondents agreed that the insecticide on LLINs could be dangerous to children who sleep under them (60.2%) and children cannot sleep well under LLINs when the weather is warm (85.6%). Also, majority of the respondents had high level of perceived barriers regarding wearing long clothes (93.8%), mosquito repellents (70.8%) and mosquito coils (92.7%).

Table 13. Number and Percent Distribution of Perceived Barriers of Respondents on Four Point Likert's Scale (n=422)

Statements of perceived barriers		Strongly agree	Agree	Disagree	Strongly disagree
The insecticide on LLINs can be dangerous to children who sleep under them	n	65	189	121	47
	%	15.4%	44.8%	28.7%	11.1%
Children cannot sleep well under LLINs when the weather is warm	n	167	194	46	15
	%	39.6%	46.0%	10.9%	3.5%
It is very hot when children wear long clothes at night time during hot season	n	195	201	20	6
	%	46.2%	47.6%	4.8%	1.4%
Mosquito repellents are difficult to buy	n	84	215	107	16
	%	19.9%	50.9%	25.4%	3.8%
Mosquito coil causes bad smell and harmful to health of children	n	211	180	19	12
	%	50.0%	42.7%	4.5%	2.8%
There are a lot of multiple breeding sites (bushes and trees) around the household and it is difficult to clean all breeding sites.	n	33	96	192	101
	%	7.8%	22.7%	45.5%	24.0%
It is too far to go to health facility to seek treatment if your children get fever	n	52	119	129	122
	%	12.3%	28.2%	30.6%	28.9%

Level of Perceived Barriers regarding Malaria Preventive Practices

According to table 14, among the respondents and three levels of perceived barriers, most of the respondents (67.1%) had moderate level while 14.9% and 18% had high and low level, respectively of perceived barriers. Moreover, the mean score and standard deviations of perceived benefits of respondents are 20 and 3 while the maximum and minimum scores of the respondents are 28 and 10, respectively.

Table 14. Level of Perceived Barriers regarding Malaria Preventive Practices (n=422)

Level of perceived barriers	Frequency(n)	Percentage (%)
Low level(≤17scores)	76	18.0
Moderate level(18-22scores)	283	67.1
High level(≥23scores)	63	14.9

4.3.5 Perceived Self Efficacy

As a result of table 15, majority of the respondents agreed to perception of self-efficacy regarding use of bed net for under five children (91.5%) and cleaning bushes (96.9%) and cleaning stagnant water (96.4%) around the households. Also, almost all (99.8%) of the respondents to perception of self-efficacy regarding treatment seeking from a health facility.

However, there were 46.2% and 34.6% of the respondents who disagreed to perception of self-efficacy regarding mosquito repellents and mosquito coil, respectively, as well as 46.5 % of the respondents disagreed regarding perceived self-efficacy that they can easily protect their children from getting malaria.

Table 15. Number and Percent Distribution of Perceived Self Efficacy of Respondents on Four Point Likert's Scale (n=422)

Statements of Self Efficacy		Strongly agree	Agree	Disagree	Strongly disagree
Easily protect your children from getting malaria	n	85	141	145	51
	%	20.1%	33.4%	34.4%	12.1%
let children sleep under a bed net for the every entire night at any weather	n	214	172	28	8
	%	50.7%	40.8%	6.6%	1.9%
let children wear long sleeves when they are outside of bed nets at night time at any season	n	78	158	152	34
	%	18.5%	37.4%	36.0%	8.1%
Obtain mosquito repellents to apply children skin when they are outsides of bed nets to protect them from malaria	n	79	148	166	29
	%	18.7%	35.1%	39.3%	6.9%
Use mosquito coils to drive away mosquito to protect children from malaria	n	64	212	121	25
	%	15.2%	50.2%	28.7%	5.9%
Clean bushes around the household to protect children from mosquito bites	n	167	242	8	5
	%	39.6%	57.3%	1.9%	1.2%
Clean stagnant water around the household to protect children from mosquito bites	n	184	227	7	4
	%	43.6%	53.8%	1.7%	0.9%
Get the appropriate treatment from health facility for your child when s/he has fever/malaria	n	232	189	0	1
	%	55.0%	44.8%	0.0%	0.2%

Level of Perceived Self Efficacy regarding Malaria Preventive Practices

As shown in table 16, among 422 respondents, majority of the respondents (69.2%) were in moderate level of perceived self-efficacy regarding malaria preventive practices while only 20.9% and 10% had high and low level, respectively. In addition, the mean score and standard deviations of perceived self-efficacy of respondents were 24 and 4 while the maximum and minimum scores of the respondents are 32 and 12, respectively.

Table 16. Level of Perceived Self Efficacy regarding Malaria Preventive Practices (n=422)

Level of perceived Self Efficacy	Frequency(n)	Percentage (%)
Low level(≤20scores)	42	10.0
Moderate level(21-27scores)	292	69.2
High level(≥28scores)	88	20.8

4.4 Cues to malaria preventive practices

4.4.1 External Cues
4.4.1.1. External Cues to malaria preventive practices regarding mosquito nets

According to table 17, all of the respondents own bed nets, answered that they do not have LLINs shop around their households to buy and only 5 of the respondents did not own long lasting insecticide treated nets (LLINs). Regarding the condition of bed nets, most of the respondents (62.8%) had good condition bed nets among 422 respondents. Among 417 respondents, around (60.9 %) had good condition LLINs and most of the respondents (66.2%) had enough LLINs per family member that means every 2 people in the household had one LLIN.

Table 17. Number and Percent Distribution of External Cues to Malaria Preventive Practice regarding Mosquito Nets by Respondents

External Cues to malaria preventive practices regarding mosquito nets	Frequency (n)	Percentage (%)
Ownership of bed nets(n=422)		
Yes	422	100.0
No	0	0
Ownership of LLINs(n=422)		
Yes	417	98.8
No	5	1.2
Condition of bed nets(n=422)		
not good	157	37.2
good	265	62.8
Condition of LLINs(n=417)		
not good	163	39.1
good	254	60.9
Enough LLINs per family member (2 people per LLIN) (n=417)		
Enough	276	66.2
not enough	141	33.8
Availability of LLINs (n=422)		
Yes	0	0.0
No	422	100.0

4.4.1.2 External Cues to Malaria Preventive Practice regarding Mosquito Repellents

As shown in table 18, among 422 respondents, only (21.8 %) of respondents answered that they have shops around their households to buy mosquito repellents. As well as, only 16 respondents had mosquito repellents in their household to use for under-five children.

Table 18. Number and Percent Distribution of External Cues to Malaria Preventive Practice regarding Mosquito Repellents by Respondents (n=422)

External Cues to malaria preventive practices regarding mosquito repellents(n=422)	Frequency (n)	Percentage (%)
Availability of repellents		
Yes	92	21.8
No	330	78.2
Ownership of repellents		
Yes	16	3.8
No	406	96.2

4.4.1.3 External Cues to Malaria Preventive Practice regarding Mosquito Coils

As shown in table 19, among 422 respondents, majority (90%) of respondents answered that they have shops around their household to buy mosquito coils. Nevertheless, only (20.9 %) of the respondents had mosquito coils in their households to use.

Table 19. Number and Percent Distribution of External Cues to Malaria Preventive Practice regarding Mosquito Coils by Respondents (n=422)

External Cues to Malaria Preventive Practice regarding Mosquito Coils by Respondents	Frequency (n)	Percentage (%)
Availability of mosquito coils		
Yes	380	90.0
No	42	10.0
Ownership of mosquito coils		
Yes	88	20.9
No	334	79.1

4.4.1.4 External Cues to Malaria Preventive Practice regarding Long Sleeves and Pants

According to table 20, almost all of the respondents (99.3%) own long sleeves and pants in their households to let wear their children under five years when they are out of mosquito bed nets at night time.

Table 20. Number and Percent Distribution of External Cues to Malaria Preventive Practice regarding Long Sleeves and Pants by Respondents (n=422)

External Cues to Malaria Preventive Practice regarding long sleeves and pants	Frequency (n)	Percentage (%)
Ownership of Long Sleeves and Pants		
Yes	419	99.3
No	3	0.7

4.4.1.5 External Cues to Malaria Preventive Practice regarding Breeding Sites

As a result of table 21, most of the respondents had bushes (54%) and stagnant water, (49.8%) respectively, around their households to clean to prevent from mosquito bites to their children.

Table 21. Number and Percent Distribution of External Cues to Malaria Preventive Practice regarding Breeding Sites by Respondents (n=422)

External Cues to Malaria Preventive Practice regarding Breeding Sites	Frequency (n)	Percentage (%)
Presence of bushes around the house hold		
Yes	228	54.0
No	194	46.0
Presence of stagnant water around the house hold		
Yes	210	49.8
No	212	50.2

4.4.1.6 External Cues to Malaria Preventive Practice regarding Health Facility

As a result of table 22, over 97 % of the respondents of the respondents had health center or health volunteers around their households to seek treatment for their children under five years when they get a fever.

Table 22. Number and Percent Distribution of External Cues to Malaria Preventive Practice regarding Health Facility by Respondents (n=422)

External Cues to Malaria Preventive Practice regarding Health Facility	Frequency (n)	Percentage (%)
Availability of health facilities		
Yes	410	97.2
No	12	2.8

4.4.1.7 External Cues to Malaria Preventive Practice regarding Source of Information

As in table 23, among 422 respondents, almost all (98.1%) of the respondents ever heard about malaria prevention related messages. Majority of the respondents heard or saw about malaria prevention practices from government health staff (90.8%), TV (61.8%), radio (58.1%), poster (67.5%) and pamphlets (64.5%). However, only around 40% of the respondents heard or saw about malaria from family (38.6%), friends and neighbor (32.7%), videos (46%), billboard (47.6%) and NGO health staffs (42.2%). In addition, only 26.8%, 14.5 % and 8.3% of the respondents heard about malaria prevention related messages from village health volunteers, private doctor, and drug store, respectively while only 11% and 1.7% of respondents heard about malaria prevention related messages from teachers and religious leaders or monks, respectively. , almost all (98.1%) of the respondents ever heard about malaria prevention related messages. Majority of the respondents heard or saw about malaria prevention practices from government health staff (90.8%), TV (61.8%), radio (58.1%), poster (67.5%) and pamphlets (64.5%). However, only around 40% of the respondents heard or saw about malaria from family (38.6%), friends and neighbor (32.7%), videos (46%), billboard (47.6%) and NGO health staffs (42.2%). Also, only 26.8%, 14.5 % and 8.3% of the respondents heard about malaria prevention related messages from village health volunteers, private doctor and drug store, respectively while only 11% and 1.7% of respondents heard about malaria prevention related messages from teachers and religious leaders or monks, respectively.

Table 23. Number and Percent Distribution of External Cues to Malaria Preventive Practice regarding Source of Information by Respondents (n=422)

External Cues to Malaria Preventive Practice regarding Source of Information (n=422)	Frequency (n)	Percentage (%)
Heard/Seen of malaria prevention related messages		
Yes	414	98.1
No	8	1.9
Heard/Seen of malaria prevention related messages from village health volunteer		
Yes	113	26.8
No	309	73.2
Heard/Seen of malaria prevention related messages from government health staff		
Yes	383	90.8
No	39	9.2
Heard/Seen of malaria prevention related messages from private doctor		
Yes	61	14.5
No	361	85.5
Heard/Seen of malaria prevention related messages from drug store		
Yes	35	8.3
No	387	91.7
Heard/Seen of malaria prevention related messages from teacher		
Yes	47	11.1
No	375	88.9
Heard/Seen of malaria prevention related messages from religious leader/monks		
Yes	7	1.7
No	415	98.3

Table 23. continued Number and Percent Distribution of External Cues to Malaria Preventive Practice regarding Source of Information by Respondents (n=422)

External Cues to Malaria Preventive Practice regarding Source of Information (n=422)	Frequency (n)	Percentage (%)
Heard/Seen of malaria prevention related messages from family members		
Yes	163	38.6
No	259	61.4
Heard/Seen of malaria prevention related messages from friends/neighbours		
Yes	138	32.7
No	284	67.3
Heard/Seen of malaria prevention related messages from TV		
Yes	261	61.8
No	161	38.2
Heard/Seen of malaria prevention related messages from Radio		
Yes	245	58.1
No	177	41.9
Heard/Seen of malaria prevention related messages from video		
Yes	194	46.0
No	228	54.0
Heard/Seen of malaria prevention related messages from posters		
Yes	285	67.5
No	137	32.5
Heard/Seen of malaria prevention related messages from pamphlets		
Yes	272	64.5
No	150	35.5
Heard/Seen of malaria prevention related messages from billboards		
Yes	201	47.6
No	221	52.4
Heard/Seen of malaria prevention related messages from NGO staffs		
Yes	178	42.2
No	244	57.8

4.4.2 Internal Cues to Malaria Preventive Practice regarding experience of death of family members and children under five years due to malaria

As in table 24, among 422 respondents only 6 of the respondents had experience of death of family members due to malaria, but none of the respondents had experience of death of under-five children due to malaria in their families.

Table 24. Number and Percent Distribution of Internal Cues to malaria preventive practice regarding the experience of death of family members and children under five years due to malaria by respondents (n=422)

Internal Cues to malaria preventive practices regarding experience of death of family members and children under five years	Frequency (n)	Percentage (%)
Experience of death of family members		
Yes	6	1.4
No	416	98.6
Experience of death of children under five years in family		
Yes	0	0
No	422	100.0

Level of Cues to Malaria Preventive Practices

As shown in table25, among the 422 respondents, over half of the respondents had high level of cues to malaria preventive practices while around (41.5 %) of the respondents had low level. Moreover, the mean scores of perceived cues to malaria preventive practices of respondents are 15 while the maximum and minimum scores of the respondents are 6 and 26, respectively.

Table 25. Level of Cues to Malaria Preventive Practices (n=422)

Level of cues to malaria preventive practices	Frequency (n)	Percentage (%)
Low level (<15scores)	175	41.5
High level (≥15 scores)	247	58.5

4.5 Malaria Preventive Practices

4.5.1 Personal Protective measures

As a result of table 26, among 422 respondents, over two-third of the respondents always sleep under bed nets or LLINs (78.7%) and always let their children under five years sleep under bed nets or LLINs (84.8%). However, only 44% of the respondents always check tears or holes in bed nets/LLINs and only 21 % of the respondents always repair tears or holes in bed nets or LLINs. In addition, majority (96%) of the respondents never used repellents (96%) and never used mosquito coils (80.1%) for their under-five children in the household and only 12.1% always wear their under-five children long clothes when their children are outside of mosquito bed nets at night time while majority of the respondents sometimes wear their under-five children long clothes (86.5%).

Table 26. Frequency and Percentage Distribution of Malaria Preventive Practices regarding Personal Protective measures by respondents (n=422)

Malaria Preventive Practices regarding Personal Protective measures	Frequency (n)	Percentage (%)
Sleeping under bed nets or LLINs		
never	21	4.9
sometimes	69	16.4
always	332	78.7
Let children sleep under bed nets or LLINs		
never	12	2.9
sometimes	52	12.3
always	358	84.8
Checking tears or holes in bed nets/LLINs		
never	47	11.1
sometimes	191	45.3
always	184	43.6
Repair tears or holes in bed nets/LLINs		
never	154	36.5
sometimes	180	42.7
always	88	20.9
Using mosquito repellents		
never	406	96.2
sometimes	12	2.8
always	4	0.9
Using mosquito coils		
never	338	80.1
sometimes	73	17.3
always	11	2.6
Wearing children long sleeves and pants at night time		
never	6	1.4
sometimes	365	86.5
always	51	12.1

According to table 27, in a concern of level of malaria preventive practices regarding personal protective measures among 422 respondents, most of the respondents (70.6%) had good malaria preventive practice for personal protective measures while 29.4 % of the respondents had poor level. In addition, the mean score for personal protective measures was 7 scores while the maximum and the minimum scores were 12 and 1, respectively.

Table 27. Level of Malaria Preventive Practices regarding Personal Protective Measures among Caregivers of Under-Five Children (n=422)

Level of Malaria Preventive Practices regarding Personal Protective Measures	Frequency(n)	Percent (%)
Poor(<7 scores)	124	29.4
Good(≥7 scores)	298	70.6

4.5.2 Environmental Control Measures

Among 422 respondents, 228 respondents answered the question for cleaning bushes around the household as the rest did not have bushes around the households while 210 answered the question for cleaning stagnant water around the household as 212 respondents did not have stagnant water around the household and skipped the questions. Therefore, there are only 176 respondents who answered both questions regarding environmental control practices.

According to table 28, regarding environmental control practice such as cleaning bushes around the household, among 228 respondents who had environmental risk regarding bushes, only 29.8 % of the respondents always clean the bushes around the household while most of the respondents (66.2%) sometimes clean them. In addition, regarding cleaning stagnant water around the household, among 210 respondents who had environmental risk regarding stagnant water around the household, most of the respondents (59.1%) sometimes do that practice while (37.6%) always clean stagnant water around the households.

Table 28. Frequency and Percentage Distribution of Malaria Preventive Practices regarding Environmental Control Measures by Respondents

Malaria Preventive Practices among caregivers	Frequency (n)	Percentage (%)
Environmental Control Measures		
cleaning bushes around the household(n=228)		
never	9	4.0
sometimes	151	66.2
always	68	29.8
cleaning stagnant water around the household(n=210)		
never	7	3.3
sometimes	124	59.1
always	79	37.6

According to table 29, in a concern of level of malaria preventive practices regarding personal protective measures among 176 respondents who had both environmental risks such as bushes and stagnant water around the household, over half (57.4%) had poor malaria preventive practice for environmental control practice. In addition, the mean scores for environmental control practices were 3 scores while the maximum and the minimum scores were 4 and 0, respectively.

Table 29. Level of Malaria Preventive Practices Regarding Environmental Control Measures among Caregivers of Under-Five Children (n=176)

Level of Malaria Preventive Practices Regarding Environmental Control Measures (n=176)	Frequency (n)	Percentage (%)
Poor(<3scores)	101	57.4
Good(≥3scores)	75	42.6

4.5.3 Treatment seeking Practice

According to table 30, only 410 respondents answered the questions for treatment seeking practice. Among 410 respondents, majority of the respondents (80.5%) always received health care from health center or health volunteer while their children get a fever while only 19.3% respondents sometimes do that practice and one

respondent never received health care from health center or health volunteer while their children get a fever.

Table 30. Frequency and Percentage Distribution of Malaria Preventive Practices regarding Treatment Seeking Practice by Respondents (n=410)

Malaria Preventive Practices regarding treatment seeking practice among caregivers (n=410)	Frequency (n)	Percentage (%)
receiving health care from health center/health volunteer if their children get fever		
never	1	0.2
sometimes	79	19.3
always	330	80.5

According to table 31, among 410 respondents, majority of the respondents (80.5%) had good malaria preventive practice regarding treatment seeking practice. In addition, the mean score for treatment seeking practice was 2 scores while the maximum and the minimum scores were 2 and 0, respectively.

Table 31. Level of Malaria Preventive Practices regarding Treatment Seeking Practice among Caregivers of Under-Five Children (n=410)

Level of Malaria Preventive Practices regarding Treatment Seeking Practice (n=410)	Frequency (n)	Percentage (%)
Poor(<2scores)	80	19.5
Good(≥2scores)	330	80.5

Part 2 Analytic Findings

4.6 Bivariate Analysis

Chi-square test was used to analyze the associations between all independent variables and three dependent variables such as level of malaria preventive practice regarding personal protective measures, level of malaria preventive practice regarding

environmental control measures and level of malaria preventive practice regarding treatment seeking practice.

In bivariate analysis, marital status, occupational status, economic status and number of children under five year and age group of children under five years ,level of knowledge, levels of perceptions towards malaria were re-categorized or combined again as mentioned in data analysis part of methodological sections to simplify analysis and results(MacCallum et al., 2002).

4.6.1. Bivariate Analysis between Independent Variables and Dependent variable, Malaria Preventive Practice regarding Personal Protective Measures

4.6.1.1 Bivariate Analysis between Modifying Factors and Level of Malaria Preventive Practices regarding Personal Protective measures

Table 32 shows the bivariate analysis results among modifying factors including six socio-demographic and economic characteristics, four household characteristics and level of knowledge with level of malaria preventive practice regarding personal protective measures among 422 caregivers of under-five children.

There was no statistically significant association among socio-demographic and economic characteristics with the level of malaria preventive practice regarding personal protective measures of the respondents except economic status which is positively statistically significant association at 0.05 level.

Among four household characteristics, only number of household members was negative statistically significant associations with level of malaria preventive practice regarding personal protective measures at 0.05 level, and other variables were not statistically significantly associated.

Moreover, level of knowledge was associated with level of malaria preventive practice regarding personal protective measures among 422 respondents, and it is statistically significant at 0.05 level. The results showed that the respondents with good level of knowledge were more likely to have good preventive practice regarding personal protective measures than poor ones.

Table 32. Bivariate analysis between modifying factors and Level of Malaria Preventive Practices regarding Personal Protective measures (n=422)

Modifying Factors	Level of Malaria Preventive Practices Regarding Personal Protective measures				Chi-Square	p value
	Poor		Good			
	n	%	n	%		
Socio-Demographic Characteristics						
Age					0.854	0.355
<30	46	26.9%	125	73.1%		
≥30	78	31.1%	173	68.9%		
Sex					0.891	#0.455
Male	4	20.0%	16	80.0%		
Female	120	29.9%	282	70.1%		
Marital Status					0.435	#0.730
Never Married	2	20.0%	8	80.0%		
Ever married	122	29.6%	290	70.4%		
Education					0.392	0.531
Illiterate and primary	43	31.4%	94	68.6%		
Secondary/high school/above	81	28.4%	204	71.6%		
Occupation status					3.101	0.078
Employed	24	22.6%	82	77.4%		
Unemployed	100	31.6%	216	68.4%		
Economic Status					4.568	**0.033***
Poorest/Second poor	72	34.1%	139	65.9%		
Middle/fourth/Richest	52	24.6%	159	75.4%		
Household Characteristics						
Relationships of respondents to U5 children					0.000	0.995
mother	99	29.4%	238	70.6%		
other	25	29.4%	60	70.6%		
Number of household members					7.966	**0.005***
≤4	45	22.7%	153	77.3%		
>4	79	35.3%	145	64.7%		
Number of children under five years					0.409	0.588
1	114	29.8%	268	70.2%		
≥2	10	25.0%	30	75.0%		
Age of under five children					1.006	0.316
<12months	19	24.7%	58	75.3%		
>12 months	105	30.4%	240	69.6%		

*p-value <0.05, # Fisher Exact Test

Table.32 Continued: Bivariate analysis between modifying factors and Level of Malaria Preventive Practices regarding Personal Protective measures (n=422)

Modifying Factors	Level of Malaria Preventive Practices Regarding Personal Protective measures				Chi-Square	P value
	Poor		Good			
	n	%	n	%		
Level of knowledge					6.450	0.011*
Poor level	73	35.1%	135	64.9%		
Good level	51	23.8%	163	76.2%		

* p- value <0.05

4.6.1.2 Bivariate Analysis between Levels of Perceptions towards Malaria and Cues to Malaria Preventive Practices and Level of Malaria Preventive Practice regarding Personal Protective measures

Table 33 shows the bivariate analysis among levels of perceptions towards malaria including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy and cues to malaria preventive practices with level of malaria preventive practice regarding personal protective measures among caregivers of under-five children.

As shown in table below, there were no statistically significant associations between perceived barriers and level of malaria preventive practice regarding personal protective measures, and between perceived self-efficacy and level of malaria preventive practice regarding personal protective measures among caregivers of under-five children and between cues to malaria preventive practices and level of malaria preventive practices regarding personal protective measures.

However, there were statistically significant associations of perceived severity and perceived benefits with level of malaria preventive practice regarding personal protective measures at p-value 0.001 level, and between perceived susceptibility and level of malaria preventive practice regarding personal protective measures at p-value 0.05 level.

Table 33. Bivariate analysis between Levels of Perception towards Malaria and Cues to Malaria Preventive Practices and Level of Malaria Preventive Practices regarding Personal Protective measures (n=422)

Perceptions towards Malaria and Cues to Malaria Preventive Practices	Level of Malaria Preventive Practices Regarding Personal Protective measures				Chi-Square	p value
	Poor		Good			
	n	%	n	%		
Level of perceived susceptibility					10.233	**0.002***
Low level	58	38.7%	92	61.3%		
High level	66	24.3%	206	75.7%		
Level of perceived severity					37.579	**0.000****
Low level	80	45.5%	96	54.5%		
High level	44	17.9%	202	82.1%		
Level of perceived benefits					13.317	**0.000****
Low level	71	38.6%	113	61.4%		
High level	53	22.3%	185	77.7%		
Level of perceived barriers					0.524	0.469
Low level	51	27.6%	134	72.4%		
High level	73	30.8%	164	69.2%		
Level of perceived Self Efficacy					1.885	0.169
Low level	64	32.7%	132	67.3%		
High level	60	26.5%	166	73.5%		
Cues to Malaria Preventive Practices					0.008	0.927
Low	51	29.1%	124	70.9%		
High	73	29.6%	174	70.4%		

*p-value<0.05, **p value<0.001

4.6.2. Bivariate Analysis between Independent Variables and Dependent variable, Malaria Preventive Practices regarding Environmental Control Measures

4.6.2.1 Bivariate Analysis between Modifying Factors and Level of Malaria Preventive Practices regarding Environmental Control Measures

Table 34 shows the bivariate analysis among modifying factors including six socio-demographic and economic characteristics, four household characteristics and level of knowledge with level of malaria preventive practices regarding environmental

control measures among 176 caregivers of under-five children. There was no statistically significant association between modifying factors and level of malaria preventive practices regarding environmental control measures of respondents at 0.05 level.

Table 34. Bivariate analysis between modifying factors and Level of Malaria Preventive Practices regarding Environmental Control Measures (n=176)

Modifying Factors	Level of Malaria Preventive Practices Regarding Environment Control measures				Chi-Square	p value
	Poor		Good			
	n	%	n	%		
Socio-Demographic Characteristics						
Age					0.833	0.362
<30	46	61.3%	29	38.7%		
≥30	55	54.5%	46	45.5%		
Sex					2.864	#0.120
Male	9	81.8%	2	18.2%		
Female	92	55.8%	73	44.2%		
Marital Status					3.039	#0.137
Never Married	4	100.0%	0	0.0%		
Ever married	97	56.4%	75	43.6%		
Education					0.31	0.577
Illiterate and primary	31	54.4%	26	45.6%		
Secondary/high school/above	70	58.8%	49	41.2%		
Occupation status					0.221	0.639
Employed	26	60.5%	17	39.5%		
Unemployed	75	56.4%	58	43.6%		
Economic Status					0.593	0.441
Poorest/Second poor	49	60.5%	32	39.5%		
Middle/fourth/Richest	52	54.7%	43	45.3%		
Household Characteristics						
Relationships of respondents to U5 children					0.311	0.577
mother	83	56.5%	64	43.5%		
other	18	62.1%	11	37.9%		
Number of household members					0.353	0.553
≤4	49	59.8%	33	40.2%		
>4	52	55.3%	42	44.7%		
Number of children under five years					2.791	0.095
1	92	59.7%	62	40.3%		
≥2	9	40.9%	13	59.1%		
Age of under five children					1.539	0.215
<12months	19	48.7%	20	51.3%		
≥12 months	82	59.9%	55	40.1%		

 # Fisher Exact test

Table 34 Continued: Bivariate analysis between modifying factors and Level of Malaria Preventive Practices regarding Environmental Control measures (n=176)

Modifying Factors	Level of Malaria Preventive Practices				Chi-Square	P value
	Poor		Good			
	n	%	n	%		
Level of knowledge					2.747	0.097
Poor level	49	64.5%	27	35.5%		
Good level	52	52.0%	48	48.0%		

4.6.2.2 Bivariate Analysis between Levels of Perceptions towards Malaria and Cues to Malaria Preventive Practices and Level of Malaria Preventive Practices regarding Environmental Control measures

Table 35 shows the bivariate analysis among levels of perceptions towards malaria including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy and cues to malaria preventive practices with level of malaria preventive practices regarding environment control measures among 176 caregivers of under-five children. There was no statistically significant association among levels of perceptions towards malaria and cues to malaria preventive practices with level of malaria preventive practices regarding environment control measures at 0.05 level except perceived severity and perceived barriers. Perceived severity and barriers had statistically significant negative associations with level of malaria preventive practice regarding environmental control measures at 0.05 level.

Table 35. Bivariate analysis between Level of Perception towards Malaria and Cues to Malaria Preventive Practices and Level of Malaria Preventive Practices regarding Environment Control measures (n=176)

Perceptions towards Malaria and Cues to Malaria Preventive Practices	Level of Malaria Preventive Practices regarding Environment Control measures				Chi-Square	p value
	Poor		Good			
	n	%	n	%		
Level of perceived susceptibility					0.528	0.467
Low level	35	53.8%	30	46.2%		
High level	66	59.5%	45	40.5%		
Level of perceived severity					4.278	**0.039***
Low level	28	46.7%	32	53.3%		
High level	73	62.9%	43	37.1%		
Level of perceived benefits					0.248	0.618
Low level	38	55.1%	31	44.9%		
High level	63	58.9%	44	41.1%		
Level of perceived barriers					8.544	**0.003***
Low level	33	44.6%	41	55.4%		
High level	68	66.7%	34	33.3%		
Level of perceived Self Efficacy					0.005	0.946
Low level	49	57.6%	36	42.4%		
High level	52	57.1%	39	42.9%		
Cues to Malaria Preventive Practices					0.221	0.639
Low	26	60.5%	17	39.5%		
High	75	56.4%	58	43.6%		

*p values <0.05

4.6.3. Bivariate Analysis between Independent Variables and Dependent variable, Malaria Preventive Practice regarding Treatment seeking practice

4.6.3.1 Bivariate Analysis between Modifying Factors and Level of Malaria Preventive Practices regarding Treatment seeking practice

Table 36 shows the bivariate analysis among modifying factors including six socio-demographic and economic characteristics, four household characteristics and

level of knowledge with level of malaria preventive practices regarding treatment seeking practice among 410 caregivers of under-five children.

Except for economic status, there was no statistically significant association among modifying factors with level of malaria preventive practice regarding treatment seeking practice of respondents at 0.05 level. Economic status was positively statistically significantly associated with level of malaria preventive practice regarding treatment seeking practice among caregivers at statically significant level.

Table 36. Bivariate analysis between modifying factors and Level of Malaria Preventive Practices regarding Treatment seeking Practice (n=410)

Modifying Factors	Level of Malaria Preventive Practices regarding Treatment Seeking Practice				Chi-Square	P value
	Poor		Good			
	n	%	n	%		
Socio-Demographic Characteristics						
Age					0.662	0.416
<30	35	21.5%	128	78.5%		
≥30	45	18.2%	202	81.8%		
Sex					0.290	#0.590
Male	3	15.0%	17	85.0%		
Female	77	19.7%	313	80.3%		
Marital Status						#1.000
Never Married	1	11.1%	8	88.9%		
Ever married	79	19.7%	322	80.3%		
Education					0.577	0.448
Illiterate and primary	28	21.7%	101	78.3%		
Secondary/high school/above	52	18.5%	229	81.5%		
Occupation status					0.889	0.346
Employed	17	16.3%	87	83.7%		
Unemployed	63	20.6%	243	79.4%		
Economic Status					4.58	**0.032***
Lowest/Second low	48	23.8%	154	76.2%		
Middle/fourth/Richest	32	15.4%	176	84.6%		
Household Characteristics						
Relationships of respondents to U5 children					0.463	0.496
mother	66	20.2%	261	79.8%		
other	14	16.9%	69	83.1%		
Number of household members					0.013	0.908
≤4	37	19.3%	155	80.7%		
>4	43	19.7%	175	80.3%		
Number of children under five years					2.704	0.100
1	69	18.5%	304	81.5%		
≥2	11	29.7%	26	70.3%		
Age of under five children					0.806	0.369
<12months	17	23.3%	56	76.7%		
≥12 months	63	18.7%	274	81.3%		

*p-value <0.05#, Fisher Exact test

Table.36 Continued: Bivariate analysis between modifying factors and Level of Malaria Preventive Practices regarding Treatment seeking Practice

Modifying Factors	Level of Malaria Preventive Practices regarding Treatment Seeking Practice				Chi-Square	P value
	Poor		Good			
	n	%	n	%		
Level of knowledge					0.299	0.584
Poor level	38	18.4%	168	81.6%		
Good level	42	20.6%	162	79.4%		

4.6.3.2. Bivariate Analysis between Level of Perceptions towards Malaria and Cues to Malaria Preventive Practices and Level of Malaria Preventive Practices regarding Treatment Seeking Practice

Table 37 shows the bivariate analysis the bivariate analysis among levels of perceptions towards malaria including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy and cues to malaria preventive practices with level of malaria preventive practice regarding treatment seeking practice among 410 caregivers of under-five children.

As shown in table below, at p-value 0.001 level, perceived severity and perceived benefits make the statistically significant association with level of malaria preventive practice regarding treatment seeking practice. In addition, at p-value 0.05 level, there was a statistically significant association between level of perceived self-efficacy and level of malaria preventive practice regarding treatment seeking practice. The results revealed that the respondent with high perceived susceptibility and self-efficacy were more likely to do good preventive practice regarding treatment seeking practice than lower ones. However, levels of perceived susceptibility and perceived barriers and cues to malaria preventive practice had no statistically significant associations with level of malaria preventive practice regarding treatment seeking practice at 0.05 level.

Table 37. Bivariate analysis between Level of Perception towards Malaria and Cues to Malaria Preventive Practices and Level of Malaria Preventive Practices regarding Treatment Seeking Practice (n=410)

Perceptions towards Malaria and Cues to Malaria Preventive Practices	Level of Malaria Preventive Practices Regarding Treatment Seeking Practice				Chi-Square	p value
	Poor		Good			
	n	%	n	%		
Level of perceived susceptibility					0.656	0.418
Low level	32	21.6%	116	78.4%		
High level	48	18.3%	214	81.7%		
Level of perceived severity					43.138	**0.000****
Low level	60	34.5%	114	65.5%		
High level	20	8.5%	216	91.5%		
Level of perceived benefits					13.959	**0.000****
Low level	50	27.8%	130	72.2%		
High level	30	13.0%	200	87.0%		
Level of perceived barriers					2.047	0.152
Low level	30	16.4%	153	83.6%		
High level	50	22.0%	177	78.0%		
Level of perceived Self Efficacy					4.123	**0.042***
Low level	45	23.8%	144	76.2%		
High level	35	15.8%	186	84.2%		
Cues to Malaria Preventive Practices					0.000	0.990
Low	34	19.5%	140	80.5%		
High	46	19.5%	190	80.5%		

*P value <0.05, **P value<0.001

4.7.   Multivariate Analysis

Multiple logistic regression with enter method was used to analyze the associations between the multiple independent variables with p values less than 0.25 in bivariate analysis and which are theoretically essential and confounders in previous studies and each dependent variables in our study, which are level of malaria preventive practice regarding personal protective measures, level of malaria preventive practice

regarding environmental control measures and level of malaria preventive practice regarding treatment seeking practice.

Theoretically important variables and confounders for malaria preventive practices in previous study such as sex, economic status ,education and age of children under-five year (Adams, 2015), marital status (Charles Ibiene Tobin-West, 2016), occupation(Adams, 2015; Adebayo et al., 2015),level of perceived susceptibility(Linn, 2016) were included for analysis with personal protective measures and environmental control measures. Theoretically important variables for treatment seeking practice such as age of caregivers, level of perceived susceptibility, level of perceived barriers (Mitiku & Assefa, 2017),education (Obol, David Lagoro, & Christopher Garimoi, 2011) and level of knowledge(Mitiku & Assefa, 2017; Moe Moe Thandar, 2015), were included in analysis with treatment seeking practice as dependent variable.

4.7.1 Multivariate Analysis between Independent Variables and Level of Malaria Preventive Practice Regarding Personal Protective Measures

To find out the associations with level of malaria preventive practice regarding personal protective measures, twelve independent variables including the variables which are p value<0.05 (economic status, number of household members, level of knowledge, level of perceived susceptibility, level of perceived severity, level of perceived benefits) and p value=0.05-0.25(occupational status, level of perceived self-efficacy) and theoretically important variables (sex, marital status, education, age of children under five) were put together at the same time to run with enter method in binary logistic regression in SPSS. Among six statistically significant variables at bivariate analysis, two variables namely number of household members and levels of perceived susceptibility maintained their significance at 0.05 level, and level of perceived severity maintained its significance at 0.001 level, and other variables lost their significance at multivariate analysis.

Table 38 shows those variables which maintain their significant associations with level of malaria preventive practice regarding personal protective measures. As shown in table, number of household members had a negative statistically significant association with malaria preventive practice regarding personal protective measures at

p value<0.05 while perceived severity had positive statistically significant association at 0.05 level and strong positive statistically significant association at 0.001 level, respectively. Respondents who had more than four number of children under five were 0.545 times less likely to do good preventive practice regarding personal protective measures than those with four or less than four family members(AOR=0.545, 95%CI=0.343-0.868, p value=0.010). Respondents with high perceived severity were 3.248 times more likely to do good malaria preventive practice regarding personal protective measures, respectively than those with low level(AOR=3.248, 95%CI=1.973-5.348, p value <0.001).

Table 38. Multivariate Analysis among Number of Household Members, Level of Susceptibility and Level of Perceived Severity with Level of Malaria Preventive Practice Regarding Personal Protective Measures by Multiple Logistic Regression (n=420)

Variables	B	S.E.	Sig.	AOR (95% CI)	95% C.I	
					Lower	Upper
Number of household members ≤ 4(Ref:) >4	-0.606	0.237	0.010*	0.545	0.343	0.868
Perceived severity Low (Ref:) High	1.178	0.254	0.000**	3.248	1.973	5.348

*p value<0.05, **p value<0.001Method =Enter method, Hosmer and Lemeshow Test χ2 =6.854 (df= 8, p= 0.553), Nagelkerke R Square=0.180, Overall Percentage of correct classification = 73.9%

4.7.2 Multivariate Analysis between Independent Variables and Level of Malaria Preventive Practice Regarding Environmental Control Measures

To find out the associations with level of malaria preventive practice regarding environmental control measures, ten independent variables including the variables which are p value<0.05(level of perceived severity and level of perceived barriers) and

p value=0.05-0.25(sex, marital status, number of children under five years, level of knowledge) and theoretically important variables (education, occupation, economic status, age group of children under five, level of perceived susceptibility)were put together at the same time to run with enter method in binary logistic regression in SPSS. Two independent variables which are statistically significant at bivariate analysis, namely, level of perceived severity and barriers maintained statistically significant at 0.05 level at multivariate analysis.

Table 39 shows those variables which had statistically significant associations with level of malaria preventive practice regarding environmental control measures at multivariate analysis. As shown in the table, respondents with high level of perceived severity were less likely to do good malaria preventive practice regarding environmental control measures (AOR=0.460, 95%CI=0.225-0.944, p value=0.034). Respondents with high perceived barrier were 0.356 times less likely to do good malaria preventive practice regarding environmental control measures than those with low level (AOR=0.356, 95%CI=0.182-0.707, p value=0.003).

Table 39. Multivariate Analysis of Level of Perceived Severity and Level of Perceived barrier with Level of Malaria Preventive Practice Regarding Environmental Control Measures by Multiple Logistic Regression (n=176)

Variables	B	S.E.	Sig.	AOR (95% CI)	95% C.I	
					Lower	Upper
Perceived severity Low (Ref:) High	-0.776	0.366	0.034*	0.460	0.225	0.944
Perceived barrier Low (Ref:) High	-1.032	0.344	0.003*	0.356	0.182	0.699

*p value<0.05, Method =Enter method, Hosmer and Lemeshow Test $\chi2$ = 2.469(df =8, p= 0.963), Nagelkerke R Square= 0.147, overall percentage of correct classification = 79.5 %

4.7.3. Multivariate Analysis between Independent Variables and Level of Malaria Preventive Practice Regarding Treatment Seeking Practice

To find out the associations with level of malaria preventive practice regarding treatment-seeking practices, ten independent variables including the variables which are p value<0.05 (economic status, level of perceived susceptibility, level of perceived severity and level of perceived benefits, , level of perceived self-efficacy) ,and p value=0.05-0.25 (number of children under five years, level of perceived barriers) and theoretically important variables (age of caregivers, education, level of knowledge)were put together at same time to run with enter method in binary logistic regression in SPSS. Among two statistically significant variables and two strong statistically significant variables in the bivariate analysis, only perceived severity still maintained its significance and others lost their significance at multivariate analysis and perceived barriers becomes statistically significant at multivariate level.

Table 40 shows those variables which maintain their statistically significant associations with level of malaria preventive practice regarding treatment-seeking practices. Respondents with high perceived severity are 6.642 times more likely to do good malaria preventive practice regarding treatment seeking practice at 0.001 level. Respondents with high perceived barriers are 0.548 times less likely to do good malaria preventive practice regarding treatment seeking practice at 0.05 level.

Table 40. Multivariate Analysis between Economic Status and Level of Perceived barriers, Level of Malaria Preventive Practice Regarding Treatment Seeking Practice by Multiple Logistic Regression (n=410)

Variables	B	S.E.	Sig.	AOR (95% CI)	95% C.I	
					Lower	Upper
Perceived severity Low (Ref:) High	1.893	0.330	**0.000****	6.642	3.480	12.675
Perceived barrier Low (Ref:) High	-0.601	0.291	**0.039****	0.548	0.310	0.970

*p value<0.05, **p value<0.001, Method =Enter method, Hosmer and Lemeshow Test $\chi 2$ = 6.174 (df =8, p= 0.628), Nagelkerke R Square=0.220, Overall Percentage of correct classification = 79.8%

Table 41. Summary Table of Analysis Results of Three Dependent Variables

Independent Variables	Analysis Results of Dependent Variables					
	Practice 1		Practice 2		Practice 3	
	Personal Protective Measures		Environmental		Treatment seeking Practice	
	Bi-variate	Multi-variate	Bi-variate	Multi-variate	Bi-variate	Multi-variate
Economic Status	A	-	-	-	A	
Number of household members	A	A	-	-	-	
Number of children under-five years	-	-	-	-		
Level of Knowledge	A	-	-	-	-	
Level of perceived susceptibility	A	-	-	-	-	-
Level of perceived severity	SA	SA	A	A	SA	SA
Level of perceived benefits	SA	-	-	-	SA	-
Level of perceived barriers	-	-	A	A	-	A
Level of perceived self-efficacy	-	-	-	-	A	

A= Significant Association (p<0.05), SA= Strongly Significant Association (p<0.001)

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CHAPTER V
DISCUSSION, CONCLUSION, AND RECOMMENDATION

The main purpose of this research was to describe characteristics and malaria preventive practices among caregivers for under-five children and to find out the associations among these characteristics including modifying factors, perceptions towards malaria, and cues to malaria preventive practices with malaria preventive practices among caregivers for under five children, in high-risk areas of Ngapudaw Township, Ayeyarwady Region-Myanmar.

5.1. Discussion on Descriptive Findings

5.1.1 Modifying Factors

5.1.1.1 Socio-demographic and Economic Characteristics

Among 422 respondents, the mean age of the respondents was 34 and ranged from 18 to 83 years. By categorizing into two groups, over half (59.5%) of respondents were above 30 years of age. The results were similar to the cross-sectional study of caregivers treatment seeking practice among caregivers of under-five children in 23 mobile and 25 non-mobile villages in Ingapu Township, Ayeyarwady Region, Myanmar (Moe Moe Thandar, 2015).Majority of the respondents were female(95.3%), married (91.9%) and housewife (72.3%) – due to the Burmese culture where women are mostly to take care of family and children at home rather than working outside. Regarding education, the highest number of respondents had secondary school level education (38.2%), and 5.9% of respondents had never learned under the government education system. Regarding economic status, the highest proportion (30.8%) were in second poor level while 19.2% of respondents were poorest among the community. It is different from wealth status of Myanmar Demographic Health Survey where poorest level had the highest number of respondents and may be different due to different populations like caregivers of under-five children in our study and the general population in a demographic health survey.

5.1.1.2. Household Characteristics

Majority of the respondents (79.9%) were mothers. It may be due to Myanmar traditional culture that child care is the responsibility of the mother. Majority of the respondents had more than four household members, and the average number of household members was 5, and it ranged from 2 to 11. It is higher compared to data of Myanmar Census Report in Ayeyarwady Region Myanmar which showed an average number of household members was 4.1 in 2014(Myanmar, August 2014).

5.1.1.3. Knowledge

Majority of the respondents (97.4%) knew that malaria is caused by a mosquito bite and over 88% knows that under 5 children are vulnerable groups of malaria. Also, almost all (99.5 %) knew that using mosquito bed nets or LLINs was a method of malaria prevention and (99.8%) knew about taking the full course of antimalarial treatment from a health facility. This result is higher compared to the results found in the study of caregivers treatment-seeking behavior for under-five children in the malaria-endemic area, Ingapu Township, Ayeyarwady region, Myanmar (Moe Moe Thandar, 2015). However, there were misconceptions about the cause of malaria as 44.5%, and 75.6% of the respondents still wrongly answered causes of malaria to be due to bathing in a stream or dirty water and eating a banana. The idea may arise from the concurrence of bathing in stream or dirty water, the presence of mosquito breeding sites and linguistic similarity may confuse people, that eating banana can cause malaria as the word for banana in Myanmar language is "ngat pyaw thee" which sounds similar to the word for malaria "ngat phya". This idea is supported with the qualitative study to assess consumer preferences and barrier to use long-lasting insecticide-treated net done in three townships of Sagaing, Kayah, and Tannitharyi region in Myanmar, in which eating banana is the perceived third frequent cause of malaria (Shafique, 2014). Also, 28.7% of the respondents still wrongly knew that taking self-treatment with malaria drugs can prevent malaria. Taking antimalarial drugs without RDT testing is not allowed according to the national malaria treatment guideline. In addition, some antimalarial drug, chloroquine, is still readily available in the markets despite chloroquine monotherapy being banned in Myanmar, and ACT combination drugs without RDT test kits are also readily available as some project distributes ACT

combination drugs in drug stores but test kits were only provided to health volunteers and their fixed and mobile clinics in the same township with drug stores distributed by ACT.Thirty-eight percent (38.2%) and 40.3% of the respondents did not know the uses of mosquito coil and mosquito repellent as malaria prevention practices. It may be possible because, in Myanmar, use of LLINs is a core malaria preventive measures and also raising awareness about the use of mosquito coil in malaria prevention was reduced as it can increase the risk of respiratory diseases in under-five children (Tun* et al., 2005). In addition, use of mosquito repellents is uncommon in Myanmar although awareness regarding mosquito repellent was done in some malaria projects. Mosquito repellent was cited method of prevention in forest and migrant workers and is not available in every township due to high costs (Shafique, 2014). Regarding overall knowledge level, over half of the respondents had good knowledge while 1.9% had poor knowledge.

5.1.2. Perceptions towards Malaria

5.1.2.1.   Perceived Susceptibility

Most of the respondents had moderate level (55.5%) while 18.7% and 25.8% had low and high level, respectively as majority (91.0%) and 41.0% of the respondents still agreed on statement that 'only weak child could die from malaria' and 'they do not worry about malaria because it can be easily treated'. They may agree on the first statement and the second statement as they may not know that every child under five is susceptible to malaria and severe malaria mostly occur in children under five or as they could wrongly know malaria can be treated by self-medication with antimalaria drugs (28.7%) and traditional drugs (21.8%) as observed in our study.

5.1.2.2.   Perceived Severity

Most of the respondents had moderate level (51.9%) while only 25.1and 23% had high and low level respectively. It may be on account of 46.2% of the respondents who still agreed to wait a couple of days before going to health care provider. Perception on delay in treatment seeking is possible due to self-medication practice where health

facilities sources are scared (IK., 2002; Mitiku & Assefa, 2017; Ruebush TK, 1995; Thera MA, 2000).

5.1.2.3.   Perceived Benefits

Most of the respondents (64.2%) were in moderate group regarding perceived benefits, and discouragingly, the result revealed that 45.8% of respondents still agreed that the chances of getting malaria are the same whether children sleep under a mosquito net or not. It indicated that benefits of use of bed nets in health education provided by government and non-government organization still need to emphasize to change people perception even though health education session had improved the knowledge of respondents.

5.1.2.4.   Perceived Barriers

Most of the respondents (67.1%) had moderate level of perception on barriers. Unfortunately, most of the respondents had perceived as the use of LLINs as insecticides can be dangerous to children(60.2%) , and children cannot sleep well under bed net due to hot weather(85.6%). Another 93.8% had percieved barrier wearing long sleeve clothes since it is so hot at night during hot weather. The use of mosquito coils and mosquito repellents were perceived as a barrier because mosquito coils produce a bad smell that is harmful to health by (92.7%), and mosquito repellents are difficult to buy (70.8%). The high number of results regarding bed nets may be due to poor knowledge on the proper use of LLINs. The high number of results regarding bed nets and wearing long clothes may also be due to hot weather at the time of interview. The statement regarding percieved barrier to wearing long clothes seemed to be a general statement and may need to be modified for further research. Barrier regarding mosquito repellents has been proven as 78.2% of respondents answered that the shop to buy mosquito repellent was not available around their households as one of the external cues to malaria preventive practices in our study. The high results regarding perceived barrier on mosquito coils may be possible as higher knowledge about side effects of mosquito coil on children respiratory disease in that region.

5.1.2.5.   Perceived Self Efficacy

Majority of the respondents (69.2%) had moderate perception regarding self-efficacy with malaria preventive practices. Forty-seven percent (46.5%) disagreed that they can easily protect their children from getting malaria, 46.2% disagreed to use mosquito repellents and 34.6% of the respondents disagreed to use mosquito coil to protect children from malaria. The disagreement on the easy protection of children may be due to little knowledge on early diagnosis and effective treatment of malaria by RDT and ACT drugs, and high number of disagreement on the use of mosquito repellent and coil may be due to their high perceived barrier to these preventive measures as mentioned in our study.

5.1.3. Cues to Malaria Preventive Practices

Even though all of the respondents own bed nets, all respondents answered that they did not have LLIN shops around their households. Only 5 of the respondents did not own long lasting insecticide treated nets (LLINs). These may be possible as mass distribution of LLINs to vulnerable populations including children under five in previous year(2017) by National Malaria Control Program together with the support of WHO and GFATM (The Global Fund to AIDS, TB and Malaria). Regarding the condition of bed nets, most of the respondents (62.8%) had good condition bed nets. Among 417 respondents who own LLINs, around (60.9 %) had good condition of LLINs and most of the respondents (66.2%) had enough LLINs per family, i.e., one LLIN to two family members in the household. These results revealed that around 40% answered that more than two people slept under one LLINs and they did not know the correct way of using bed nets and LLINs to prevent malaria. The real situation regarding the use of bed nets and LLINs in that township may be worse than that reported in our study as all answers in our study were self-reported (no observation).

Regarding mosquito repellents, only (21.8 %) of respondents answered that they have shops around their households to buy and only 16 respondents had mosquito repellents in their household to use for under-five children. It is possible as transportation in that region is difficult to get mosquito repellents easily, and around

40% of the respondents in our study did not know the use of mosquito repellents to prevent malaria.

Even though majority (90%) of respondents answered that mosquito coil is available in the shop around the household, only 20.9 % of the respondents own mosquito coils. These may be possible as they have high regarding side effects of mosquito coil in respiratory disease in children and little knowledge on the effectiveness of mosquito coil to prevent malaria.

In external cues regarding environmental risk, most of the respondents mentioned there were bushes (54%) and stagnant water, (49.8%) around their households to clean to prevent from mosquito bites to their children. Even though it is a forested area, there has been deforestation going on. Therefore, these areas had less bush in some places, and less stagnant water as the weather at the time of interview was summer.

In external cues regarding the source of information, almost all (98.1%) of the respondents ever heard about malaria prevention related messages. Majority of the respondents heard or saw about malaria prevention practices from government health staffs (90.8%), TV (61.8%), radio (58.1%), poster (67.5%) and pamphlets (64.5%). That revealed the good performance of government health staffs and midwives and good support of media and BCC materials regarding malaria prevention in that region. However, only around 40% of the respondents heard or saw about malaria from family (38.6%), friends and neighbors (32.7%), videos (46%), billboards (47.6%) and NGO health staffs (42.2%). These results revealed that there was less involvement of peers, less effort of NGO health staffs and less support of media regarding video on malaria prevention knowledge. These results revealed the need to increase monitoring and evaluation on non-governmental health staffs regarding their performance and enhance the distribution of video regarding malaria via INGOs and government health staffs. Also, only 26.8%, 14.5 % and 8.3% of the respondents heard about malaria prevention related messages from village health volunteers, private doctors and drug stores respectively, while 11% and 1.7% of respondents heard about malaria prevention related messages from teachers and religious leaders or monks, respectively. These

results pointed out the need of well-trained village health volunteers and regular monitoring and evaluation of the performance of volunteers in that region, need of health education sessions or health talks to drug vendors, schools, and community leaders. Moreover, it also needs to recruit all medical doctors who have registered license from Myanmar Medical Council as members of Myanmar Medical Association and provide training to them to get adequate knowledge regarding malaria control and elimination and provide this knowledge to the community via BCC materials with the support of Myanmar Medical Association Malaria Project.

Regarding internal cues, only 6 of the respondents had experience of the death of family members due to malaria, but none of the respondents had experience of death of under-five children due to malaria in their families. These families have accessed the early diagnosis and effective treatment that has been established under the National Malaria Control Program (NMCP) with the support of WHO and GFATM, and other non-governmental organization (NGO) projects. All in all, over half (58.5%) of the respondents had high level of cues to malaria preventive practices.

5.1.4. Malaria Preventive Practice

Among 422 respondents, over two-third of the respondents always sleep under bed nets or LLINs, and majority (84.8%) of the respondents always let their children under five years sleep under bed nets or LLINs. However, only 44% of the respondents always check for tears or holes in bed nets/LLINs and only 21% of the respondents always repair tears or holes in bed nets or LLINs. The respondents had good practice to use bed nets or LLINs, but they have bad practice for maintenance of bed nets. It may be due to less distribution of knowledge regarding maintenance of bed nets in health education sessions. Regarding use of repellents, 96% of the respondents never use repellents which may be due to the high cost and less availability. Majority (80.1%) of the respondents never used mosquito coils for their under-five children while 12.1% answered that they always wear long sleeve clothes on their under-five children. This poor practice for the use of mosquito coil may be due to good knowledge about common respiratory diseases such as pneumonia in children in Myanmar. Overall, most of the

respondents (70.6%) had good malaria preventive practice for personal protective measures.

Among 228 respondents who had environmental risk regarding bushes, only 29.8 % of the respondents always clean the bushes around their households, and among 210 respondents who had stagnant water around their households, 37.6% always clean stagnant water around the households. In terms of malaria preventive practices regarding environmental control measures, among 176 respondents who had both environmental risks (bushes and stagnant water) around their households, over half (57.4%) had poor environmental control practice for malaria prevention. It may be due to less awareness about environmental control measures for malaria as the use of LLINs is a core preventive measure in Myanmar(Shafique, 2014).

Among 410 respondents who had health center or health volunteer around the households to seek health care, majority (80.5%) of the respondents always received health care at the health center or from health volunteer when their children get a fever. This result means that majority had good malaria preventive practice regarding treatment seeking practice. It may be due to intensive malaria control implementation by Vector Borne Disease Control (VBDC) team and other malaria projects which opened fixed and mobile clinics, and provide malaria volunteers in villages of Ngapudaw Township, Ayeyarwady Myanmar – all under the control of National Malaria Control Program.

5.2. Discussion on Analytic Findings

5.2.1. Association between Modifying Factors and Malaria Preventive Practices

5.2.1.1. Association between Socio-demographic and Economic Characteristics and Malaria Preventive Practices

Among the socio-demographic and economic characteristics, only economic status had a negatively statistically significant association with malaria preventive practices regarding personal protective measures as well as a positively significantly association with malaria preventive practices treatment seeking practice at bivariate analysis. However, they became lost their significance at multivariate analysis, and it

had no statically significant association with malaria preventive practice regarding environmental control measures.

The finding regarding personal protective measures may be due to less requirement of expenditure on use of LLINs as they may not need to buy LLINs due to continuous distribution to vulnerable groups including children under five done by government in 2017. The finding regarding treatment seeking practice was supported with the finding in the study in Nigeria's mother where mother with lower wealth index are less likely to seek prompt malaria treatment than higher wealth index(Kolawole & Stephen, 2016). Economic status becomes insignificant at multivariate analysis because economic status was not strong variable enough to predict malaria preventive practices regarding personal protective measures and treatment seeking practice in comparing to other variables which are significant at multivariate analysis in our study. The insignificance findings for environmental control measures at both levels may be possible as the respondents may not need to buy expensive preventive measure tools for environment sanitation like cleaning bushes and stagnant water around households and economic status might not statistically influence on that kind of malaria preventive practices among respondents.

Other variables namely age of caregivers, sex, marital status, education, occupation were not statistically significantly associated with three malaria preventive practices at both levels of analysis. The findings regarding the age, sex and marital status, education and occupation were consistent with the community based cross-sectional thesis study of Mahidol University student's thesis on malaria preventive practices among caregivers of under-five children in Ingapu Township of Myanmar(Han, 2017) which had methodological weakness in sample size calculation. The findings regarding age and sex was also in agreement with systematic review study done over six demographic health survey in three African countries (Angola, Liberia, and Tanzania) in two different time periods regarding predictors of malaria prevention practices including use of insecticide-treated nets (ITNs), indoor residual spray (IRS), and the combination of prompt and appropriate treatment of malaria among children under five years(Adams, 2015). The finding regarding occupational status was also in

agreement with the study about the caregivers' perception of malaria and treatment seeking behavior of under-five children in West Ethiopia(Mitiku & Assefa, 2017).

However, the finding regarding age was in disagreement with the community based cross-sectional study among 140 community households in Nsaabwa Village, Uganda revealed that younger respondents had better malaria practices towards malaria prevention and controls compared to older ones (p value=0.024) (FELLOW, 2013). The different findings may be due to due to different populations and different countries or illiterate old age with poor knowledge who may believe in wrong practices. The finding regarding marital status in our study was inconsistent to the result in descriptive, cross-sectional study design among caregivers of under-five children in Kenya in which married woman was more likely to own ITNs and their children were more like to sleep under bed nets(Malusha et al., 2010). The finding in our study may be possible as unmarried women are only small proportions to show the statistically significant results and our study was done on all preventive measures –personal protective measures, environmental control measures and treatment seeking practice and not done only on use of ITNs. The findings regarding education were inconsistent with the studies in a population-based cross-section study Nigerian caregivers of under-five children (al., 2011), (Adaobi I Bisi-Onyemaechi, 2017) regarding use of ITN nets and cohort study among primary caregivers of Uganda children(6months-5years) (Njama, 2003) regarding knowledge,attitude and practice of malaria prevention. The findings regarding occupational status was also inconsistent to the ideas in background paper on systematic review on relationship between socioeconomic status and malaria on meeting "Ensuring that malaria control interventions reach the poor" in London in 2002, that levels of expenditure on preventive measure are positively correlated with proxy measures of socioeconomic status like education and occupation(Eve Worralla, 2003). The different results of education and occupation with malaria preventive practices in our study may be possible as they may be possible confounders for knowledge and perceptions on malaria preventive practices according to health belief model in our study. This idea can be supported by findings in Nigeria studies among caregivers (Adebayo et al., 2015) and mothers of under-five children (Orimadegun & Ilesanmi, 2015).

5.2.1.2. Association between Household Characteristics and Malaria Preventive Practices

Among household characteristics, only number of household members was a statistically significant negative association with personal protective measures among 422 caregivers at both bivariate and multivariate analysis, but it was not associated with environmental control measures and treatment seeking practice. Significant result regarding personal protective measures was inconsistent with the findings in the community based cross-sectional study among caregivers of under-five children in Ingapu Township of Myanmar regarding malaria preventive practices (Han, 2017). Insignificant results regarding environmental control practice and treatment seeking practice was in agreement with above study (Han, 2017) and also the studies among caregivers of under-five children regarding malaria treatment seeking practice in mobile and non-mobile villages in Myanmar (Moe Moe Thandar, 2015) and in Mandua District, West Ethiopia regarding malaria treatment seeking practice (Mitiku & Assefa, 2017). The significant results found in our study for personal protective measures may be possible because, if they have multiple family members, caregivers will be busy by taking care of other family members, but if there are fewer family members, they have more time to do malaria preventive practices in terms of personal protective measures for their under-five children. Another reason may be that if they have fewer household members, they may have enough LLINs to share to sleep as around 60% of the respondents in our study had enough LLINs per family.

Other variables namely relationship of respondents to under five children, number of under-five children, age of under-five children were not statistically significantly associated with three malaria preventive practices among caregivers. It was in agreement with the community based cross-sectional study among caregivers of under-five children in Ingapu Township of Myanmar regarding malaria preventive practices(Han, 2017) and regarding malaria treatment seeking practice in mobile and non-mobile villages (Moe Moe Thandar, 2015).

5.2.1.3. Association between Knowledge and Malaria Preventive Practices

Level of knowledge has positive statistically significant association only with malaria preventive practice regarding personal protective measures among 422 caregivers at bivariate analysis, and it becomes insignificant multivariate analysis. However, it had no statistically significant associations with malaria preventive practice regarding environment control measures among 176 caregivers and with malaria preventive practice regarding treatment seeking practice among 410 caregivers at both analysis levels. The findings in personal protective measures was in agreement with the study in rural southwestern Nigeria conducted among caregivers of under-fives in which the results revealed that among 274 caregivers, knowledge is a determinant of use of malaria preventive measures among respondents(OR= 9.3, 95% C.I- 1.35-64.3)(Dr. Mobolaji M. Salawu*, 2013). The findings regarding environmental measures and treatment seeking practices at both analysis levels and personal protective measures at multivariate analysis were all inconsistent with the study above. It may be possible because according to health belief model, knowledge may modify major constructs of perception, namely perceived susceptibility, perceived severity, perceived barriers, perceived benefits and perceived self-efficacy and it may not have a direct effect on malaria preventive practices of respondents (Karen Glanz, 2008).

5.2.2. Association between Perceptions and Malaria Preventive Practices

5.2.2.1 Association between Perceived susceptibility and Malaria Preventive Practices

Perceived susceptibility had a positive statistically significant association with malaria preventive practice regarding personal protective measures, and this finding is supported by the cross-sectional study on prevention of diarrhea among caregivers of under-five children in Indonesia (Helmi Rumboa). It is also supported by health belief model theory that the patient who had high perceptions regarding susceptibility to disease are more likely to do the preventive behavior(Karen Glanz, 2008). However, it lost its significance with preventive practices at multivariate analysis as it is not stronger enough to show associations than perceived severity. No statistically significant

association with environmental control practices and treatment seeking practices at both levels of analysis is possible because environmental sanitation and treatment seeking practice is less well-known practice in malaria preventions in Myanmar. Also, another major component of health belief model like perceived barriers was associated with environmental control practice and treatment seeking practice at a multivariate level in our study. Therefore, the effect of perceived susceptibility is not stronger enough to overwhelm the effects of perceived barriers on malaria preventive practices.

5.2.2.2 Association between Perceived severity and Malaria Preventive Practices

Perceived severity had been a positively strong statistically significant association with malaria preventive practice regarding personal protective measures and with malaria preventive practice regarding treatment seeking practice and, surprisingly, negatively statistically significant association with environmental control measures at both levels of analysis. The positively statistically significant association of perceived severity and caregivers behavior could be explained by the theory of health belief model as if the respondents believe the disease is potentially serious; they are more likely to do the actions that will prevent them from that disease(Karen Glanz, 2008). The significant result of malaria preventive practice regarding environmental control measures can be explained as similar results found as low perception regarding severity of disease are more likely to do good preventive behavior in case of the cross-section study among caregivers of under-five children for preventive behavior of diarrhea in Indonesia (Helmi Rumboa) and is supported by the health belief model theory where cues or readiness to perform certain action is high despite of low perceived severity that good preventive behavior will be performed(Irwin M. Rosenstock, 1974). In our study, even though the variable namely cues to malaria preventive practice was not statistically significantly associated with malaria preventive practice, most of the respondents in our study had high cues to malaria preventive practices and the highest number of respondents (77.3%) among 75 respondents, who had good malaria preventive practice for environmental control measures had high cues to malaria preventive practices.

5.2.2.3 Association between Perceived benefits and Malaria Preventive Practices

Perceived benefits had statistically significant strong positive association with personal protective measures and treatment seeking practice at bivariate analysis, but it lost its significance at multivariate analysis. Statistically significant associations of perceived benefits with these malaria preventive practices at bivariate analysis can be supported by the findings in the cross-sectional study among caregivers of under-five children in Mandura district, West Ethiopia (Mitiku & Assefa, 2017)and Indonesia(Helmi Rumboa). Loss of significance at multivariate analysis may be possible because it may not be powerful predictor than other components like perceived barriers to predicting preventive behavior. It is also supported by health belief model performance as perceived benefits, was a stronger predictor of sick role behavior than preventive behavior even though both perceived susceptibility and perceived benefits were important in people behavior (Karen Glanz, 2008). There is no significant result with environmental control practices at both levels of analysis may be possible because perceived barriers are negatively statistically significant in our study. According to health belief model, when perceived barriers are so high, people are less likely to do good malaria preventive practice.

5.2.2.4 Association between Perceived barriers and Malaria Preventive Practices

Perceived barriers had statistically significant negative associations with malaria preventive practice regarding environmental control measures at both levels of statistical analysis. The findings in our study is supported by the study regarding preventive behavior of diarrhea among caregivers of under-five children in Indonesia (Helmi Rumboa). The health belief model theory had already explained high perception on barrier could disrupt the certain preventive actions (Karen Glanz, 2008). Statistically Significant association with treatment seeking practice only at multivariate analysis may happen as the researcher removes cues to malaria preventive practice in multivariate analysis. Removing the exposure of source of information which is one of external cues to actions, perceived barrier becomes significant. This idea was supported by the manuscripts about "Health Belief Model as an Explanatory Framework" in which mentioned that the greater the exposure of campaign, fewer the barriers to

performing action (Christina L. Jones Jakob D. Jensen, Courtney L. Scherr, Natasha R. Brown, and, & Weaver, 2015). However, there is no statistically significant association with malaria preventive practice regarding personal protective measures and at both levels. It may be occurred in malaria preventive practice regarding personal protective measure because perceived threat (susceptibility and severity) and perceived benefits are statistically significantly associated with malaria preventive practice regarding personal protective measures at bivariate analysis and perceived severity still maintained its significant at multivariate analysis and the effect of these variables might overcome the effect of high perceived barrier.

5.2.2.5 Association between Perceived Self-efficacy and Malaria Preventive Practices

Perceived self-efficacy is only statistically significantly associated with malaria preventive practice regarding treatment-seeking behavior at bivariate analysis, and our study finding is consistent with health belief model theory that the respondents who had high self-efficacy or competency to overcome barriers are likely to perform preventive behavior(Karen Glanz, 2008). However, it becomes insignificance at multivariate analysis, and it may be due to effect of other components like level of perceived barriers which becomes significant after adjusting in multiple logistic regression(Katz, 2007). It was not statistically significantly associated with malaria preventive practice regarding personal protective measures and environmental control measures, and the findings are consistent with the cross-sectional study in Mandura district in West Ethiopia (Mitiku & Assefa, 2017). It may be due to less difference in motivation to respondents with good and poor malaria preventive practices as majority respondents (98.1%) already heard malaria prevention related messages from various sources as motivation.

5.2.3. Association between Cues to Malaria Preventive Practices and Malaria Preventive Practices

Cues to malaria preventive practices did not have a statistically significant association with each of three malaria preventive practices. There was no study which

studied and found cues to malaria preventive practice as a predictor of malaria preventive practices among caregivers to compare the results in our study. However, there was a study among caregivers of under-five children in West Ethiopia which studied cues to malaria preventive practice to predict the treatment-seeking behavior of caregivers for under-five children and but there was no statistically significant association(Mitiku & Assefa, 2017) which is consistent with our study findings.

5.5. Conclusion

- In general, the results showed that most of the respondents had good malaria preventive practice regarding personal protective measures except mosquito repellents and coils, good malaria preventive practice regarding treatment seeking practice and poor malaria preventive practice regarding environmental control practices.
- In bivariate analysis,
- With personal protective measures, four independent variables namely economic status, number of household members, level of knowledge, level of perceived susceptibility, showed statistically significant association at p-value 0.05 level. Two independents variables namely level of perceived severity and barriers showed strongly statistically significant associations at p-value 0.001 level.
- With environmental control measures, two independents variables namely level of perceived severity and barriers showed statistically significant associations at p-value 0.05 level.
- With malaria preventive practice regarding treatment seeking practice, two independent variables like economic status, level of perceived self-efficacy showed statistically significant associations at p-value 0.05 level and two independent variables namely perceived severity and benefits showed strongly statistically significant associations at p-value 0.001 level.
- In multivariate analysis with multiple logistic regression as final models at 0.05 level,
- For personal protective measures, two variables, namely, number of household members and level of perceived severity maintained their statistically

significant associations. Respondents with four and less than four numbers of household members and high perceived severity are more likely to do good malaria preventive practices regarding personal protective measures.

- For environmental control practices, two variables, perceived severity, and perceived barriers hold their statistical significance. Respondents with high perceived severity and perceived barriers are less likely to do good malaria preventive practice regarding environmental control practices.

- For malaria preventive practice regarding treatment seeking practice, perceived severity held its statistically strong significance and perceived barrires becomes statistically significant. Respondents with high perceived severity and low perceived barriers are more likely to do good malaria preventive practice regarding treatment seeking practice.

5.6. **Strengths and Limitations**

Strengths

- As we mentioned in introduction part of the study, after searching articles via google scholar, Pub Med, Pro Quest, Science direct and electronic library of College of Public Health Sciences with keywords such as "malaria preventive practices" "caregivers" "under five children" "Ngapudaw Township" "Ayeyarwady Region" "Myanmar", this is the first study using the health belief model to evaluate malaria preventive practices among caregivers for their under-five children and find out its associations among caregivers of under-five children in Ngapudaw Township as one of malaria-endemic areas in Myanmar.

- Moreover, it also explore the condition of bed nets and LLINs, ownership, availability of mosquito repellents, ownership of mosquito coils, ownership of long sleeves which had not been studied in previous quantitative studies among caregivers of under five children in Myanmar and it also showed requirements of behavior change communication regarding health education and health talk specifically focus on perception and malaria preventive practices regarding correct way of using mosquito nets, mosquito repellent use and environmental sanitation and treatment seeking practice according to results.

For the above facts, it not only increases the availability of data necessary to support but also guide effective malaria control policies and will be helpful for the institute to provide appropriate health education intervention programs for caregivers of under-five children.

Limitation

- This study was only made in caregivers of under-five children in high-risk areas of Ngapudaw Township. Hence, it cannot represent malaria preventive practice of the whole population of caregivers of under-five children in Myanmar.

- Being a cross-sectional study, it cannot provide information about the cause and effect of malaria in under five children.

- As the respondents' answers were only self-reported and no observation was done due to time and budget limitation, the real situation of bed net and wealth status of respondents cannot be represented by this study, and there was possibility of recall bias, respond bias and socially desirable bias regarding malaria preventive practices and wealth status of the respondents.

- In each village, correct answer sheets for knowledge were spread after data collection in one village. Villagers who had already received the correct answer sheet may have gone and talked to the villagers in another village who might be selected participants and had not yet been interviewed on that day. So, there was some possibility of contamination regarding knowledge from one village to another village at the time of data collection as the distances from one village to another village were not too far.

- According to health belief model limitation, the model was not suitable for studying human behavior regarding treatment seeking and in our study, treatment seeking practice involved as secondary prevention practice.

- Statement regarding perceived barriers to wearing of long clothes in our questionnaire needs to be improved because many respondents attempted to an agreement for having barriers on wearing long clothes as it looked like a general statement.

- Due to the skip-pattern question used for environmental control practice and on the availability of health facility for treatment seeking practice, different denominators come out, and we need to analyze separately on each of malaria preventive practice and reduce required sample size as 176 instead of 422 for environmental control practice.

- Due to limited time and limited skill of researchers in statistics, the data cannot be analyzed in a specific level of perception, knowledge, and practice, thus did not get specific information of each level so the results may be a little different from reality. If there is time available to do and learn advanced statistical analysis, it would be better to use multiple ordinal regression analysis to assess each level to get specific information.

5.7.   Recommendations

According to the findings of the study, recommendation for improving malaria preventive practice among caregivers for under five children in high-risk areas of Ngapudaw Township, Ayeyarwady Region were divided into program level and research.

Recommendations for program level

- In our study, even though respondents' knowledge and government support malaria preventive measurement tools like LLINs were high, people perceptions and practices were still low and need to be improved This is indicating that community participation is needed for malaria prevention practices among caregivers and community. Government and National Malaria Control Program should implement the community-based health promotion programs including community empowerment or development program like participatory rural appraisal approach (PRA) for malaria preventive and treatment seeking practices with the support of GFATM.

- Health education program should be implemented among caregivers of under-five children in that region focusing not only on knowledge but also on perception and behavior regarding cause, biting time, severity and vulnerable group of malaria and benefits and correct way of doing malaria prevention practices together with Social Behavioral Change Communication Activities(SBCC) by proposed plan of President Malaria Initiative in 2018. (SBCC activities include recruiting and providing training of village midwife(at least 1VMW in one village), and providing health education to community by means of community counselling by village midwife and village health volunteer using BCC materials with focus message on specific targeted namely, forest dwellers, new settlers and external and internal migrant workers and people crossing national borders(BURMA, 2018).

- Knowledge regarding use of self-medication on malaria treatment is still high as Chloroquine and ACT without RDT testing are readily available in the market even though there is policy banning of mono-therapy and policy regarding every malaria case must be tested with RDT. Therefore, policymaker needs to strengthen the existing policy and national program need to implement action taking for self-medication and mono-therapy.

- Also, as use of mosquito repellent is low due to less availability, national program should collaborate with non-governmental organizations supported by GFATM to support the mosquito repellents in local stores.

- As fewer respondents heard regarding malaria prevention related messages from village health volunteers and drug store, teacher, and religious leaders-regular, monitoring and evaluation of the performance of volunteers in that region, need of health education sessions or health talks to drug vendors, schools, and community leaders.

- In our study, fewer respondents heard regarding malaria prevention related messages from private doctors. Therefore, the program should make a policy to recruit all medical doctors as members of Myanmar Medical Association to provide training to them to get adequate knowledge regarding malaria control and elimination with ongoing implementation activities of recruiting quality general practitioners in Myanmar Medical Association Malaria Project with the

support of GFATM. These trained doctors, in turn, would provide the knowledge to the community via BCC materials together.

Recommendations for further research

- The future study should be a quantitative study like the intervention study by providing community-based health promotion and education via community empowerment or community development programme like participatory rural appraisal approach (PRA) with informal community leaders and using health belief models to explore the effects of cues to malaria preventive practices. It can also explain the cause and effect of other variables on malaria prevention practices.

- Also, the future qualitative study should be carried out by focusing on malaria preventive practices among caregivers of under-five children in that region to know the reasons behind the low use of mosquito repellents and coils and poor practice on environmental sanitation in malaria prevention to be sequential explanatory design.

- The further research assessing malaria preventive practices, the real condition of bed nets, wealth status and malaria preventive practices among caregivers of under-five children should do the observation with a checklist to know the real conditions of bed nets.

- In similar research, correct answers to knowledge for selected participants should be given by health volunteers or midwife after the whole data collection was finished in that region to avoid contamination of knowledge from one village to another.

- The next quantitative research which focuses specifically to treatment seeking practice among caregivers of under-five children should be studied with using health service utilization model like Anderson's model including health system factors instead of health belief model for better explanation

- Statements regarding the perceived barrier to wearing of long clothes should be like that it is difficult to let children under-five always wear long clothes at night time when they are out of mosquito bed nets.

- The next quantitative research which should be done on large sample size for environmental control practices for malaria prevention and skipped patterned

should be removed on questions regarding environment sanitation and treatment seeking practice.

- Data analysis should be done with multiple ordinal logistic regression analysis by categorizing dependent variables into three groups to get more specific information and to be matched with reality.

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Appendix A. Participant Information Sheets

Title of Research: "CAREGIVERS' MALARIA PREVENTIVE PRACTICE FOR UNDER FIVE CHILDREN AND ITS ASSOCIATION IN NGAPUDAW HIGH-RISK TOWNSHIP, AYEYARWADY REGION-MYANMAR"

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1.   **Introduction**

You are warmly being invited to participate in this research project. However, you can decide freely whether you want to participate or not after reading this document and knowing information about the research, benefits, and risks. You also have the right to withdraw from the study at any time without giving any reason. You can ask whatever you want to know and about the facts that are not clear in your mind.

2.   **Contents of the survey question**

The survey involves face to face interview session and interviewer will ask you about different factors such as socio-demographic and economic characteristics (age, Sex, marital status, education, occupation and wealth status including ownership of seven assets and six housing characteristics), household characteristics (Relationship of respondents to under five children, Number of household members, Number of under-five children, Age of under-five children), knowledge about malaria including cause, symptoms, treatment and prevention methods), perception about malaria and malaria preventive practices, cues to malaria preventive practices (cues or readiness to perform malaria prevention practices) and malaria preventive practices of caregivers for under-five children using questionnaire containing total 113 questions.

3.   **Participants Selection**

In this research, the participants will be caregivers of youngest under-five children in the households who are residing in high-risk area of malaria (Kwin Bet Station Health Center Area or/ and Nat Maw Station Health Center Area) of Ngapudaw Township in Ayeyarwady Region, Myanmar. This study will need at least 384 participants. Participants who meet inclusion criteria and who do not meet the exclusion criteria will be involved in this study.

Inclusion Criteria	Exclusion Criteria
- Male and female caregivers of youngest under-five children in the households (the child's father, mother, grandparents, or others) in high risk (stratum 3a) areas of Ngapudaw Township who are willing to participate and give oral and written consent will be included. (The illiterate respondents will only need to give oral consent in front of the literate witness for taking oral consent)	- Male and female caregivers of youngest under-five children in the households, whose age less than 18 years (legal age in Myanmar to give consent) - Male and female caregivers of youngest under-five children in the household, who have a mental health problem - Male and female caregivers of youngest under-five children in the household, who suffer from serious illness or cannot talk or speak at the time of interview will be excluded

4.   **Objectives of the research**

- To determine the different factors such as socio-demographic and economic characteristics, household characteristics, knowledge level regarding malaria among caregivers of under-five children in our study area

- To identify the level of perception towards malaria prevention practices such as perceived susceptibility of under-five children to malaria, perceived severity of malaria disease, perceived benefits of using preventive measure tools, perceived barriers to using preventive measures tools, perceived regarding confidence to do malaria preventive practice among caregivers of under-five children in our study areas

- To determine cues to malaria preventive practice such as Ownership, condition and availability of bed nets/LLINs, enough LLINs per family members, Ownership and availability of mosquito coils and mosquito repellents, Ownership of long sleeves, Presence of breeding sites (bushes and stagnant water) around the household, Availability of health facility/health volunteer, Source of information about Malaria Prevention, Death of family members due to malaria, Death of children under five years due to malaria) among caregivers of under-five children in our study area

- To assess the level of malaria preventive practice among caregivers for under five children in our study area

- To find out the relationships between different factors, perception regarding malaria and malaria preventive practices and level of malaria preventive practice among caregivers for under five children in our study area.

5.   **Procedure of research**

The list of sample of participants will be selected according to list from general administrative office at village leader's house. This maximum sample size to collect the data is 422 samples. Then, the principal researcher and research assistants will go to the selected participant's houses by motor-bike or by a walk with the help of village leader and community health worker. After the principal researcher and research assistants explain about the information regarding the study and taking consent in both oral and written consent, data collection will be started by interviewing about the components that already mentioned above. The interview time will be taken around 30- 35 minutes.

6.   **Procedure of taking consent**

After the principal researcher and research assistants explain you regarding the study using participant information sheets, they will ask your will

to participate in this study and they will take oral consent and written consent using informed consent form. If the participant is illiterate, the researcher will read all the information in this document and in consent form in front of the literate witness who can read and write well from the village and get thumb prints from participants as well as signature from witness. If participant willing to participate, they can give written consent by giving thumb print on paper and witnesses also need to sign in the consent form. If you do not want to participate, you do not need to give consents and you do not need to give an explanation.

7.   **Benefits**

The study will not give benefit directly to you as it provides the baseline information for institute and country to develop a policy regarding malaria for children under-five year and for the researcher to develop the further study. However, your participation will be beneficial for your community and township showing that the need of malaria control strategy in your areas and health education and health care services will be more provided by institute or malaria program.

As your participation is voluntary and no special compensation for participation in this study will be done. Nevertheless, the researcher will give you a small present such as soaps or washing powder as appreciation for your participation.

8.   **Confidentiality**

Any information that is linked to you will be kept confidentially. Even though the study will be published, your names or other identifying information will not be mentioned in the report or summaries of the study. The final report can be available from principal researcher and the report will not be used with another intension. The data will be kept confidentially during the process of report and research and all data files together with the participants' answer on questionnaires will be destroyed after final report has been done.

9.   **Right of participant**

You have the right to choose or refuse for giving consent and participating in this study. Even after giving consent, you can withdraw from the study at any time. There will not be any bad consequence to you for this

reason. You can also ask anything you want to know before, during and after the study conduct any time. You can contact the principal researcher with given address mentioned above or you can make report to the Research Ethics Review Committee, Chulalongkorn University (RECCU)., Jamjuree 1 Bldg., 2nd floor., 254 Phayathai Road., Pathuwam District, Bangkok 10330, Thailand, Tel/Fax +662218-3202 E-mail: eccu@chula.ac.th at any time if you have any questions or complaints about this study or the researcher does not treat the participant according to the items.

Appendix B. Informed Consent Form

Address……………………………………………………………………………………

Date………………………………..

The code number of participant ………….

I who have signed here below do agree to participate in this research project.

Title: "CAREGIVERS' MALARIA PREVENTIVE PRACTICE FOR UNDER FIVE CHILDREN AND ITS ASSOCIATION IN NGAPUDAW HIGH-RISK TOWNSHIP, AYEYARWADY REGION-MYANMAR"

Name of Principal Researcher: Ms. Ei Phyu Htwe

Contact Address: No.22, 140th street, Tarmwe, Yangon.

Telephone: 09798445836

I have read or been informed in details about the rationale and objectives of this research study what I will be engaged with, risk and benefits of the study and the rights of the participants. I have already received the contact details of the principal researcher. I have been explained by the researcher in information sheet and I clearly understand with satisfaction.

I am willing to participate in this research and to response the questionnaires which are focusing on socio-demographic information, housing characteristics, knowledge and perception regarding malaria, cues to malaria preventive practices and malaria preventive practices. I am acknowledged that I might feel not being comfortable in answering the questions which are included in this research questionnaire. I have been informed that the interview will take about 30-35minutes, and will be done only 1 time.

I have my right to withdraw from this study at any time if I wish and I would not need to give any reason for withdrawal. This withdrawal will not have any negative impact on me. The researcher has guaranteed that procedures acting upon me would be exactly the same as identified in participant information sheet. All personal information about me will be kept in confidential. Results of the study will be described by using

the overall picture. Any of personal information which could be able to identify me will not be described in the report.

   If I am not treated as mentioned in the participant information sheet, I have known that I can report to Ms. Ei Phyu Htwe, principal researcher, Master Student at College of Public Health Sciences, Tel: 09798445836, email address: dr.eiphyuhtwe2014@gmail.com, or to the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University (CCU). Jamjuree 1 Bldg., 2nd floor, 254 Phayathai Road, Pathumwan district, Bangkok 10330, Thailand, Tel./ax, +66-2218-3202 email: eccu@chula.ac.th.

   I have read the information in this consent form, or it has been read to me. Furthermore, I have received a copy of participant's information sheet and informed consent form.

   Researcher's Name ………………………… Participant's Name
…………………

   Signature of researcher ………………… Signature of participant
……………

   Date ___/ ___/ ___/   Date ___/ ___/ ___/

   (Day /month /year)   (Day /month /year)

If illiterate

   I have witnessed the accurate reading of the consent form to the potential participant, and the individual had the opportunity to ask questions. I confirm that the individual has given consent freely.

   Witness's Name ………………………………………………………………..

   Signature of witness ………………………………………………………….

   Date __/ __/ __/

   (Day /month /year)

   Thumb print of participant

Appendix C.   **Interviewer-Administered Questionnaire**

Code Number: …………………………….

"CAREGIVERS' MALARIA PREVENTIVE PRACTICE FOR UNDER FIVE CHILDREN AND ITS ASSOCIATION IN NGAPUDAW HIGH-RISK TOWNSHIP, AYEYARWADY REGION-MYANMAR"

(Instruction for the interviewer: Read loudly all questions and choices to respondents firstly? tick (✔) and fill the blank accordinig to the answer of respondent!)

I. Part 1. Modifying Factors

A. Socio-demographic Characteristics

1. How old were you at your last birthday?

    Age in Completed years   1.1   ☐

2. Sex: (observed by interviewer)

    2.1 ☐ Male   2.2 ☐ Female

3. What is your current marital status?

    3.1 ☐ Single   3.2 ☐ Married

    3.3 ☐ Divorce/separated   3.4 ☐ Widowed

4. What is your highest educational level?

    4.1 ☐ Illiterate or no formal education   4.2 ☐ Primary school (Grade 1- 4)

    4.3 ☐ Secondary school   (Grade 5-8)   4.4 ☐ High school education (Grade 9- 10)

    4.5 ☐ Higher education level (University and above)

5. What is your current occupation, that is, what kind of work do you mainly do?

    5.1 ☐ Employee (Government)   5.2 ☐ Employee (Private)

    5.3 ☐ Self-employee   5.4 ☐ Employer

    5.5 ☐ Housewife   5.6 ☐ Unemployed

    5.7 ☐ Student   5.8 ☐ Other……….

6.   Economic status

	DETERMINE IF THE RESPONDENT LIVES IN AN URBAN OR RURAL AREA By INTERVIEWER	☐Urban ☐Rural
No.	Question	Answer
6.1	Does your household own the housing unit?	6.1.1☐Yes 6.1. 2☐No
6.2	Main source of lighting in your household	6.2.1☐Electricity 6.2.2☐Kerosene 6.2.3☐Battery 6.2.4☐Other
6.3	Main source of drinking water in your household	6.3.1☐Tube well, borehole 6.3.2☐Protected well / Spring 6.3.3☐Pool / Pond / Lake 6.3.4☐Bottled water / Water from vending machine 6.3.5☐Other
6.4	Is tap water the main source of non-drinking water in your household?	6.4.1☐Yes 6.4.2☐No
6.5	Main type of cooking fuel used in your household	6.4.1☐Electricity 6.5.2☐Firewood 6.5.3☐Charcoal 6.5.4☐Other
6.6	Does your household have no toilet?	6.6.1☐Yes 6.6.2☐No
6.7	Main construction material of the housing roof	6.7.1☐Dhani / Theke / In leaf 6.7.2☐Corrugated sheet 6.7.3☐Other
6.8	Main construction material of the housing walls	6.8.1☐Wood 6.8.2☐Tile / Brick / Concrete 6.8.3☐Other
6.9	Main construction material of the housing floor	6.9.1☐Bamboo 6.9.2☐Wood 6.9.3☐Tile / Brick / Concrete 6.9.4☐Other
6.10	Does your household have a television?	6.10.1☐Yes 6.10.2☐No

No.	Question	Answer
6.11	Does your household have Internet at home?	6.11.1☐Yes 6.11.2☐No
6.12	Does your household have a motorcycle / moped / tuk tuk?	6.12.1☐Yes 6.12.2☐No
6.13	Does your household have a bicycle?	6.13.1☐Yes 6.13.2☐No

B.   **Household characteristics**

7. How are you related to youngest under-five child in the household?

    7.1☐Mother   7.2☐.Fathers

    7.3☐.Grandparents   7.4☐ Others………

8. How many numbers of household members are there in the household?

    8.1

9. How many numbers of children under five are there in the household?

    9.1

10. What is youngest under-five child's completed age in months in the household?

    10.1☐ <12 months   10.2☐ 12-23months

    10.3☐ 24-35months   10.4☐ 36-47months

    10.5☐ 48-59months

จุฬาลงกรณ์มหาวิทยาลัย

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C. Knowledge about malaria (Positive/Direct questions- Code 1 only will get 1 score, other Code will get 0score and Negative/Inverse questions- Code2 only will get 1 score, other Code will get 0score)

No	Statements	Yes	No	Don't know
11.	**Malaria is caused**			
11.1.	Due to mosquito bite	11.1.1□	11.1.2□	11.1.3□
11.2.(Inv)	Due to coughing and sneezing	11.2.1□	11.2.2□	11.2.3□
11.3.(Inv)	Due to contact with malaria patient	11.3.1□	11.3.2□	11.3.3□
11.4.(Inv)	Due to bathing in stream water/dirty water	11.4.1□	11.4.2□	11.4.3□
11.5.(Inv)	Due to eating bananas	11.5.1□	11.5.2□	11.5.3□
12.	**the biting time of malaria mosquito is**			
12.1.(Inv)	Day time	12.1.1□	12.1.2□	12.1.3□
12.2.	Night time	12.2.1□	12.2.2□	12.2.3□
12.3.(Inv)	Both Day and Night time	12.3.1□	12.3.2□	12.3.3□
13.	**Vulnerable groups of malaria are**			
13.1.	Under-five children	13.1.1□	13.1.2□	13.1.3□
13.2.	Pregnant mothers	13.2.1□	13.2.2□	13.2.3□
13.3.	Forest workers	13.3.1□	13.3.2□	13.3.3□
13.4.	Farmers	13.4.1□	13.4.2□	13.4.3□
14.	**Common symptoms of malaria are**			
14.1.	Fever	14.1.1□	14.1.2□	14.1.3□
14.2.	Chills and rigors	14.2.1□	14.2.2□	14.2.3□
14.3.	Headache	14.3.1□	14.3.2□	14.3.3□
14.4.	Sweating	14.4.1□	14.4.2□	14.4.3□

No	Statements	Yes	No	Don't know
15.	**Malaria can be treated by**			
15.1.(Inv)	-self-taking anti malaria drugs	15.1.1☐	15.1.2☐	15.1.3☐
15.2(Inv)	-self-taking traditional medicine	15.2.1☐	15.2.2☐	15.2.3☐
15.3.(Inv)	-Traditional healer	15.3.1☐	15.3.2☐	15.3.3☐
15.4(Inv)	-Pray for spirits	15.4.1☐	15.4.2☐	15.4.3☐
15.5	-Taking full course of antimalarial treatment from health facility(sub-center or station health center)	15.5.1☐	15.5.2☐	15.5.3☐
16	**Malaria can be prevented by**			
16.1.	-Use mosquito bed net	16.1.1☐	16.1.2☐	16.1.3☐
16.2.	-Use Long lasting Insecticide Treated Nets	16.2.1☐	16.2.2☐	16.2.3☐
16.3.	-Avoid mosquito bites	16.3.1☐	16.3.2☐	16.3.3☐
16.4.	-Use mosquito coil	16.4.1☐	16.4.2☐	16.4.3☐
16.5.	-Use mosquito repellent	16.5.1☐	16.5.2☐	16.5.3☐
16.6.	-Wear long-sleeved clothing	16.6.1☐	16.6.2☐	16.6.3☐
16.7.	-Clean environment	16.7.1☐	16.7.2☐	16.7.3☐
16.8.	-Cover water containers	16.8.1☐	16.8.2☐	16.8.3☐

Inv- Inversed question/Negative question

II.Part 2. Perception towards malaria (Positive/Direct questions will get scores 4-1 ranging from strongly agree to strongly disagree and Negative/Inverse questions will get scores 1-4 ranging from strongly disagree to strongly agree)

No.	Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
17.	**Perceived susceptibility**				
17.1 (Inv)	I don't worry about malaria because it can be easily treated.	17.1.1☐	17.1.2☐	17.1.3☐	17.1.4☐

No.	Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
17.2	Children always have a chance to be infected with malaria	17.2.1☐	17.2.2☐	17.2.3☐	17.2.4☐
17.3.	Children under five year who do not sleep under bed net at night in malaria-endemic areas have more chance to develop malaria	17.3.1☐	17.3.2☐	17.3.3☐	17.3.4☐
17.4. (Inv)	My children are so healthy that they would be able to recover from a case of malaria without going to health facility(sub-center or station health center or health worker)	17.4.1☐	17.4.2☐	17.4.3☐	17.4.4☐
17.5. (Inv)	Only weak children can die from malaria	17.5.1☐	17.5.2☐	17.5.3☐	17.5.4☐
18.	**Perceived severity of malaria**				
18.1.	Risk of death from malaria is higher in children compared to adults	18.1.1☐	18.1.2☐	18.1.3☐	18.1.4☐
18.2.	Complications of malaria are dangerous and result in death.	18.2.1☐	18.2.2☐	18.2.3☐	18.2.4☐

No.	Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
18.3.	When my child has a fever, I almost always worry that it might be malaria	18.3.1☐	18.3.2☐	18.3.3☐	18.3.4☐
18.4. (Inv)	When my child has a fever, I usually wait a couple of days before going to a health provider	18.4.1☐	18.4.2☐	18.4.3☐	18.4.4☐
19.	**Perceived benefits**				
19.1. (Inv)	The chances of getting malaria are the same whether or not children sleep under a bed net	19.1.1☐	19.1.2☐	19.1.3☐	19.1.4☐
19.2.	Burning mosquito coil will drive away mosquito from biting children	19.2.1☐	19.2.2☐	19.2.3☐	19.2.4☐
19.3.	Wearing children long sleeve and pants will protect children from mosquito bites when they are outside of bed nets at night time	19.3.1☐	19.3.2☐	19.3.3☐	19.3.4☐
19.4.	Proper application of mosquito repellent in children skin can protect children from mosquito bites and malaria	19.4.1☐	19.4.2☐	19.4.3☐	19.4.4☐

No.	Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
19.5. (Inv)	Cleaning bushes around household is not effective way to reduce mosquito breeding sites and to protect children from malaria	19.5.1□	19.5.2□	19.5.3□	19.5.4□
19.6. (Inv)	Cleaning stagnant water around household cannot protect children from mosquito bites and malaria	19.6.1□	19.6.2□	19.6.3□	19.6.4□
19.7.	Children will get better as soon as if taken to health facility	19.7.1□	19.7.2□	19.7.3□	19.7.4□
20.	**Perceived barrier**				
20.1	The insecticide on Long lasting Insecticide Treated Nets can be dangerous to children who sleep under them	20.1.1□	20.1.2□	20.1.3□	20.1.4□
20.2	Children cannot sleep well under Long lasting Insecticide Treated Nets when the weather is warm	20.2.1□	20.2.2□	20.2.3□	20.2.4□
20.3.	It is very hot when children wear long clothes at night time during hot season	20.3.1□	20.3.2□	20.3.3□	20.3.4□
20.4.	Mosquito repellents are difficult to buy	20.4.1□	20.4.2□	20.4.3□	20.4.4□

No.	Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
20.5.	Mosquito coil causes bad smell and harmful to health of children	20.5.1☐	20.5.2☐	20.5.3☐	20.5.4☐
20.6.	There are a lot of multiple breeding sites (bushes and trees) around the household and it is difficult to clean all breeding sites.	20.6.1☐	20.6.2☐	20.6.3☐	20.6.4☐
20.7.	It is too far to go to health facility to seek treatment if your children get fever	20.7.1☐	20.7.2☐	20.7.3☐	20.7.4☐
21.	**Perceived self-efficacy**				
21.1.	Easily protect your children from getting malaria	21.1.1☐	21.1.2☐	21.1.3☐	21.1.4☐
21.2.	let children sleep under a bed net for the every entire night at any weather	21.2.1☐	21.2.2☐	21.2.3☐	21.2.4☐
21.3.	let children wear long sleeves when they are outside of bed nets at night time at any season	21.3.1☐	21.3.2☐	21.3.3☐	21.3.4☐
21.4.	Obtain mosquito repellents to apply children skin when they are outsides of bed nets to protect them from malaria	21.4.1☐	21.4.2☐	21.4.3☐	21.4.4☐

No.	Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
21.5.	Use mosquito coils to drive away mosquito to protect children from malaria	21.5.1☐	21.5.2☐	21.5.3☐	21.5.4☐
21.6.	Clean bushes around the household to protect children from mosquito bites	21.6.1☐	21.6.2☐	21.6.3☐	21.6.4☐
21.7.	Clean stagnant water around the household to protect children from mosquito bites	21.7.1☐	21.7.2☐	21.7.3☐	21.7.4☐
21.8.	Get the appropriate treatment from health facility for your child when s/he has fever/malaria	21.8.1☐	21.8.2☐	21.8.3☐	21.8.4☐

Inv =Inverse questions/Negative questions

III.   Part 3. Cues to malaria preventive practices and malaria preventive practices

A. Bednets /Long Lasting Insecticide Treated Nets(LLINs)

22.   Do you have mosquito nets in this household that can be used while sleeping? (If Code 2 or 3 answered, skip to Q24)

22.1☐1 Yes   22.2☐2 No

22.3☐ Don't know

23.   How many mosquito nets does your household have that can be used while sleeping?

23.1   [   ]

24.   Do your bed nets have holes or tears in it? (Code 2 only will get 1 score for condition of bed nets)

24.1☐ Yes   24.2☐ No

24.3☐ Don't know

25. What types of bed nets do you use? (If Code 1answered, skip to Q31) (Answer can be more than 1)

25.1☐ untreated net

25.2☐ long lasting insecticide treated nets (LLINs)

26. How many numbers of long lasting Insecticide Treated Nets (LLINs) are there in your households? (If every 2 person owns one LLINs, it will regard as enough LLINs per family members and will get one score. If not, only 0 score will be given)

26.1 [   ]

27. When did you receive long lasting Insecticide Treated Nets? (Code 1-4 answer together with code 1 in question 28 will get 1 score and others will get 0 scores for conditions of LLINs)

27.1☐ Before 6 months ago

27.2☐ 6months- before 1 years ago

27.3☐ 1- before2 years ago

27.4☐ 2- before 3 years ago

27.5☐ 3-before 5 years ago

27.6☐ Since and more than 5 years ago

27.7☐ Don't Know

28. How many times have your long lasting Insecticide Treated Nets been washed? (Code 1 only will get 1 scores)

28.1☐ 20 times and less than 20 times

28.2☐ more than 20 times

28.3☐ Don't know

29. In your household, how many people sleep under one long lasting Insecticide Treated Net usually?

29.1☐ ≤2 people   29.2☐ 3 or more people

30. Is there any shop who sell long lasting Insecticide Treated Nets in your community? (Code 1 only will get 1 score)

30.1☐ Yes   30.2☐ No

30.3☐ Don't know

31. How often do you sleep under bed net/long lasting Insecticide Treated Nets during last week? (Code 1 only will get 1 score)

   31.1☐ Always   31.2☐ Sometimes   31.3☐ Never

32. How often do your children sleep under bed net/long lasting Insecticide Treated Nets during last week? (Code 1 only will get 1 score)

   32.1☐ Always   32.2☐ Sometimes   32.3☐ Never

33. How often do you check for holes bed net/long lasting Insecticide Treated Nets during last week? (Code 1 only will get 1 score)

   33.1☐ Always   33.2☐ Sometimes   33.3☐ Never

34. How often do you immediately repair bed net/long lasting Insecticide Treated Nets when there is a hole during last week? (Code 1 only will get 1 score)

   34.1☐ Always   34.2☐ Sometimes   34.3☐ Never

B. **Mosquito Repellents**

35. Is there any shop who sell mosquito repellents in your community? (Code 1 only will get 1 score)

   35.1☐ Yes   35.2☐ No

   35.3☐ Don't know

36. Do you have mosquito repellents in your households? (Code 1 only will get 1 score) (If Code 2 answered, skip to Q38)

   35.1☐ Yes   35.2☐ No

37. How often do you apply to the skin of your children under five year when they are outside bed nets in the night time? (Code 1 only will get 1 score)

   37.1☐ Always   37.2☐ Sometimes   37.3☐ Never

C. **Mosquito Coils**

38. Is there any shop who sell mosquito coils in your community? (Code 1 only will get 1 score)

   38.1☐ Yes   38.2☐ No

   38.3☐ Don't know

39. Do you have mosquito coils in your households? (If Code 2 answered, skip to Q43)

   39.1☐Yes   39.2☐ No

40. How often do you use mosquito coils to driven out mosquito when your children are outside of bed nets at night time? (Code 1 only will get 1 score)

40.1☐ Always   40.2☐ Sometimes   40.3☐ Never

D.   Long sleeves

41. Do you have long sleeves for your children to wear in your households? (If Code 2 answered, skip to Q43)

41.1☐ Yes   41.2☐ No

42. How often do your children wear long sleeves when they are outside of bed nets at night time? (Code 1 only will get 1 score)

42.1☐ Always   42.2☐ Sometimes   42.3☐ Never

E.   Bushes/ stagnant water

43. Are there any bushes around your household? (If Code 2 answered, skip to Q45) (Code 1 only will get 1 score)

43.1☐Yes

43.2☐ No

44. How often do you clean/cuts bushes around your house? (Code 1 only will get 1 score)

44.1☐ Always   44.2☐ Sometimes   44.3☐ Never

45. Is there any stagnant water around your household? (Code 1 only will get 1 score) (If Code 2 answered, skip to Q47)

45.1☐ Yes

45.2☐ No

46. How often do you clean stagnant water near your house? (Code 1 only will get 1 score)

46.1☐ Always   46.2☐ Sometimes   46.3☐ Never

F.   Health Facility/Health worker

47. Are there any health worker/center to seek treatment for your children health in your community? (If Code 2 or 3 answered, skip to Q49) (Code 1 only will get 1 score)

47.1☐ Yes   47.2☐ No

47.3☐ Don't know

48. How often do you visit the health worker/center when your children fall sick? (Code 1 only will get 1 score)

48.1□ Always   48.2□ Sometimes   48.3□ Never

G.   Source of information about malaria prevention

49. Have you ever heard or received any information related to Malaria Prevention? (If Code 2 answered, skip to Q51) (Code 1 only will get 1 score)

49.1□Yes   49.2□ No

50. Where did you hear or see the messages or information? (Answer can be more than 1) (1 score for each code except code 16)

50.1□ Village Health Volunteer

50.2□ Government Health Staff

50.3□ Private Doctor

50.4□ Drug Store

50.5□ Teacher

50.6□ Religious Leaders/monks

50.7□ Family members

50.8□ Friends/Neighbours

50.9□ TELEVISION

50.10□RADIO

50.11□VIDEO

50.12□Posters

50.13□Pamphlets

50.14□Billboards

50.15□NGO staffs

50.16□OTHER (SPECIFY):   ………….

H.   Experience of death of family members due to malaria

51. Have you ever been experience in death of family members due to malaria? (If Code 2 answered, skip Q52) (Code 1 only will get 1 score)

51.1□ Yes   51.2□ No

52. Who died due to malaria in your family? (Code 1 only will get 1 score)

52.1□ Children under five years   52.2□ Other family members ……….

Appendix D. Budget

NO.	Description	Unit	Estimated Expenses (Baht)
1	Printing Questionnaires, Consent forms		4000
2.	Buying stationary		1000
3.	Travelling Ayeyarwady for two times	6000*2	12000
4.	Advocacy with authorities(treating lunch)/Providing snacks and water, presents to respondents for appreciation of their participation		24600
5.	Transportation to study sites by car or bike		10000
6.	Training for research assistants and Pretests		10000
7.	Travelling and accommodation perdium from Yangon to Ayeyarwady for one research assistant from Yangon		5000
8.	Daily perdium for three research assistants		15000
9.	Miscellaneous		2000
10.	Preparation and Printing of Thesis Paper		4500
	Total		84100

Appendix E. Time Frame

Research Activities	Time	Frame							
	Nov	Dec	Jan	Feb	March	April	May	June	July
Literature review	■	■	■						
Thesis Proposal Writing and Preparation		■	■						
Tool development for data collecting			■	■					
Thesis Proposal Defense/Ethical Approval			■	■	■				
Field preparation and data collection					■	■			
Data analysis						■	■		
Thesis writing								■	■
Thesis Defense Exam									■
Submitting Final Thesis									■
Total	9		months						

Appendix F.   Wealth Index Scoring and Calculation

Scoring of rural area in question No. 6 was done using coding number according standardize scoring in Myanmar Equity Tool according to Myanmar Census as follow;
- For Q6.1. (1=-0.025530808557484) (2=0.345544778502443)
-For Q6.2 (1=0.371659018974553) (2=-0.102020130983158) (3=0.00219786488820126) (4=-0.0839642312507093)
- For Q6.3 (1=0.0259880009672461) (2=-0.00141626285317562) (3=-0.162272142711908) (4=0.417222311375859) (5=0.0259880009672461)
- For Q6.4 (1=0.131993214614489) (2=-0.00951544838130225)
- For Q6.5 (1=0.636284380209355) (2=-0.0673020128779394) (3=0.392233966046171) (4=-0.0673020128779394)
- For Q6.6 (1=-0.318405128511842) (2=0.0745454722181857
- For Q6.7 (1=-0.267632087520993) (2=0.207029538060123) (3=-0.0248301579333771)
- For Q6.8 (1=0.155846115392707) (2=0.401412657571093) (3=-0.0984432979631162)
- For Q6.9 (1=-0.196904057438958) (2=0.0578959186202151) (3=0.38406545483466) (4=-0.0020308798728003)
- For Q6.10 (1=0.133887716987529) (2=-0.0864678317972501)
- For Q6.11 (1=0.373700371807049) (2=-0.00758553700058694)
- For Q6.12 (1=0.118485721307809) (2=-0.0716352645001091)
- For Q6.13 (1=0.0818349475261608) (2=-0.0378962952521668)
Calculate sum of rural scores by following formula,
RuralScore=Q6.1_RUR+Q6.2_RUR+Q6.3_RUR+Q6.4_RUR+Q6.5_RUR+Q6.6_RUR+Q6.7_RUR+Q6.8_RUR+Q6.9_RUR+Q6.10_RUR+Q6.11_RUR+Q6.12_RUR+Q6.13_RUR.
Scoring of urban area was done using coding number according standardize scoring in Myanmar Equity Tool according to Myanmar Census as follow;
- For Q6.1 (1=-0.0152788703241126) (2=0.0296774684424243)
- For Q6.2 (1=0.0789746818944892) (2=-0.19171597556422) (3=-0.479537125127508) (4=-0.19171597556422)
- For Q6.3 (1=-0.14079901746662) (2=-0.149666156807015) (3=-0.259416772722511) (4=0.131957854071569) (5=0.131957854071569)
- For Q4 (1=0.109241041668876) (2=-0.0410550098868406)
-For Q6.5 (1=0.184809665613407) (2=-0.25301708026281) (3=-0.0889954352927103) (4=0.184809665613407)
- For Q6.6 (1=-0.329594996854224) (2=0.00866449197525057)
-For Q6.7 (1=-0.396154255213975) (2=0.0654648072132339) (3=-0.0983750328408838)
-For Q6.8 (1=-0.012430185299896) (2=0.259325350455836) (3=-0.197027166368122)
-For Q6.9 (1=-0.269884615846232) (2=-0.107747189261285) (3=0.239437731703686) (4=-0.0107852850572689)
- For Q6.10 (1=0.0536242051754263) (2=-0.167856787521704)
- For Q6.11 (1=0.172320630482368) (2=-0.0353871864701528)

- For Q6.1212 (1=0.0313760310021862) (2=-0.02194414211602)
- For Q6.13 (1=-0.000331694578401517) (2=0.000293193695119422)
Calculate the sum of urban scores by following formula,
UrbanScore=Q6.1_URB+Q6.2_URB+Q6.3_URB+Q6.4_URB+Q6.5_URB+Q6.6_URB+Q6.7_URB+Q6.8_URB+Q6.9_URB+Q6.10_URB+Q6.11_URB+Q6.12_URB+Q6.13_URB.
After that, national scores of each respondent was calculated based on the urban and rural scores
National Score = 0.7935311+0.8882363*Urban Score.
National Score = -0.3091079+0.7449525*Rural Score.
Each respondent's quintile will be decided as followed;
National Quintile =5, if National Score >=0.8080955
National Quintile =4, if National Score >=0.1008179
National Quintile =3, if National Score >=-0.3114549
National Quintile =2, if National Score >=-0.7352678
National Quintile =1, if National Score <-0.7352678.

Appendix G. Ethic Approval Form

The Research Ethics Review Committee for Research Involving Human Research
Participants, Health Sciences Group, Chulalongkorn University
Jamjuree 1 Building, 2nd Floor, Phyathai Rd., Patumwan district, Bangkok 10330, Thailand,
Tel/Fax: 0-2218-3202 E-mail: eccu@chula.ac.th

AF 02-12

COA No. 080/2018

Certificate of Approval

Study Title No. 054.1/61   :   CAREGIVERS' MALRIA PREVENTIVE PRACTICE FOR UNDER FIVE CHILDREN AND ITS ASSOCIATION IN NGAPUDAW HIGH-RISK TOWNSHIP, AYEYARWADY REGION-MYANMAR

Principal Investigator   :   MS. EI PHYU HTWE

Place of Proposed Study/Institution :   College of Public Health Sciences,

Chulalongkorn University

The Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University, Thailand, has approved constituted in accordance with the International Conference on Harmonization – Good Clinical Practice (ICH-GCP).

Signature: ....Prida Tasanapradit....   Signature: ....Nuntaree Chaichanawongsaroj....

(Associate Professor Prida Tasanapradit, M.D.)   (Assistant Professor Nuntaree Chaichanawongsaroj, Ph.D.)

Chairman   Secretary

Date of Approval   : 28 March 2018   Approval Expire date : 27 March 2019

The approval documents including

1) Research proposal

2) Patient/Participant Information Sheet and Informed Consent Form

3) Researcher

4) Questionnaire

Protocol No. 054.1/61
Date of Approval. 28 MAR 2018
Approval Expire Date. 27 MAR 2019

The approved investigator must comply with the following conditions:
1. The research/project activities must end on the approval expired date of the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University (RECCU). In case the research/project is unable to complete within that date, the project extension can be applied one month prior to the RECCU approval expired date.
2. Strictly conduct the research/project activities as written in the proposal.
3. Using only the documents that bearing the RECCU's seal of approval with the subjects/volunteers (including subject information sheet, consent form, invitation letter for project/research participation (if available).
4. Report to the RECCU for any serious adverse events within 5 working days
5. Report to the RECCU for any change of the research/project activities prior to conduct the activities.
6. Final report (AF 03-12) and abstract is required for a one year (or less) research/project and report within 30 days after the completion of the research/project. For thesis, abstract is required and report within 30 days after the completion of the research/project.
7. Annual progress report is needed for a two- year (or more) research/project and submit the progress report before the expire date of certificate. After the completion of the research/project processes as No. 6.

VITA

Name: Miss Ei Phyu Htwe

Place of birth: Yangon,

Date of birth: 26.7.1992

Nationality: Myanmar

Religion: Islam

Email: eiphyuhtwe2014@gmail.com

Education: M.B., B.S (Yangon)

Graduated from University of Medicine (2), Yangon, Myanmar

Working Experience

February 2017- July 2017- Quality Assurance Officer at MMA – Malaria (QDSTM) project

March 2016 - January 2017- Medical Officer at MMA – Malaria (QDSTM) project at Hsipaw Township, Northern Shan State.

January 2016 - February 2017-Assistant Medical Officer at MMA – Malaria (QDSTM) project at Singu Township, Mandalay Division.

July 2014 - June 2015- Internship as house officer at Teaching Hospitals of University of Medicine (2) Yangon such as North Okkala Pa General Hospital, Thingankyun Sanpya General Hospital, Yankin Children Hospital, and group leader for research with the Title of "Survey on Knowledge and Practices about Food Hygiene among 15 Years and above Housewives in Gyo Gone RHC, Hlegu Township 2014"