

Investigating Preventative Strategies to Reduce Malaria Outbreaks in Prachuap Khiri Khan

An Interactive Qualifying Project and Interactive Science and Social Project

Sponsored by

Raks Thai Foundation

Submitted by

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Glossary

GMEP	Global Malaria Eradication Program
DDT	Dichlorodiphenyltrichloroethane
LLIN	Long-lasting insecticidal nets
ACTs	Artemisinin-based therapies
ITNs	Insecticide-treated bed nets
BSAC	Bachelor of Science in Applied Chemistry
WPI	Worcester Polytechnic Institute

Abstract

Thailand is currently facing a critical malaria outbreak, and one such region is in Prachuap Khiri Khan, where a combination of malarial transmission factors, including the migration of plantation workers, is contributing to the surge in cases. In collaboration with the Raks Thai Foundation, we aim to design and propose strategies to reduce malaria amongst those living within the targeted area by March of 2024. We spoke with relevant officials and authorities to gather information on the current situation. We carried out focus group meetings, observational studies, and interviews with a combination of 28 locals, migrant workers, volunteers, and school staff. As a result, we identified the flaws within the current malaria strategies and proposed workshop activities that will walk the locals through various innovations and products in combating malaria, while ensuring a community-focused and sustainable approach.

Executive Summary

Malaria: A Public Health Epidemic

Malaria remains a pressing public health concern in Thailand that the Ministry of Public Health has been striving to eradicate. Despite the progress made thus far, concentrated outbreaks progress in areas bordering Myanmar, Cambodia, and Malaysia. Along the Thailand-Myanmar border, worker migration introduces cross-border malaria transmission to Thailand. Governmentled initiatives such as the 1-3-7 surveillance program have proven ineffective in tracking these migration patterns. The village of Phraek Takhro is subject to these conditions, and urgent attention is required to assist this population in reducing malaria.

Thailand's hot and humid climate provides ideal conditions for agricultural plantations and mosquito breeding grounds. Phraek Takhro relies on its agricultural sector for economic development and employment opportunities. The prominence of rubber plantations in the village increases the risk of malaria as stagnant water in the coconut shell produced from tapping rubber becomes a breeding ground for mosquitoes. In combination with the late working hours, plantation workers face occupation-related risk factors for contracting malaria. The vector of the malaria parasite is the mosquito. The most prominent parasite species in Thailand are *P. vivax* and *P. falciparum*. These species have posed further difficulties to malaria elimination in border regions due to the emergence of multi-drug resistant strains. Of the various malaria elimination successes, insecticidal-treated nets (ITNs) and Artemisinin-based Combination Therapies (ACTs) have proven the most effective. However, the adoption of ACTs is incomparable to the drug resistance exhibited by *P. falciparum*, leaving Thailand-Myanmar border locations reliant on surveillance programs and other control measures.

Our Approach

The project aimed to design and propose strategies to reduce malaria among migrant workers and the local community in Phraek Takhro by March 2024. We conducted focus group meetings with Thai authority groups and developed connections to use throughout the duration of our project. We then interviewed the locals and migrant workers of the Phraek Takhro Village to gather firsthand input on malaria prevention strategies and potential improvements. We also conducted observational studies to best adapt our recommendations to daily lifestyles in the village. We used three objectives to guide us through our project and shape our framework. Through various methods, the team achieved the following objectives:

- 1. Identify current malaria prevention methods implemented in Phraek Takhro.
- 2. Determine why the current methods have been ineffective.
- 3. Understand the daily lifestyle of locals and migrant workers to tailor our strategies accordingly.

To gather information on what prevention methods are currently used and why they have been ineffective in Phraek Takhro, we conducted focus group meetings and semi-structured interviews with government authorities and local communities. The information gathered from authority meetings furthered our understanding of prevention methods in the area and helped us develop useful connections during our project. Leveraging these connections for further interviews, we then proceeded to Phraek Takhro to inquire about what prevention methods are used in the local area. During these interviews, we delved into the reasons behind the perceived ineffectiveness of current prevention methods. We used the information regarding current prevention methods to understand the preferred methods used by the locals to tailor our strategies to the target population better. We also factored in why current prevention methods have been ineffective to ensure our strategy does not encounter the same obstacles.

To further guarantee our strategy was appropriate for the community, we conducted observational studies during our time in the village. We focused on daily activities the locals and migrant workers participated in, including mealtimes and destinations throughout the day. It was important our team did not interact with the locals then and strictly observed. This information helped us understand how to adapt our strategy to their lifestyles best. Data was organized into individual documents for each interview containing the interview questions and responses. Thematic analysis and axial coding were employed to organize and analyze the interview data and identify trends in demographics, occupations, prevention methods, obstacles, and improvements. The team organized the data into systematic Excel spreadsheets by these categories. Axial coding was then used to identify key takeaways from our data.

Our Findings

Through our focus group meetings, interviews, and observational studies, the team identified the most effective strategy for the village of Phraek Takhro must be natural, sustainable, and easily applicable to the lifestyles of locals and plantation workers. After identifying the most frequently used prevention methods, such as bed nets, spray repellents, and covering clothing, the team concluded all these methods were convenient for the locals and workers. Bed nets and spray repellents used to be distributed to locals by the government, making these tools accessible. However, repellents and bed nets were not distributed to Myanmar migrant plantation workers. Myanmar plantation workers created mosquito-repellent waist belts, as pictured in Figure 1, to combat the challenges of reapplying repellent. Both locals and plantation workers wear long sleeves and pants due to the simplicity of this prevention method. The methods used throughout the village emphasize the importance of convenience, and this convenience strongly correlates with compliance with these methods.

- 1. Remote Area
- 2. Knowledge Gap
- 3. Lack of Official Support
- 4. Insufficient Products

The team identified four reasons current prevention methods are ineffective: remote areas, knowledge gap, limited official support, and insufficient products. Phraek Takhro is in a remote, forest-heavy area with limited access to electricity and internet, which poses challenges in spreading health care information to locals and plantation workers. This creates insufficient communication, resulting in an observed knowledge gap regarding malaria symptoms, transmission, and treatment. Our team also was made aware of the limited outside help from officials. Before the COVID-19 pandemic, there was distribution of bed nets and spray repellents to locals. However, these programs were discontinued due to funding. The bed nets available are not large enough to sleep comfortably, and the large holes do not stop the mosquitoes. This requires locals and migrant workers to travel far to obtain sufficient supplies, which is not always feasible. We determined the strategy must address the communication gap, develop educational programs, enhance official support, and involve community engagement. Above all, the strategy must be self-sufficient regarding medical supplies and support to guarantee its longevity and success in the community.



Figure 1. Mosquito repellent waist belt developed by plantation workers.

Our Recommendations

Bi-Weekly Informative Workshop

We recommend that the Raks Thai Foundation holds bi-weekly informative workshops in the Phraek Takhro Village. Our team has designed four infographics to advertise and promote this workshop, as shown in Figure 2. These workshops will take place after customary community gatherings that occur every Sunday and should include using natural resources such as citronella and other native herbs to make repellents. Banana leaves and reusable bottles will be used as packaging to maintain sustainability. This workshop will include a demonstration of how to make and maintain natural mosquito repellents long-term. Moreover, mosquito repellent patches and mothballs are innovations for villagers to use for repelling mosquitoes while tapping rubber and staying home. As sustainability and environmentally friendliness is concerned, the repellent patch will be made from pineapple pulp, which is easier to decompose and less harmful to the environment in the area. Moth balls are also very efficient since they are reusable and easy to use just by hanging in households. They are used with essential oil extracted from herbs, giving a natural and fresh scent. Those who attend these workshops will receive more accurate information about malaria symptoms, prevention, and treatment. A poster will also be shared throughout the village to advertise the workshop. At the workshop, the community will receive flyers detailing specific instructions on making repellent and malaria-related information shown by images and cartoons. Furthermore, repellent patches and essential oils for use with moth balls will be included in workshops to support local costs. These recommendations aim to address the identified challenges, fostering sustainable practices and community resilience against malaria. Finally, we will also call out and recommend the government officials to consider making and distributing bigger ITNs since the normal size of the distributed ITNs was ineffective.



Figure 2. Workshop advertisement and infographics for recommended products that will

be distributed at the workshop.

Executive Summary (Thai)

มาลาเรีย: โรคระบาดด้านสาธารณสุข

โรคไข้มาลาเรียเป็นโรคที่กระทรวงสาธารณสุขพยายามกำจัดให้หมดสิ้น แม้ปัจจุบันจะมีความ คืบหน้าในการควบคุมการระบาด แต่การระบาดยังคงชุกชุมตลอดแนวชายแดน เมียนมาร์ กัมพูชา และ มาเลเซีย การย้ายถิ่นฐานของแรงงานตามแนวชายแดนไทย-เมียนมาร์ทำให้เกิดการระบาดของโรคไข้ มาลาเรียในประเทศไทยเพิ่มขึ้น โครงการริเริ่มที่นำโดยรัฐบาล เช่น โครงการเฝ้าระวัง 1-3-7 ไม่สามารถ ติดตามการระบาดของโรคไข้มาลาเลียจากการย้ายถิ่นได้อย่างมีประสิทธิภาพ หมู่บ้านแพรกตะคร้อเป็นหนึ่ง ในหมู่บ้านหื่อยู่ภายใต้เงื่อนไขเหล่านี้ และจำต้องได้รับความช่วยเหลืออย่างเร่งด่วนในการลดการระบาดของ โรคไข้มาลาเรีย

ประเทศไทยมีสภาพภูมิอากาศร้อนชิ้นเหมาะกับการเกษตรกรรม อากาศที่ร้อนชื้นเป็นปัจจัยสำคัญ ของวงจรชีวิตยุง เศรษฐกิจของหมู่บ้านแพรกตะคร้อยึดการเกษตรกรรมเป็นหลักโดยเฉพาะการทำสวนยาง แรงงานของสวนยางในหมู่บ้านมีความเสี่ยงต่อการแพร่ระบาดของโรคไข้มาลาเรีย เนื่องจากน้ำขังใน กะลามะพร้าวที่ใช้รองรับน้ำยางหลายพันต้นกลายเป็นแหล่งเพาะพันธุ์ยุงอย่างดี เมื่อประกอบกับชั่วโมงกรีดน้ำ ยางช่วงกลางคืน คนงานสวนยางจึงมีความเสี่ยงในการติดเชื้อโรคไข้มาลาเรียสูง

พาหะของปรสิตโรคไข้มาลาเรียคือ ยุงกันปล่อง ปรสิตที่พบมากที่สุดในประเทศไทยคือ *P. vivax* และ *P. falciparum* ปรสิตสองสายพันธุ์นี้สร้างปัญหาในการกำจัดการแพร่ระบาดของโรคไข้มาลาเรียในพื้นที่ ตะเข็บชายแดน นอกจากนั้นแล้วยังมีพบปรสิตดื้อยาอีกหลายสายพันธุ์ วิธีการกำจัดโรคไข้มาลาเรียที่มี ประสิทธิภาพ เช่น การใช้มุ้งชุบสารเคมี (ITNs) และการบำบัดแบบผสมผสานที่ใช้อาร์เทมิซินิน (ACTs) ไม่ สามารถลดการระบาดของของปรสิตดื้อยาสายพันธุ์ *P. falciparum* ได้ จึงจำเป็นที่จะต้องคิดค้นวิธีเฝ้าระวัง และมาตรการควบคุมอื่นๆ ที่เหมาะสมกับบริบทของตะเข็บชายแดนไทย-เมียนมาร์

วิธีดำเนินการวิจัย

โครงงานนี้มีเป้าหมายที่จะออกแบบและเสนอแนวทางลดการระบาดของโรคไข้มาลาเรียในกลุ่ม แรงงานข้ามชาติและชาวบ้านบริเวณหมู่บ้านแพรกตะคร้อ จังหวัดประจวบคีรีขันธ์ คณะผู้วิจัยได้พบเจ้าหน้าที่ ด้านสาธารณสุขเพื่อขอข้อมูลพื้นฐานด้านการระบาดของโรคไข้มาลาเรียในพื้นที่และแนวทางของการ ดำเนินการควบคุมการระบาดที่ดำเนินอยู่ในปัจจุบัน นอกจากจากนั้นแล้วยังได้สังเกตุการณ์และสัมภาษณ์ ชาวบ้านและแรงงานข้ามชาติที่อาศัยอยู่บริเวณหมู่บ้านแพรกตะคร้อเพื่อศึกษาแนวทางป้องกันตนที่ใช้อยู่จริง ข้อมูลที่ได้นำมาวิเคราะห์เพื่อประเมินประสิทธิภาพของวิธีการเหล่านี้ เพื่อนำไปปรับปรุงให้มีประสิทธิภาพใน การป้องกันตนมากขึ้น ในการศึกษาเซิงสังเกตการ์ณเพื่อค้นหาวิธีการป้องกันตนที่เหมาะสมกับวิถีชีวิตของ ประชาชนในพื้นที่ เราได้ตั้งวัตถุประสงค์ไว้ 3 ประการคือ:

- 1. สามารถระบุวิธีการป้องกันตนเองจากโรคไข้มาลาเรียที่ใช้ในหมู่บ้าน
- 2. สามารถระบุว่าได้ว่าทำไมวิธีการเหล่านี้ถึงไม่ได้ผล
- เข้าใจวัฒนธรรมและวิถีชีวิตของประชาชนในบริเวณหมู่บ้านแพรกตะคร้อเพื่อแนะนำวิธีการป้องกัน ตนที่ให้เหมาะกับบริบท

นอกจากนั้นแล้วคณะผู้วิจัยยังแสวงหามุมมองจากเจ้าหน้าที่สาธารณสุขในท้องถิ่นถึงข้อดีข้อเสียของ วิธีการป้องกันตนเหล่านี้ ข้อมูลจากเจ้าหน้าที่สาธารณสุขช่วยเพิ่มความเข้าใจในแนวทางการป้องกันโรค โดยรวม เจ้าหน้าที่สาธารณสุขยังช่วยแนะนำผู้เชี่ยวชาญในพื้นที่และหัวหน้าชุมชนเพื่อรับทราบข้อมูลเฉพาะ ของหมู่บ้านแพรกตะคร้ออีกด้วย

เพื่อค้นหาเหตุผลที่ทำให้แผนป้องกันโรคไข้มาลาเรียด้อยประสิทธิภาพในพื้นที่ตะเข็บชายแดน คณะผู้วิจัยใช้วิธีวิเคราะห์เฉพาะเรื่อง (Thematic Coding) ในการระบุบทประเด็นหลักที่มีการกล่าวถึงมาก ที่สุดจากข้อมูลสัมภาษณ์และข้อมูลจากการสังเกตการณ์ จากนั้นได้นำข้อมูลมาจัดเป็นหมวดหมู่เพื่อหา แนวโน้มในกลุ่มต่างๆ เช่น เชื้อชาติ อาชีพ วิธีการป้องกัน อุปสรรค และ การปรับปรุง โดยใช้ Microsoft Excel วิเคราะห์ข้อมูลและนำเสนอในรูปแบบของกราฟ

ผลลัพธ์และการวิเคราะห์

ผลวิเคราะห์ข้อมูลจากเจ้าหน้าที่สาธารณสุข การสัมภาษณ์และการศึกษาเชิงสังเกต ประชาชนใน พื้นที่ บ่งว่าวิธีป้องกันตนที่เหมาะกับประชาชนในพื้นที่บ้านแพรกตะคร้อจะต้องเป็นผลิตภัณฑ์จากธรรมชาติ ใช้งานง่าย สอดคล้องกับวัฒนธรรมและวิถีชีวิตของคนในพื้นที่และกลุ่มแรงงานข้ามชาติ เพื่อให้มี ประสิทธิภาพสูงสุดและยั่งยืน วิธีการป้องกันตนที่ใช้กันอย่างแพร่หลายในพื้นที่คือ มุ้งกันยุง ยากันยุง และ เสื้อผ้าปกป้องร่างกายจากยุง เนื่องจากมีความสะดวกสบายและเหมาะกับวิถีชีวิตมากที่สุด

หน่วยงานสาธารณสุขในพื้นที่เคยแจกจ่ายมุ้งกันยุงชุบสารเคมีและยากันยุง กับประชาชนชาวไทยใน หมู่บ้านแพรกตะคร้อ แต่บริการเหล่านี้ไม่ครอบคลุมแรงงานข้ามชาติจากเมียนมาร์ คนงานสวนยางชาวเมียน มาร์ได้ประดิษฐ์ยากันยุงคาดเอวเพื่อลดการทายากันยุงซ้ำๆ ตามรูปภาพที่ 1 การสวมเสื้อแขนยาวและกางเกง ขายาวเพื่อป้องกันยุงเป็นที่นิยมทั้งชาวบ้านคนไทย ชาวเมียนมาร์อพยพ และแรงงานเกษตรเนื่องจากง่ายและ สะดวกสบาย ข้อมูลเหล่านี้แสดงให้เห็นว่าบีจจัยที่เพิ่มประสิทธิภาของแผนกำจัดโรคไข้มาลาเรียในพื้นที่บ้าน แพรกตะคร้อจะต้องคำนึงถึงความสะดวกสบายที่ไม่รบกวนวิถีชีวิตและกิจวัตรประจำวันเป็นหลัก

ปัจจัยอื่นๆ ที่ทำให้วิธีการป้องกันโรคไข้มาลาเรียในพื้นที่บ้านแพรกตะคร้อด้อยประสิทธิผลคือ เป็น พื้นที่ห่างความเจริญ แพรกตะคร้ออยู่ห่างไกลตัวเมือง การเดินทางเป็นไปด้วยความยากลำบาก พื้นที่เป็นป่า ทึบ ไม่มีไฟฟ้าและอินเตอร์เน็ต ทำให้การสื่อสารข้อมูลการระบาดของโรคและข้อมูลด้านสุขภาพแก่ประชาชน ในพื้นที่เป็นอุปสรรคประชาชนในพื้นที่เป็นผู้ด้อยโอกาสด้านการศึกษาทำให้ขาดความรู้ที่ถูกต้องเกี่ยวกับ อาการของโรค การแพร่เชื้อ และการรักษาที่ถูกต้องของโรคไข้มาลาเรีย

นโยบายตัดงบประมาณด้านสาธารณสุขส่วนภูมิภาคหลังการแพร่ระบาดของไวรัสโควิดทำให้ หน่วยงานสาธารณสุขในพื้นที่จำต้องเลิกโครงการแจกมุ้งชุบสารเคมีและยากันยุง ข้อมูลเพิ่มเติมจากชาวบ้าน คือมุ้งชุบสารเคมีขนาดมาตรฐานนั้นมีขนาดเล็กเกินไปไม่สามารถใช้นอนได้ทั้งครอบครัว และรูผ้ามุ้งมีขนาด ใหญ่จนยุงสามารถลอดเข้ามาได้ ประชาชนในพื้นที่แพรกตะคร้อจึงจำเป็นต้องซื้อมุ้งและยากันยุงใช้เองจาก ตลาด ข้อมูลเหล่านี้ซี้ให้เห็นว่ากลยุทธ์ด้านการสาธารณสุขและการป้องกันโรคไข้มาลาเรียในพื้นที่หมู่บ้าน แพรกตะคร้อควรยึดหลักการพึ่งพาตนเองทั้งด้านเวชภัณฑ์ และองค์ความรู้ชุมชน เพื่อความยั่งยืนและ ความสำเร็จในการป้องกันตนเองของบ้านแพรกตะคร้อ



รูปภาพที่ 1. ยาจุดกันยุงคาดเอว พัฒนาโดยคนงานสวนยาง

ข้อเสนอแนะ

คณะผู้วิจัยมีข้อเสนอแนะสำหรับมูลนิธิรักษ์ไทยดังนี้ จัดการอบรมเชิงปฏิบัติการในชุมชนแพรก ตะคร้อเดือนละ 2 ครั้งในวันอาทิตย์ หลังกิจกรรมทางศาสนาของชาวบ้าน โดยตั้งเป้าหมายไว้ที่การเพิ่มพูน ความรู้เกี่ยวกับนวัตกรรมป้องกันโรคมาลาเรียใหม่ๆ ที่เน้นใช้วัสดุธรรมชาติ เช่น สมุนไพรพื้นบ้าน

คณะผู้วิจัยได้ออกแบบสื่อโฆษณาในการเชิญชวนให้ชาวบ้านเข้าร่วมกิจกรรมตามที่แสดงในรูปที่ 2 การอบรมเชิงปฏิบัติการนี้ประกอบด้วยการเตรียมยากันยุงสูตรธรรมชาติ และวิธีเก็บรักษายากันไว้ใช้ในระยะ ยาว คณะผู้วิจัยขอนำเสนอนวัตกรรมกันยุงใหม่สองประเภทคือ แบบสติ๊กเกอร์และแบบสำลีชุบน้ำมันหอม ระเหยที่ชาวบ้านและคนงานสวนยางสามารถประดิษฐ์ได้เองและให้ความสะดวกสบายทั้งที่บ้านและตอนออกไป ทำงาน

สติ๊กเกอร์ยากันยุงสามารถประดิษฐ์ได้จากกากมะพร้าวที่ย่อยสลายง่ายและไม่เป็นอันตรายต่อ สิ่งแวดล้อม ลูกเหม็นถือว่าเป็นนวัตกรรมที่มีประสิทธิภาพอย่างหนึ่งที่สามารถใช้ซ้ำได้ในระยะยาว ใช้งานง่าย โดยการแขวนไว้กับตัวบ้านเพื่อไล่ยุง น้ำมันหอมระเหยสกัดจากสมุนไพรพื้นบ้านสามารถนำไปใช้ในรูปลูก เหม็น เพื่อความเป็นธรรมชาติและสดชื่น ผู้ที่เข้ารับการอบรมเชิงปฏิบัติจะได้รับความรู้ที่ถูกต้องเกี่ยวกับโรค ใช้มาลาเรีย เช่น อาการของโรค การป้องกัน และการรักษา

มูลนิธิรักษ์ไทยและหน่วยงานสาธารณสุขในพื้นที่ควรเชิญชวนประชาชนในพื้นที่ให้เข้าร่วมการ อบรมเชิงปฏิบัติการให้มากที่สุด การเชิญชวนควรมีทุกรูปแบบ เช่น การกระจายข่าวสารผ่านผู้นำชุมชน การ ใช้โปสเตอร์หรือแผ่นพับที่มีรูปภาพอธิบายการผลิตยากันยุงสมุนไพรที่น่าสนใจเพื่อสื่อสารถึงประชาชนทุก คนอย่างมีประสิทธิภาพ

มูลนิธิรักษ์ไทยและหน่วยงานสาธารณสุขควรพิจารณาแจกสติ๊กเกอร์ยากันยุงและน้ำมันหอมระเหย จากสมุนไพรพื้นบ้านที่ใช้ควบคู่กับลูกเหม็นแก่ผู้ร่วมการอบรมเพื่อสร้างความสนใจและชี้ให้เห็นวิธีการใหม่ใน การป้องกันตนเองจากยุงกันปล่อง ในอนาคตควรพิจารณาแจกสติ๊กเกอร์ยากันยุงและน้ำมันหอมระเหยจาก สมุนไพรพื้นบ้านทุกบ้านเรือนในพื้นทีแพรกตะคร้อเพื่อลดค่าใช้จ่ายของการป้องกันตนเองจากโรคไข้ มาลาเรียของประชาชน

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คณะผู้วิจัยหวังว่าข้อแนะนำเหล่านี้เป็นก้าวแรกที่จะช่วยให้การป้องกันโรคไข้มาลาเรียในพื้นที่ตะเข็บ ชายแดนสามารถดำเนินต่อไปได้อย่างมีประสิทธิภาพและยั่งยืน เราขอให้หน่วยงานสาธารณสุขในพื้นที่แพรก ตะคร้อจัดมุ้งเคลือบสารเคมีขนาดเหมาะสมให้ทุกครัวเรือนโดยไม่เลือกเชื้อชาติโดยเร่งด่วน คณะผู้วิจัยหวังว่า คำแนะนำของเราจะเป็นประโยชน์ต่อหน่วยงานสาธารณสุขในพื้นที่ประจวบคีรีขันธ์ที่และช่วยเพิ่ม ประสิทธิภาพของแผนป้องกันการระบาดของโรคไข้มาลาเรียในประเทศไทย



รูปภาพที่ 2. ใบปลิวเพื่อโฆษณาการอบรมเชิงปฏิบัติและแนะนำนวัตกรรมในการอบรมเชิงปฏิบัติ

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Introduction

Malaria is a public health issue in Thailand that the Ministry of Public Health is actively working to eliminate by 2026. In 1949, malaria was the leading cause of death in Thailand, resulting in 38,406 deaths annually. Thailand's sustainable development goals include ending the malaria epidemic in addition to epidemics of other diseases such as AIDS and tuberculosis. Despite the resurgence of multi-drug resistant malaria strains, Thailand has met the criteria for inclusion in the WHO's program for countries on the cusp of eliminating malaria. Even though thirty-seven provinces are verified as malaria free, the country cannot declare malaria elimination due to concentrated outbreaks in areas bordering Myanmar, Cambodia, and Malaysia.

In Prachuap Khiri Khan, a province along the Thailand-Myanmar border, there has been a surge of malaria cases correlated with increased migration patterns and plantation conditions. The Phraek Takhro Village is located within this province and is occupied by various agricultural plantations. These plantations play a critical role in community engagement and the economy of many tropical regions. In this village, the most prevalent plantations produce rubber, pineapple, and durian. Rubber plantations not only provide the local community with income opportunities, but also provide high economic contribution, as rubber is a raw material used in many industries.

Thailand is also the largest global producer and leading exporter of pineapple and durian, emphasizing the importance of these plantations. The irrigation processes required at plantations creates still water, a prime breeding site for mosquitos, leaving plantations workers susceptible to infection. There is a large population of migrant workers from Myanmar who seek work on the village's plantations, resulting in cross-border transmission of malaria. Given these circumstances, there is a need for urgent attention to help this population and achieve Thailand's goal of malaria elimination.

In 2016, the Ministry of Public Health emphasized its commitment to the 1-3-7 malaria surveillance program. This program relies heavily on active case detection and commitment from the locals to comply with follow-up procedures. Although successful in eradicating malaria in numerous provinces across Thailand, its efficacy faced challenges in Prachuap Khiri Khan due to constant migration of plantation workers. Government officials noted a lack of proactivity when testing for malaria, which entailed implementing active case detection. However, due to the COVID-19 pandemic, the government no longer has a large enough task force to conduct such procedures. The remote nature of Phraek Takhro further complicates government surveillance methods. The village utilizes its own natural prevention methods in addition to traditional methods such as annual chemical sprays and the usage of bed nets. Prior to COVID-19, the village received free bed nets from the government, but these distribution programs are no longer funded. The village's malaria volunteers assist in malaria prevention efforts such as testing, treatment options, and information dissemination. However, given the vastness of the village and language barriers, the volunteers' efforts cannot be the sole method of prevention.

To generate an effective prevention method, the lifestyles of the plantation workers must be at the forefront of research. Previously introduced prevention methods are not customized to the locals' lifestyles, leading to their ineffectiveness. The research endeavors to prioritize an indepth exploration of the daily lives, cultural nuances, and habits of the locals. It is critical to develop a strategy that is convenient, manageable, and sustainable for this community to ensure long-term success in reducing malaria.

This BSAC ISSP project focuses on the migrant plantation worker population of the Phraek Takhro Village where malaria outbreaks are prevalent. By working with the Raks Thai Foundation, the team aimed to aid the population in increasing their use of malaria prevention methods. The goal for this project was to design and propose activities to assist in reducing malaria among migrant workers in Phraek Takhro by March of 2024. The team decided on the following objectives to achieve the project goal:

1. Identify current malaria prevention methods implemented in Phraek Takhro.

2. Determine why the current methods have been ineffective.

3. Understand the daily lifestyle of locals and migrant workers to tailor our strategies accordingly.

The team accomplished these objectives through conducting focus group meetings, individual in-person interviews, and observational studies. By raising awareness of malaria and associated health risks, the team called the Phraek Takhro community to take action through the creation of a long-term approach to reduce malaria.

Background

This chapter begins by introducing the primary focus—the Phraek Takhro Village. In this section, we undertake a comprehensive exploration of the chosen target demographic, highlighting factors that expose them to the risk of contracting malaria. The chapter then delves into an examination of plantations and their connection to malaria risk. Subsequently, it reveals the link between the local climate in Prachuap Khiri Khan and the proliferation of mosquito breeding sites. Following this, there is an analysis of malaria parasites, their transmission process, and their complex life cycle. The chapter concludes with a discussion of successful prevention methods implemented in other countries and regions of Thailand, all crucial for understanding the unique circumstances of the Phraek Takhro Village. These topics lay a sturdy foundation for strategically designing an educational initiative aimed at effectively promoting malaria prevention strategies within the community.

Phraek Takhro Village

Thailand is divided into 76 administrative provinces which are further divided into districts and subdistricts (Thailand Maps & Facts, 2021). The focus region for this project is the village of Phraek Takhro, located in the Bueng Nakhon Subdistrict, which is a part of the Hua Hin District of the Prachuap Khiri Khan Province. Situated amongst an interplay of environmental factors, the village experiences a tropical climate, fostering ideal conditions for agricultural work. In the village, there are rubber, pineapple, and durian plantations that provide work opportunities for locals and migrant workers. The village borders Myanmar allowing many entry points into Thailand creating complex human migration patterns.

Human Behavior: Driven by Socioeconomic Factors

The border separating Thailand and Myanmar functions as a conduit for the cross-border spread of malaria, exerting a significant influence on the prevalence of the disease in Prachuap Khiri Khan. Ongoing migration, spurred by economic, social, and political factors, facilitates the continual movement of people between the two countries. This area serves as a focal point for various ethnolinguistic groups, often in conflict with the instability of the Myanmar government (Parker et al., 2015). Political unrest and inadequate economic development along the Thailand-Myanmar border contribute to a lack of robust public health infrastructure in these regions (Parker et al., 2015). Despite over ten distinct ethnic groups residing in this area, they fall outside the purview of both the Thai and Myanmar governments, resulting in limited government-backed health services for these communities (Parker et al., 2015). As many individuals traverse this border region, they expose themselves to malaria infected mosquitoes, carrying malaria parasites in their bloodstream. The migration of people from malaria-prone areas into Prachuap Khiri Khan amplifies the local transmission dynamics (Parker et al., 2015). Moreover, the constant movement of populations complicates efforts for disease surveillance and control, as individuals may not consistently remain in one location for prevention, diagnosis, and treatment measures by volunteers and government-run organizations (Parker et al., 2015).

Plantations: Thailand's Largest Economic Industry

The Phraek Takhro region is well known for its thriving agricultural industry, particularly in cultivating crops like pineapple, durian, and rubber, which significantly contribute to the country's economic stability. Since agriculture holds a dominant position in the Thai economy, engaging 60% of the workforce as of 1992 (Dutt & Mukhopadhyay, 1996), the prevalence of

plantations in this region not only results in a diverse range of agricultural products but also serves as a crucial source of employment for the local population, supporting 6.4 million households (Sapbamrer, R et al., 2022).

Phraek Takhro's plantations showcase the country's climatic diversity, ranging from tropical lowlands to subtropical highlands, creating optimal conditions for cultivating crops essential for both domestic and international markets. In Phraek Takhro, plantations are extensive mountainous areas with dirt paths used for travel by foot or motorbike. Typically, plantation workers reside in households on the plantations, limiting their need to travel beyond these boundaries. The housing structures often lack proper screening, creating an environment conducive to interactions between humans and mosquitoes, as illustrated in Figure 3 (Pooseesod et al., 2021). The surrounding land of the plantation is designated as protected, housing various wildlife species and greenery that provide habitats for mosquitoes.

Moreover, working hours fluctuate based on optimal harvest times for specific crops, leading to prolonged exposure times for plantation workers which increases the risks of contracting malaria.



Figure 3. Image of common housing infrastructure within the village

Plantation Risk Factors

The increasing proliferation of plantations in Southeast Asia has been linked to the increasing rise in malaria cases and transmission. The distinctive geographical and topographical features of plantations in Thailand significantly contribute to the prevalence of malaria within this occupation. Each agricultural sector, owing to its unique nature, exhibits diverse risk factors that contribute to the spread of malaria. Plantations like durian and rubber, characterized by substantial trees, create more shaded areas, potentially fostering an environment conducive to mosquitoes. Research in Thailand indicates that workers in rubber plantations are 2.9 times more likely to contract malaria compared to other villagers, attributable to their occupational responsibilities. The specific factors that increase the risk of malaria in this scenario originate from the distinct work schedule mandated by the optimal rubber-tapping timeframe, which is from 9:00 p.m. to 5:00 a.m. This schedule allows for a 4-5% increase in natural rubber production. However, it increases the risk of malaria by a considerable amount. Overnight and early morning outdoor exposure during these hours is identified as an ideal time for infection as it increases human-mosquito interaction, particularly since many vectors exhibit photophobic behaviors (Bhumiratana et al., 2013).

Geography and Topography

The unique location of Prachuap Khiri Khan exposes it to various climatic influences, influenced by factors like altitude and proximity to large bodies of water. This geographical and topographical setting impacts local weather patterns, temperature variations, and precipitation levels, all of which play a role in the transmission of malaria. Prachuap Khiri Khan encompasses numerous hills and valleys, creating low-elevation zones in certain areas considered ideal

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habitats for mosquitoes, thereby expanding potential locations for the proliferation of malaria and potential transmission sites (WEATHER SPARK, 2018). Furthermore, the presence of forest ecosystems is recognized for supporting malaria transmission, as shaded areas enhance the survival of the malaria vector (Kar et al., 2014).

Thailand's Climate in Relation to Vector Malaria

The climate of Prachuap Khiri Khan is characterized as a tropical savanna, marked by distinct dry and wet seasons caused by monsoons. This region is mainly affected by two monsoons: southwest monsoon and northeast monsoon, and can be categorized into three seasons: summer, rainy season, and winter. The rainy season is caused by the southwest monsoon which brings humid air from the sea around late June to early November. The winter season is caused by the northeast monsoon which brings the cold air from China around mid-November to January. This climatic pattern creates an environment conducive to the breeding of mosquitoes, particularly the Anopheles mosquito, which serves as the primary vector for transmitting malaria. The warm and humid conditions during the wet season provide standing water for mosquitoes to lay their eggs. Stagnant water bodies such as ponds and marshes become breeding sites for mosquito larvae, increasing the population of the vector.

Malaria Parasites

Of the many malaria parasites, only five can infect humans: *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, *Plasmodium malariae*, and *Plasmodium knowlesi*. The most severe infections that can lead to death if untreated result from *P. falciparum* infections. (CDC, 2023). Relapsing symptoms are seen in cases of *P. vivax* and *P. ovale* due to recrudescence, which is a small population of parasites surviving in the blood, or relapse of

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dormant hypnozoites in the liver. (Sato, 2021). Of these parasites, 80% of cases in Thailand are identified to be from the species *P. vivax*, while less than 20% of cases are identified to be from *P. falciparum*. (Heffelfinger et al., 2023).

Parasites Transmission and Life Cycle

The blood-borne malaria parasite is transmitted between humans through blood transfusions, organ transplants, shared syringes and needles, congenitally, and through mosquitoes. The blood-borne malaria parasite is transmitted between humans through blood transfusions, organ transplants, shared syringes and needles, congenitally, and through the female Anopheles mosquito (the main method of transmission in the target area). As only female mosquitoes ingest blood to produce eggs, the female Anopheles mosquito is the only vector for the malaria parasites.

Due to the complexity of the parasite's life cycle, it needs both human and mosquito hosts to propagate. In the human body, the exo-erythrocytic cycle takes place in the liver, and allows the parasite to divide in a safe environment without detection from the immune system. Once there is a high population of the parasite, it enters human red blood cells in the erythrocytic cycle and continues to asexually propagate and differentiate into male and female gametes. When a mosquito feeds on an infected human's blood, the parasite enters the female mosquito's midgut lumen and the sporogonic cycle is activated. This eventually results in the parasite traveling to the salivary gland of the female Anopheles mosquito, allowing the parasite to be transmitted to a new human host.

It is crucial to understand the biological processes of the malaria parasite to better assist in the elimination of the disease in Thailand. Understanding the parasite's life cycle helps recognize ways in which propagation can be halted. While this may not help prevent the disease, it helps in early detection and treatment.

Symptoms

About ten days post-infection, the parasite becomes apparent in the form of flu-like symptoms: chills, headache, muscle aches, tiredness, fever, nausea, vomiting, and/or diarrhea. These can eventually lead to severe symptoms including kidney failure, seizures, mental confusion, coma, and/or death. Symptoms can present as early as seven days to a year postinfection. For relapsing parasites, symptoms can re-arise months to four years post-infection as the parasite lives dormant in the liver. (CDC, 2023).

Treatment

The treatment course for malaria relies on the use of antimalarial drugs such as Artemisinin-based Combination Therapies (ACTs), which combines two pharmaceuticals and is preferred for their efficiency and potential to lower resistance emergence (Mutabingwa, 2005). While there is an array of other antimalarial drugs such as chloroquine, mefloquine, and doxycycline, ACTs have proven to be the most effective. Thailand was one of the forty-three countries that adopted ACTs by February of 2005 to help combat malaria outbreaks (Mutabingwa, 2005). However, the efficacy of these therapies was quickly challenged by the emergence of artemisinin resistance malaria along the Thailand-Myanmar border (Na-Bangchang & Karbwang, 2013). This multi-drug resistant strain results from *P. falciparum*, the second most common species in the target region. Malaria should be promptly treated as severe complications can arise soon after infection. If medications are not administered, the patient's condition can rapidly worsen and be fatal.

Previous Malaria Successes

Across the world, malaria has been combated in a multitude of ways. In this section, our group highlights past successes in malaria prevention, and explores the eradication of the disease in other countries. The research shows the impacts of these strategies and the implications for the future. This information provides guidelines on potential improvements and considerations for implementations in Thailand.

Successful Prevention and Treatment Methods

The Global Malaria Eradication Programme (GMEP) in the 1950s and 1960s was highly successful in the elimination of malaria from several regions of the world but fell short due to its inability to build on its achievements and adapt its interventions to different malaria strains that show drug and insecticide resistance. This program relied primarily on vector control by mainly indoor residual spraying and systematic detection and treatment of cases. The GMEP eventually ended in 1969 due to increasing costs to combat mounting drug and insecticide resistance (Malaria Consortium., 2014).

Long lasting insecticidal nets (LLINs), as seen in Figure 4, artemisinin-based combination therapies (ACTs), and change in land use, such as clearing forests for the cultivation of cash crops have led to a great improvement on the malaria epidemic in the last decade due to the adoption of the Global Malaria Control Strategy in 1992 and the Roll Back Malaria initiative

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in 1998 (Shretta et al., 2017). The GMEP also followed on the discovery of dichloro-diphenyltrichloroethane (DDT) effectiveness in killing the malaria vector.



Figure 4. Image of village local holding a LLIN that had been previously distributed.

The experience from the GMEP teaches contemporary elimination programs about the need to sustain investments, involve community engagement, integrate with healthcare systems, and invest in information and communication technologies (Shretta et al., 2017). Currently, malaria clinics, malaria volunteers, and the existing health infrastructure in diverse areas carry out most of the malaria case identification in Thailand. In the forest areas, where there was a high volume of population movements, treatment was provided by malaria staff (Konchom et al., 2005). However, it was generally difficult to treat patients for a radical cure and case
investigation due to their occupational activities and migratory habits. Encompassing the human element of malaria control is required for effective elimination.

Successes in Other Countries

Numerous countries have successfully combated malaria epidemics using malaria eradication programs, surveillance, and prevention methods.

Argentina was the first South American country to eradicate malaria. The country took a different approach to malaria prevention by altering their agriculture. Argentina managed breeding sites via infrastructure and vertical vegetation which decreased the density of shaded areas that the vector thrived in (Sharma et al., 2022). These tactics should be considered and re-evaluated for plantations.

Both El Salvador and Algeria used geographical stratification and mapping to locate sources of malaria. Once the outbreak point was located, follow up epidemiological surveys were distributed, and surveillance was used to track imported malaria. These strategies allowed El Salvador and Algeria to control the disease's spread, which eventually led to its eradication (Sharma et al., 2022).

Like the Thailand-Myanmar border, the Thailand-Cambodia border is facing malaria outbreaks concentrated among plantation workers. A case study was conducted where active case detection approaches were implemented in three provinces in Cambodia in an attempt to reach remote populations (Stratil et al., 2021). Mobile malaria posts were placed at each border crossing and forest entry point. Any person who passed through the post was subjected to

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malaria testing. These posts helped Cambodia identify migration patterns and track positive malaria cases. With the information gained from the malaria mobile post, outreach sites where testing and ITNs were offered were placed in areas popular among locals. This study revealed that service delivery sites were successful in reaching remote populations, and mobile malaria posts were the most effective in detecting malaria cases (Stratil et al., 2021). However, the limitation to this strategy is maintaining a health care workforce to conduct testing at the mobile malaria post sites. It is essential to study other countries' tactics and learn what could potentially be applied to the Phraek Takhro Village.

With the knowledge of the village our project focuses on, plantations, the malaria parasite, climate, and potential tactics, the team had a comprehensive understanding of the information needed to investigate the malaria outbreaks and design an effective strategy to combat the outbreaks.

Methodology

The ultimate goal in collaboration with the Raks Thai Foundation was to propose activities and effective strategies, to reduce malaria amongst the population in Phraek Takhro village by March of 2024. Thus, the team identified three objectives that must be initially met before a strategy can be designed.

- 1. Identify current malaria prevention methods implemented in Phraek Takhro Village.
- 2. Determine why the current methods have been ineffective.
- 3. Understand the daily lifestyles of locals and migrant workers to tailor our strategy accordingly.

This section will discuss the importance and purpose of each objective, detailing its vitality in our investigation to tailor a strategy that works best for the population within the targeted area. Moreover, the utilization of different types of information gathering methods suitable for each objective will also be described.

Identifying current malaria prevention methods implemented in Phraek Takhro village

Our first objective aims to gather data on the current prevention methods in place which will provide us with insights into what practices are preferred and considered effective by the locals. Information on the past and current prevention methods explored by the community is vital so that we can appropriately assess what types of adaptations or interventions should be made, learning from the community's past experience in dealing with this long persisting disease. In order to gather this information, we sought out knowledge from two main groups of people, the Thai authorities and the locals from the Phraek Takhro village. Firstly, the Thai authorities are essential in recognizing what forms of official support are being provided to the Phraek Takhro village. On the other hand, we also acknowledge that locals within the village may have their own strategies in dealing with malaria, thus this warrants another key area of data collection. Focus group meetings were held with Thai authorities to ensure equal input from all participants, allowing conversations to further understand the current prevention methods implemented. Meanwhile, semi-structured interviews were conducted with the locals which allowed us to have pre-determined questions in addition to further questions as deemed necessary.

On the 25th of January 2024, our team traveled to Prachuap Khiri Khan for a total of three days. Over the first two days, our team conducted a total of four focus group meetings to mark the beginning of a strong relationship with the Thai authorities, where the Raks Thai Foundation served as the backbone behind all operations. The authority groups included the Director of Sub District Health Promoting Hospital, the Head of Vector Borne Disease Prevention and Control, and the President of Administration for Bueng Nakhon Subdistrict. Discussions on the topics of malaria and prevention methods were made, and the questions are outlined in Appendices E, F, G, and H.

With the connections obtained from the authority meetings, we were given the opportunity to travel to the village for some preliminary interviews to understand the prevention

methods utilized within the village. Semi-structured interviews with the Village headman, malaria volunteers, and locals were conducted, where enquiries about the current prevention methods, the resources available and current problems faced are the key topics that we focused on. Overall, our team made two trips in order to reach data saturation, and next the team investigated why the current prevention methods are ineffective.

Determine Why Current Methods Have Been Ineffective

Our team aimed to understand factors that contributed to the ineffectiveness of the current prevention methods in the Phraek Takhro Village. With this information, we were able to adapt our strategy to account for previously made mistakes and develop a more effective strategy. During the focus group meetings, we asked the Thai authorities why they believed there were still malaria outbreaks despite the malaria prevention efforts. Taking this information into consideration, we set out to learn more from locals of Phraek Takhro Village. We wanted to hear directly from the locals to understand their perspectives as they are the population most affected. On our first visit to the village, we began conducting in-person interviews with locals in the area. We interviewed locals for 2 to 3 hours and organized a second visit to the village to continue our research.

Our second data collection trip began at the health clinic in the Phraek Takhro Village where we were greeted by three malaria volunteers who generously offered to guide us for the duration of our visit. We planned to interview at least 15 locals, 15 migrant workers, and 15 malaria volunteers. A baseline of 15 for each target group was appropriate based on the number of previously prepared questions and the time reserved for interviews. Before beginning interviews, we divided into two groups to maximize efficiency of data collection since we were required to leave the area by 5 pm due to safety concerns. Each pair was assigned at least one malaria volunteer to provide translations due to the language barrier.

We conducted semi-structured interviews with prepared questions outlined in Appendices B, C, and D. On the first day, we traveled by motorcycle through mountainous terrain to reach locals not working on the plantations. Upon talking to the first locals, we noted hesitation and unwillingness to reveal information, thus we incorporated ice-breaker-style questions. We aimed to make the interviews feel like normal conversations to help locals feel at ease and provide us with authentic information. Each interview lasted approximately 10 minutes, and the locals' understanding of malaria, current prevention methods and their personal opinions were thoroughly explored. We interviewed a total of 28 locals.

On the second day, we followed the same steps as the previous day, but focused on plantation workers and malaria volunteers. To access this population, we traveled to the rubber plantations. During our time on the plantations, we conducted observational studies which allowed us to witness how the workers interact as part of the plantation community. The observational study helped us gain a perspective of the daily life of the workers in this area. We spent approximately 4 hours observing those in the area before continuing with interviews. Only a few malaria volunteers were interviewed due to them being sparsely spread throughout the province. The volunteers informed us that most malaria efforts stem from the school, so our group visited the local school to interview teachers and administration staff. After our interviews with the school staff, we were informed of natural prevention methods present in the village that are often used by the locals. The team was told of nonchemical alternatives from the focus group meetings and quickly realized these methods are more suitable for the area. We scheduled a meeting with and interviewed a Chulalongkorn faculty member who graduated with a degree in medicinal herbs and a concentration in malaria. We aimed to understand what natural methods he believed were most effective and what other herbs could be introduced to and utilized in the village.

Understand the Daily Lifestyle of Locals and Migrant Workers to Tailor our Strategies Accordingly

We aimed to understand the daily lifestyles of the locals and migrant workers in the Phraek Takhro village. We can then adjust our strategies accordingly to better suit our target population. In the time we spent in the Phraek Takhro village, we dedicated our time to observe the locals and the migrant workers. During the observation, we did not interact with the locals and migrant workers so that we could get the most accurate understanding of their lifestyles. We took note of the locations that we observed and the villagers' behavior and activities such as during the meals or when they worked. We conducted our observational study for around 2 to 3 hours. To further develop our understanding of the villagers' lifestyle we also asked questions regarding their daily routines or activities in our interviews. This provided us with more information on the villagers' activity that our observation periods may not cover.

Results and Analysis

Once all the data had been gathered, we sorted and analyzed the information from the interview, meeting, and observations. This allowed us to identify four main issues that may be connected to the main causes of Prachuap Khiri Khan's widespread malaria problem. This chapter delves into our research results from Phraek Takhro Village, providing insight into our findings and their connections to the decline of malaria in the area. Our main objectives for this chapter were to paint a clear picture of the challenges and discuss the malaria situation in Phraek Takhro Village associated with the information we found.

Identifying current malaria prevention methods implemented

A noteworthy discovery was the significant correlation between the perceived simplicity of the use of a preventive measure and its execution by locals and plantation workers. The results of the analysis showed that participants regularly adopted strategies that did not disrupt their daily activities or required minimal effort to implement. Along with using local methods, the locals and migrant plantation workers combine conventional malaria preventive measures including bed nets and spray repellents. The local methods include burning lemon leaves to produce smoke that repels mosquitoes, flipping water basins to prevent standing water, and leveling the land to prevent water collection. Although locals and migrant workers mentioned these strategies in interviews, they were not the most common. Rather, bed nets, spray repellent, and wearing clothing with coverage were the three preventative strategies that were most frequently used as seen in Figure 5.



Figure 5. This graph shows the number of various malaria prevention methods mentioned throughout the interview.

These three approaches are practical for locals' and migrant workers' lifestyles. Before COVID-19, locals and malaria volunteers told us that the government would provide bed nets and insect repellent spray to the community, this facilitated simple access to these preventative measures for both locals and migrant workers. However, post-COVID-19 locals and migrant workers have expressed concern for the discontinued distribution of these supportive products since they have limited access to them otherwise. Likewise, villagers can lower their risk of mosquito bites by wearing long sleeves and long pants. Mosquito repellent waist belts were introduced since some plantation workers did not find wearing long sleeves and long pants convenient for tapping rubber. The belts work by igniting a flame to the spiral repellent, then insert into a disk attached to the belts. The scent of the spiral repellent is very well spread which allows them to go about their day while staying protected from mosquitoes without reapplying spray repellents or wearing long sleeves clothing that is inconvenient during working.

We discovered from our conversations with the school principal and headmaster that a larger audience in Phraek Takhro Village needed to be informed about malaria awareness and related issues. The school placed a high priority on educating students about malaria prevention and symptoms, hoping that the young people would be able to relay the knowledge to their families, the school also grew citronella that was used to make repellent spray for students to take home. The community relies heavily on the Ban Phraek Takhro Border Control Police School for malaria information dissemination and distribution of natural products.

A critical aspect in accomplishing our goal was evaluating the preventative measures currently in place in Phraek Takhro and making references regarding their prevalence. Convenience and lifestyle compatibility play a major role in the willingness of locals and plantation workers to adhere to malaria control measures. These insights were used to help design strategies that will be favored to villagers and accommodate their daily routines.

Determine why the current methods have been ineffective

While there are multiple malaria prevention methods being implemented by those in Phraek Takhro Village, the increased number of malaria cases means that these methods are not efficient. From our results summarized in Figure 2, we have identified four main points to summarize why the currently implemented malaria prevention methods are unsuccessful: the remote area, the knowledge gap, the lack of official support, and insufficient products being distributed.

This remote forest-heavy area directly borders Myanmar, adding to the difficulties of malaria control in the area through the spread of malaria related information. During our meeting with the Director of Sub District Health Promoting Hospital, we were informed there are forty-seven points along the Thailand-Myanmar border where migrant plantation workers can cross into Thailand on motorbike or by foot to work. Official entry points between these two countries are closed, making these unsupervised border crossings increasingly popular. However, these border crossings are not monitored, meaning that it is not possible to determine who is entering Thailand and who is not receiving information about the malaria disease and malaria prevention methods.

With the village of Phraek Takhro being so vast and remote, the lack of internet increases difficulties in communicating malaria information to the entire population. In the village, information about malaria disease and prevention methods is related to locals through the volunteers who travel between residences and verbally spread information to those encountered. Upon visiting the village, it was noted that volunteers knew where locals reside, but were unaware of the location of migrant worker households. This creates challenges in spreading information and health care to the plantation workers and their families. In addition, limited access to electricity and the internet means that word of mouth is the primary means by which information is spread. Thus, when people cannot be found, the information is not conveyed to them and they are left without the necessary knowledge.

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Given this deficit of knowledge, it has become clear to us that the insufficient communication methods are not sufficient to reach the entire village population, resulting in a knowledge gap between what volunteers believe is being understood and what locals are actually understanding. Interviews revealed that a significant portion of malaria-related information is shared to children through the Border Police School, creating a knowledge deficit between adults with and without children enrolled in the school. After conducting interviews with both malaria health volunteers and locals, we noted that there is a disparity in knowledge regarding malaria. The three volunteers who guided us for the duration of our trip communicated to us that they travel through the village by motorbike and spread malaria awareness to individual households. While volunteers stated that sufficient information about both the malaria disease and malaria prevention methods are being communicated to locals, the interviewed locals were unable to identify symptoms of malaria. For example, one interviewed plantation worker simply stated that people who are diagnosed with malaria get red eyes and a local briefly mentioned infected individuals being "hot and cold" in reference to a fever.

Furthermore, not all locals and plantation workers are concerned with the use of preventative measures as they do not have a thorough understanding of the disease they are protecting themselves against. This is also shown in observing the collected interview data. One local who was unable to report any knowledge on malaria stated that while he uses mosquito repellent, he is sometimes lazy and does not put it on. Those who do use repellents and other preventative measures as recommended face other barriers in terms of their access to malaria prevention materials. A significant portion of the population also perceived malaria as a common or normal disease as they accept mosquitoes as part of their living environment. Knowing this,

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there is a heightened need for awareness and education as most locals and workers do not seek prevention methods.

Our team has witnessed limited outside support from officials, in addition, the support provided has been insufficient. Due to the remote nature of the village, it is difficult for locals to travel to stores to buy supplies such as bed nets and repellents. The visualization of the remote area can be viewed in Figure 6.



Figure 6. Image depicting the remote area and living quarters in the village.

Stores that sell these necessities are very far and difficult to travel to according to two of the locals interviewed. In cases where locals need medical treatment and must travel to the hospital, they report that Hua Hin Hospital is 55 kilometers (34.18 miles) away from the village. This is a difficult distance to travel when a motorbike is unavailable or when one requires medical attention. Instead, those who were ill preferred a volunteer to visit their household rather than travel to a hospital that is further away. Prior to the COVID-19 pandemic, bed nets and repellents were distributed by local authorities to those of the Phraek Takhro Village. While one volunteer did mention that they were in the process of preparing for distribution, there has been no action or communication proving this.

During our interviews, we were informed that these preventative measures were no longer being distributed and the supplies that had been provided prior to COVID-19 did not meet the needs of locals in this area. Many locals expressed concern over the size of the nets provided, claiming they were too small for even a single tall person to use. Additionally, locals mentioned that the holes of the provided nets are too large and allow mosquitos to bypass the nets. The only sufficient bed nets must be purchased at a nearby store, which occasionally deters locals from using them due to the additional cost. As seen in Figure 5, bed nets are the most frequently used prevention method, emphasizing the importance of providing sufficient bed nets to the population. The chemical spray repellents available to locals are also insufficient as 5 interviewees mentioned an allergy to the repellent while 2 complained of the smell as seen in Figure 7.



Figure 7. This bar graph shows the number of times various obstacles to malaria prevention and treatment were mentioned throughout interviews.

Additionally, 2 interviewees complained about the amount of time before reapplication is required. Our interviews with authority officials and malaria volunteers also yielded mention of a chemical spray that is applied to the walls of houses annually to prevent mosquitoes from coming near the walls of the houses. When the team inquired about these treatments to locals and the school, we were told the spray was ineffective as people were still reporting mosquito bites.

Understand the Daily Lifestyle of Locals and Migrant Workers to Tailor our Strategies Accordingly

Through our observational analysis, we learned that the locals of the Phraek Takhro village live a very simple and sustainable lifestyle. While observing the daily behaviors of the locals, we noted they occupy their time by relaxing in their households and enjoying local foods such as areca nut. We did not observe anything notable, which suggested a straightforward lifestyle. A limitation of this study was the short time frame of our observational analysis, which could result in an inaccurate representation of their lifestyles.

[We consulted the malaria volunteers to gain an outside perspective and cover any additional information our observational studies did not reveal. Similar to what we had observed, the volunteers explained locals have a simplistic lifestyle. They mentioned they mainly do housework and chores, and for leisure, they explore the nearby forest. However, there appears to be a disconnect between the volunteers and the migrant plantation workers as there is minimal interaction between the two groups.]

The majority of individuals communicated using the Thai language, but it was evident they are not fluent. Their Thai was sufficient in communicating general ideas, but was not proficient in advanced dialogue. While workers were conversing, we observed other languages that were later identified as Burmese and Karen. This prompted the concern of language barriers as a prevalent limitation in our study. The locals and migrant plantation workers reside across the plantations. Houses were located significant distances from one another, secluding individuals from neighborly interactions. Their homes included minimal infrastructure, limited design, and only the necessities to live a sustainable life, enforcing the common theme of simplicity. We observed that they have hung tarps and sheets to further enclose their living spaces. We also noted that there are distinct separations between sleeping quarters and living quarters. We found that the migrant plantation workers' households have larger families than those of the local population, as seen by the abundance of essential needs surrounding their dwellings.



Figure 8. This bar graph shows the occupations of the locals and workers in the village.

Plantation work is the most common and prevalent occupation within the Phraek Takhro Village. Among the local population, mostly men were observed going to work on the plantations while women stayed at home and tended to the house and children. In regards to the migrant workers, both men and women work on the plantations. This was further supported during our interviews when we inquired about the occupation of each interviewees, and (as seen by Figure 8) found that 82% of our sample population were plantation workers.

[Based on observational research, migrant plantation workers tend to engage in more malaria prevention activities than the Thai locals as they are actively practicing methods that do not complicate their everyday lives.]

Conclusions and Recommendations

The prevalence of malaria in Prachuap Khiri Khan requires a comprehensive approach to build a more resilient community. The perception of malaria being considered as a normal or common disease by a significant portion of the population underscores a need for heightened awareness and education as most locals and workers do not utilize many prevention methods since they accept the mosquitos as part of their living environment. All education provided on the disease's knowledge is distributed through the children at school and health clinics in the village.

The inefficiency of current malaria prevention methods drives the need for redesigned techniques that are proven to be sustainable, are suitable for the villagers' needs, and accommodate the villagers' preference for natural products. Our research revealed that urgent attention is required to assist this population in reducing malaria through the introduction of new malaria prevention methods.

The insufficient and limited information distribution throughout the village coupled with ineffective prevention measures have contributed to the increased need for improved prevention strategies. With children being the primary recipient of malaria-related information, and the school the source of natural products, outreach via communication must be extended to a wider community. The situation is further complicated by the long distance between residences and hospitals, making access to medical resources difficult.

To address these challenges, we proposed the Raks Thai Foundation host bi-weekly workshops after customary community gatherings on Sundays. This workshop includes making natural products in the form of repellents using resources such as citronella and other native herbs locally grown and maintained at the school. We would like to highlight the usage of banana leaves and reusable bottles as packaging to maintain sustainability. This proposal promotes the collaboration of multiple stakeholders, such as the Border Police School and the malaria volunteers in the area. This approach ensures information is distributed to all audience members and is spread universally across the village. Community members who attend will receive a kit to create the repellent, larger bed nets as requested, and further information on malaria prevention, symptoms, and treatment. We hope that our collaboration with the herbal medicine expert will manufacture additional mosquito repellent products such as essential oil moth balls and adhesive repellent patches in the future. We recommend the Raks Thai Foundation continues researching these products to implement into the workshops.

A flyer and infographic were created to promote the bi-weekly workshops, ensuring the spread of malaria-related information to every village member. Informative floutlining the necessary ingredients for crafting natural citronella mosquito repellent, as per the guidance from the Border Police School, will be handed out during the workshop, as depicted in Figure 5. Similarly, an infographic detailing natural mosquito repellent patches and home-based prevention techniques using locally sourced herbs, as advised by the herb medicine expert, are illustrated in Figure 6 and Figure 7. The advertisement encompassing information on all-natural products, providing a comprehensive overview of the workshop and recommended methods, can be found in Figure 4.

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Our malaria workshop encompasses sustainable prevention methods that we would like to make available to the Phraek Takhro community. Through the distribution of homemade mosquito repellent kits, essential oil moth balls, and adhesive repellent patches, the community will have access to convenient and natural prevention methods.

To accommodate the request for natural prevention methods, we intend to use herbs such as citronella, bitter bush, rosemary, and basil. All of these herbs have been proven effective as mosquito repellents and they do not contain the harsh chemicals that cause allergic reactions and skin irritation. The natural scents of these repellents mean there are no harsh chemical odors, addressing a complaint from locals.

To promote sustainability, the components of the kit will be packaged in banana leaves and reusable bottles. The repellent patch will be made from pineapple pulp that is locally sourced from the village's plantations. It was essential that resources are available to the locals to ensure they do not face shortages of supplies. Additionally, the moth balls are reusable since villagers simply have to soak them in essential oils to repel mosquitos.

All of the prevention methods included in this workshop have been tailored to the lifestyles of locals and migrant plantation workers. The natural qualities of the methods align with the locals' preferences, and the accessibility of the products makes them convenient for local use. By addressing the natural preferences of locals, the sustainability of products, and the suitability to the target population, we can warrant the longevity and utilization of our proposed methods.



Figure 9. Example of a flyer distributed to educate village members about natural, sustainable prevention methods that will be implemented at the bi-weekly workshops.

Recommended Products



Figure 10. Infographic describing the ingredients essential to making natural citronella mosquito repellent as described by the Ban Phraek Takhro Border Patrol Police School.



Figure 11. Infographic advertising the usage of natural mosquito repellent patches as described

by a medicinal herb malaria specialist.



Figure 12. Infographic advertising an at-home prevention method utilizing locally grown herbs

recommended by medicinal herb specialist

Appendix A - Semi-Structured Interview Verbal Consent

You are being invited to participate in an in-person interview at XX location. This interview will take approximately 30 minutes in order to gather data as part of our research project: Investigating Malaria Outbreaks in Prchuap Khiri Khan. We will be partnering with the Raks Thai Foundation to investigate the malaria outbreaks in rubber plantations located in Phraek Takhro. Malaria is a major public health issue in Thailand, with the Ministry of Public Health actively working on the National Malaria Elimination Strategy to eradicate the disease by 2026. Through raising awareness, understanding the target population, and recommending strategies, the goal is to assist in the elimination of malaria in Thailand. Working alongside the Raks Thai Foundation, strategies to eliminate malaria in Prachuab Kiri Khan will be investigated and implemented. The information gathered during this study will be published and all participants will remain anonymous. You have the right to ask any questions about the topics discussed before, during, or after your interview. Your participation is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the interview any time they see fit. All of the data collected will be kept in a password-protected file. We appreciate your participation and thank you for your cooperation.



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ภาควิชาเคมี คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330

วันที่ 16 มกราคม 2567

เรื่อง ขออนุญาตสัมภาษณ์เพื่อเก็บข้อมูลประกอบการทำโครงงานวิจัย

เรียน นายแพทย์สาธารณสุข จังหวัดประจวบคีรีขันธ์

สิ่งที่ส่งมาด้วย 1. Team profile

2. Project description

ด้วยหลักสูตรวิทยาศาสตรบัณฑิต สาขาวิชาเคมีประยุกต์ (หลักสูตรนานาชาติ) ได้จัดการเรียนการสอน รายวิชา 2302307 INTERACTIVE SCIENCE AND SOCIAL PROJECTS (โครงงานวิทยาศาสตร์และสังคมแบบ ปฏิสัมพันธ์) เป็นรายวิชาบังคับของนิสิตระดับปริญญาบัณฑิต ชั้นปีที่ 3 ประจำปีการศึกษา 2566

ในการนี้ นิสิตกลุ่ม IQP-ISSP2 และมูลนิธิรักษ์ไทย ได้ร่วมกันจัดทำ "โครงงานศึกษาแนวทางในการ ควบคุมและกำจัดโรคไข้มาลาเรียในคนงานสวนยางตะเข็บชายแดนของจังหวัดประจวบคีรีขันธ์" จึงขอ อนุญาต เข้าพบหัวหน้ากลุ่มงานควบคุมโรค เพื่อสัมภาษณ์และเก็บข้อมูลประกอบการทำโครงงานวิจัย **ในวันที่ 26** มกราคม 2567 เวลา 09.30-10.30 น. ณ สำนักงานสาธารณสุขจังหวัดประจวบคีรีขันธ์ อำเภอเมือง จังหวัด ประจวบคีรีขันธ์

โอกาสนี้ คณะผู้วิจัยขออนุญาตเข้าพบผู้อำนวยการโรงพยาบาลส่งเสริมสุขภาพตำบลบ้านแพรกตะคร้อ ในวันที่ 27 มกราคม 2567 เวลา 10.30-11.30 น. ณ โรงพยาบาลส่งเสริมสุขภาพตำบลบ้านแพรกตะคร้อ ตำบลบึงนคร จังหวัดประจวบคีรีขันธ์ เพื่อขอความรู้เพิ่มเติมเกี่ยวกับสถานการณ์การระบาดของโรคไข้มาลาเรีย ในแนวตะเข็บชายแดนของจังหวัดประจวบคีรีขันธ์ในปัจจุบันด้วย

จึงเรียนมาเพื่อโปรดพิจารณาให้ความอนุเคราะห์ จักขอบพระคุณยิ่ง

7835

(ศาสตราจารย์ ดร.วรวีร์ โฮเว่น) หัวหน้าภาควิชาเคมี



ที่ อว 64.16.2.02/0156/2567

ภาควิชาเคมี คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330

วันที่ 16 มกราคม 2567

เรื่อง ขออนุญาตสัมภาษณ์เพื่อเก็บข้อมูลประกอบการทำโครงงานวิจัย

เรียน ผู้อำนวยการสำนักงานป้องกันควบคุมโรคที่ 5 จังหวัดราชบุรี

สิ่งที่ส่งมาด้วย 1. Team profile 2. Project description

2. Hoject description

ด้วยหลักสูตรวิทยาศาสตรบัณฑิต สาขาวิชาเคมีประยุกต์ (หลักสูตรนานาชาติ) ได้จัดการเรียนการสอน รายวิชา 2302307 INTERACTIVE SCIENCE AND SOCIAL PROJECTS (โครงงานวิทยาศาสตร์และสังคมแบบ ปฏิสัมพันธ์) เป็นรายวิชาบังคับของนิสิตระดับปริญญาบัณฑิต ชั้นปีที่ 3 ประจำปีการศึกษา 2566

ในการนี้ นิสิตกลุ่ม IQP-ISSP2 และมูลนิธิรักษ์ไทย ได้ร่วมกันจัดทำ "โครงงานศึกษาแนวทางในการ ควบคุมและกำจัดโรคไข้มาลาเรียในคนงานสวนยางตะเข็บชายแดนของจังหวัดประจวบคีรีขันธ์" จึงขอ อนุญาต เข้าพบหัวหน้าศูนย์ควบคุมโรคติดต่อนำโดยแมลงที่ 5.3 จังหวัดประจวบคีรีขันธ์ เพื่อสัมภาษณ์และเก็บข้อมูล ประกอบการทำโครงงานวิจัย ในวันที่ 26 มกราคม 2567 เวลา 11.00-12.00 น. ณ ศูนย์ควบคุมโรคติดต่อ นำโดยแมลงที่ 5.3 จังหวัดประจวบคีรีขันธ์ อำเภอเมือง จังหวัดประจวบคีรีขันธ์

จึงเรียนมาเพื่อโปรดพิจารณาให้ความอนุเคราะห์ จักขอบพระคุณยิ่ง

2575

(ศาสตราจารย์ ดร.วรวีร์ โฮเว่น) หัวหน้าภาควิชาเคมี



ที่ อว 64.16.2.02/0157/2567

ภาควิชาเคมี คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330

วันที่ 16 มกราคม 2567

เรื่อง ขออนุญาตสัมภาษณ์เพื่อเก็บข้อมูลประกอบการทำโครงงานวิจัย

เรียน นายกองค์การบริหารส่วนตำบลบึงนคร

สิ่งที่ส่งมาด้วย 1. Team profile

2. Project description

ด้วยหลักสูตรวิทยาศาสตรบัณฑิต สาขาวิชาเคมีประยุกต์ (หลักสูตรนานาชาติ) ได้จัดการเรียนการสอน รายวิชา 2302307 INTERACTIVE SCIENCE AND SOCIAL PROJECTS (โครงงานวิทยาศาสตร์และสังคมแบบ ปฏิสัมพันธ์) เป็นรายวิชาบังคับของนิสิตระดับปริญญาบัณฑิต ชั้นปีที่ 3 ประจำปีการศึกษา 2566

ในการนี้ นิสิตกลุ่ม IQP-ISSP2 และมูลนิธิรักษ์ไทย ได้ร่วมกันจัดทำ "โครงงานศึกษาแนวทางในการ ควบคุมและกำจัดโรคไข้มาลาเรียในคนงานสวนยางตะเข็บชายแดนของจังหวัดประจวบคีรีขันธ์" จึงขอ อนุญาต เข้าพบท่านนายกองค์การบริหารส่วนตำบลบึงนคร เพื่อสัมภาษณ์และเก็บข้อมูลประกอบการทำโครงงานวิจัย ในวันที่ 26 มกราคม 2567 เวลา 14.30-15.30 น. ณ องค์การบริหารส่วนตำบลบึงนคร จังหวัด ประจวบคีรีขันธ์

จึงเรียนมาเพื่อโปรดพิจารณาให้ความอนุเคราะห์ จักขอบพระคุณยิ่ง

(ศาสตราจารย์ ดร.วรวีร์ โฮเว่น) หัวหน้าภาควิชาเคมี



ที่ อว 64.16.2.02/0158/2567

ภาควิชาเคมี คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330

วันที่ 16 มกราคม 2567

เรื่อง ขออนุญาตสัมภาษณ์เพื่อเก็บข้อมูลประกอบการทำโครงงานวิจัย

เรียน ผู้ใหญ่บ้าน หมู่11 บ้านแพรกตะคร้อ

สิ่งที่ส่งมาด้วย 1. Team profile

2. Project description

ด้วยหลักสูตรวิทยาศาสตรบัณฑิต สาขาวิชาเคมีประยุกต์ (หลักสูตรนานาชาติ) ได้จัดการเรียนการสอน รายวิชา 2302307 INTERACTIVE SCIENCE AND SOCIAL PROJECTS (โครงงานวิทยาศาสตร์และสังคมแบบ ปฏิสัมพันธ์) เป็นรายวิชาบังคับของนิสิตระดับปริญญาบัณฑิต ชั้นปีที่ 3 ประจำปีการศึกษา 2566

ในการนี้ นิสิตกลุ่ม IQP-ISSP2 และมูลนิธิรักษ์ไทย ได้ร่วมกันจัดทำ "โครงงานศึกษาแนวทางในการ ควบคุมและกำจัดโรคไข้มาลาเรียในคนงานสวนยางตะเข็บชายแดนของจังหวัดประจวบคีรีขันธ์" จึงขออนุญาต เข้าพบผู้ใหญ่บ้าน คณะกรรมการหมู่บ้าน และอาสาสมัครสาธารณสุข (อ.ส.ม.มาลาเรีย) หมู่ 11 บ้านแพรกตะคร้อ เพื่อชี้แจงรายละเอียดโครงงานและผลที่คาดหวัง ในวันที่ 27 มกราคม 2567 เวลา 10.30-11.30 น. ณ โรงพยาบาลส่งเสริมสุขภาพตำบลบ้านแพรกตะคร้อ ต.บึงนคร อ.หัวหิน จ.ประจวบคีรีขันธ์

โอกาสนี้ คณะผู้วิจัยขอความอนุเคราะห์ศึกษาดูงานในส่วนการควบคุมและกำจัดโรคไข้มาลาเรียในพื้นที่ บ้านแพรกตะคร้อระหว่างเดือนมกราคมและกุมภาพันธ์ 2566 ด้วย

จึงเรียนมาเพื่อโปรดพิจารณาให้ความอนุเคราะห์ จักขอบพระคุณยิ่ง

(ศาสตราจารย์ ดร.วรวีร์ โฮเว่น) หัวหน้าภาควิชาเคมี



โครงงานวิทยาศาสตร์และสังคมแบบปฏิสัมพันธ์ เรื่อง โครงงานศึกษาแนวทางควบคุมและกำจัดโรคไข้มาลาเรียในคนงานสวนยางตะเข็บชายแดน จังหวัดประจวบคีรีขันธ์

หลักการและเหตุผล

โรคไข้มาลาเรียเป็นโรคติดต่อที่สร้างปัญหาทางเศรษฐกิจและสังคมให้แก่ประเทศไทยมาเป็นเวลานาน ในปี พ.ศ. 2565 มีผู้ติดเซื้อในประเทศ 16,684 คน ประเทศไทยโดยกระทรวงสาธารณะสุขตั้งยุทธศาสตร์และ แผนปฏิบัติการกำจัดโรคไข้มาลาเรียให้หมดสิ้นภายในปีพ.ศ. 2569 ผลการดำเนินงานในปัจจุบันมีจังหวัดที่ปลอด โรคไข้มาลาเรียแล้วทั้งสิ้น 37 จังหวัด พื้นที่ที่พบการระบาดชุกคือแนวตะเข็บชายแดนที่มีการเข้าถึงได้ยาก ผู้ติด เชื้อส่วนใหญ่คือแรงงานอพยพจากประเทศเพื่อนบ้านซึ่งย้ายถิ่นฐานบ่อยครั้งทำให้การติดตามและการรักษา ผู้ติดเชื้อโรคไข้มาลาเรียไม่สัมฤทธิ์ผล คณะผู้วิจัยและมูลนิธิรักษ์ไทยต้องการมีส่วนร่วมและช่วยขับเคลื่อนบริการ กำจัดโรคไข้มาลาเรียตามแนวตะเข็บชายแดนเพื่อผลักดันให้แผนยุทธศาสตร์ของประเทศเป็นไปตามเป้าหมาย

โครงงานนี้เป็นกิจกรรมร่วมระหว่างหลักสูตรวิทยาศาสตร์บัณฑิต สาขาวิชาเคมีประยุกต์ (หลักสูตร นานาชาติ) ภาควิชาเคมี จุฬาลงกรณ์มหาวิทยาลัย และ Worcester Polytechnic Institute เมือง Worcester รัฐ Massachusetts ประเทศสหรัฐอเมริกา

วัตถุประสงค์

- เรียนรู้กระบวนการแพรโรคไข้มาลาเรียและการเข้าถึงการรักษาของโรคไข้มาลาเรียในกลุ่มคนงานสวนยาง ของจังหวัดประจวบคีรีขันธ์
- 2. เรียนรู้มาตราการและวิธีการกำจัดการแพร่เชื้อมาลาเรียในพื้นที่จังหวัดประจวบคีรีขันธ์
- 3. เรียนรู้แนวทางการป้องกันโรคไข้มาลาเรียและวิถีชีวิตของคนงานสวนยาง
- นำข้อมูลมาบูรณาการเพื่อปรับกลยุทธ์และมาตรการในการค้นหา สกัดกั้น และป้องกันการแพร่เชื้อ ไข้มาลาเรียในคนงานสวนยาง

Appendix B - Rubber Plantation Workers

Questions regarding the worker's daily routine.

- 1. What does a typical day look like?
- 2. When does your day start and finish?
- 3. Are there any preventative measures for protocol? (specific types of clothes, sprays, etc.)

Current protocols and treatments for malaria.

- 1. What happens when someone gets infected by malaria?
- 2. What types of treatment are available?
- 3. Where do you go for treatment?
- 4. Are there any follow-ups?

Opinions on why malaria outbreak persists.

- 1. Why do you think malaria infection rates are still high within the plantation?
- 2. What do you think should be done or implemented in order to lower the infection rate?

Appendix C - Regional Malaria Prevention

Volunteers/Workers

- 1. What activities do you currently partake in regarding malaria?
- 2. What are some past experiences you have had with malaria outbreaks/cases?
- 3. What preventative methods do you promote at the clinic?
- 4. What recommendations do you have for the local population?
- 5. Based on your experience, what are the most effective treatments for malaria?
- 6. What do you believe is the most effective prevention tool?
- 7. What changes should be made to the rubber plantation to reduce infection among the workers?
- 8. How do you gain locals' trust regarding health information? How would we be able to encourage people to interact with malaria education?

Appendix D - Locals

- 1. Can you describe your daily activities and routine in Prachuap Khiri Khan?
- 2. Are you familiar with malaria, its symptoms, and its transmission?
- 3. Have you or anyone you know ever been diagnosed with malaria?
- 4. What preventive measures, if any, do you take to protect yourself and your family from malaria?
- 5. Are there any challenges or obstacles hindering community participation in malaria elimination efforts?
- 6. Have you faced any challenges in accessing healthcare services for malaria?
- 7. If you are aware of malaria elimination programs, what is your opinion on their effectiveness?
- 8. What changes or improvements would you like to see in the community's approach to malaria elimination?

Appendix E - Head of Vector Borne Disease

Prevention and Control

- 1. In your opinion, what is the main cause of the increase in malaria in rubber plantations across the border?
- How are you currently utilizing LLIN/ITN for malaria prevention/How are LLIN/ITN distributed to local populations?
- 3. Have you noticed that local populations prefer to use malaria prevention methods that are chemical-free?
- 4. What are some specific initiatives focused on promoting malaria prevention methods without the use of chemicals?
- 5. What measures are in place to assess the effectiveness of LLIN/ITN and chemical free prevention methods?
- 6. What improvements are being considered to enhance current prevention methods?
- 7. How does your unit collaborate with local communities to promise non-chemical prevention methods?
- 8. What community engagement strategies are used to gather feedback regarding the effectiveness of these strategies?

Appendix F - Head of Disease Prevention and Control

- 1. In your opinion, what is the best method to prevent malaria? What is the best method that does not use chemicals?
- 2. What system do you use to detect and track active cases?
- 3. What type of individuals are a part of your data collection pool?
- 4. Do you notice a lack of reported cases from certain regions?
- 5. What have you identified to be the most successful method of identifying positive cases?
- 6. How do you reach individuals to collect data? How do you ensure they will follow up?
- 7. How do you utilize your data to make changes with current malaria prevention methods?
- 8. Based on data collected, what are your suggestions and viewpoint to combat malaria outbreaks?
- 9. To what extent do you collaborate with other organizations or communities to identify malaria prevention methods?
- 10. If yes, what organizations?
- 11. What data trends collected within the last year do you think are the most concerning in terms of malaria outbreaks?

Appendix G - Subdistrict Administrative Organization of Bueng Nakhon: President of the Subdistrict Administrative Organization

- 1. What language barriers may we encounter when conducting interviews?
- 2. How will individuals be selected for interviews?
- 3. How would surveys be collected and distributed?
- 4. Are group interviews more beneficial than one on one?
- 5. What are some methods currently being used in the village?
Appendix H - Village Headman

- 1. Can you provide a brief overview and responsibilities as a Village Headman?
- 2. How do those responsibilities fall under malaria prevention and education?
- 3. What malaria clinics/prevention techniques are accessible within the village?
- 4. How do you gain locals'/migrant workers' trust regarding health information?
- 5. How would we be able to encourage people to interact with malaria education?

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