# THE DEVELOPMENT OF A TOOL TO ASSESS COMMUNITY CAPACITY

# OF SUSTAINABLE COMMUNITY-BASED DENGUE PREVENTION

# AND CONTROL: A STUDY IN SOUTHERN THAILAND

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A Dissertation Submitted in Partial Fulfillment of the Requirements

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การพัฒนาเครื่องมือเพื่อประเมินความสามารถในการป้องกันและควบคุมโรคไข้เลือดออก
ที่ใช้ชุมชนเป็นฐานอย่างยั่งยืน: กรณีศึกษาชุมชนภาคใต้ของประเทศไทย

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จรวย สุวรรณบำรุง: การพัฒนาเครื่องมือเพื่อประเมินความสามารถในการป้องกันและควบคุมโรคไข้เลือดออกที่ใช้ชุมชนเป็นฐานอย่างยั่งยืน: กรณีศึกษาชุมชนภาคใต้ของประเทศไทย. (THE DEVELOPMENT OF A TOOL TO ASSESS COMMUNITY CAPACITY OF SUSTAINABLE COMMUNITY-BASED DENGUE PREVENTION AND CONTROL: A STUDY IN SOUTHERN THAILAND) อ. ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ. ดร. รัตนา สำโรงทอง, อ. ที่ปรึกษาวิทยานิพนธ์ร่วม: รศ. ดร. เพชรน้อย สิงห์ช่างชัย, รศ. ดร. ลือชัย ศรีเงินยวง, 216  หน้า

ความยั่งยืนของการใช้ชุมชนเป็นฐานในการป้องกันและควบคุมโรคไข้เลือดออก จำเป็นต้องมีเครื่องมือประเมินที่มีความเฉพาะ แต่ในประเทศไทยมีการศึกษาเกี่ยวกับเครื่องมือที่ใช้ประเมินความสามารถในการป้องกันและควบคุมโรคไข้เลือดออกของชุมชนน้อยมาก ดังนั้นการศึกษาครั้งนี้จึงมีวัตถุประสงค์เพื่อพัฒนา ทดสอบ และนำเครื่องมือไปประยุกต์ใช้เพื่อกำหนดแนวทางในการประเมินความสามารถในการป้องกันและควบคุมโรคไข้เลือดออกที่ใช้ชุมชนเป็นฐานอย่างยั่งยืน

ดำเนินการศึกษาในพื้นที่ภาคใต้ของประเทศไทยโดยแบ่งเป็น 3 ระยะ คือ  ระยะที่ 1 ค้นหาความหมายและองค์ประกอบความสามารถของชุมชน โดยใช้วิธีการเก็บรวบรวมข้อมูลเชิงคุณภาพ ประกอบด้วยการทบทวนวรรณกรรม การสัมภาษณ์เชิงลึกกลุ่มผู้นำชุมชน 60 คน และสนทนากลุ่ม จำนวน 8 กลุ่มที่ไม่ใช่ผู้นำชุมชน 60 คน จาก 4 ตำบลของ 4 จังหวัด วิเคราะห์เนื้อหาและตรวจสอบจากผู้ทรงคุณวุฒิ 3 ท่าน พบว่ามี 10 องค์ประกอบเบื้องต้นของความสามารถ ระยะที่ 2 ดำเนินการพัฒนาข้อคำถามและทดสอบเครื่องมือ โดยพัฒนาข้อคำถามที่แบ่งออกเป็นกลุ่มผู้นำชุมชน และกลุ่มที่ไม่ใช่ผู้นำชุมชน ตรวจสอบความตรงเชิงเนื้อหาโดยผู้ทรงคุณวุฒิ 7 ท่าน ค่าดัชนีความตรงเนื้อหาของกลุ่มผู้นำชุมชน 0.90 และกลุ่มที่ไม่ใช่ผู้นำชุมชน 0.91 กำหนดข้อคำถามเป็นมาตรวัดอัตราส่วน 5 ระดับ ทดสอบความเที่ยงข้อคำถามกับกลุ่มผู้นำชุมชน 60 คน โดยค่าสัมประสิทธิ์อัลฟาโดยรวม 0.98 และกลุ่มที่ไม่ใช่ผู้นำชุมชน 60 คน มีค่าสัมประสิทธิ์อัลฟาโดยรวม 0.97 ปรับปรุงและตัดข้อคำถามในกลุ่มผู้นำชุมชนเหลือ 182 ข้อ และกลุ่มที่ไม่ใช่ผู้นำชุมชน เหลือ 167 ข้อ ทดสอบความตรงเชิงโครงสร้างด้วยการวิเคราะห์องค์ประกอบกับกลุ่มผู้นำชุมชน 964 คนและกลุ่มที่ไม่ใช่ผู้นำชุมชน 1,248 คนจาก 8 ตำบลของ 8 จังหวัด กำหนดค่าน้ำหนักองค์ประกอบมากกว่า 0.5 ค่าไอเกนมากกว่า 2 โดยองค์ประกอบที่ได้ทั้งหมดสามารถอธิบายความแปรปรวนความสามารถในกลุ่มผู้นำชุมชนได้ร้อยละ  57.58  และกลุ่มที่ไม่ใช่ผู้นำชุมชนร้อยละ 57.11   สุดท้าย ระยะที่ 3  ดำเนินการนำเครื่องมือไปประเมินความสามารถของชุมชนที่มีปัญหาไข้เลือดออกจำนวน 1 ชุมชน เพื่อกำหนดแนวทางในการใช้เครื่องมือไปประยุกต์ใช้ โดยเน้นการมีส่วนร่วมของชุมชน

ผลการศึกษาพบว่าเครื่องมือประเมินความสามารถในการป้องกันและควบคุมโรคไข้เลือดออกที่ใช้ชุมชนเป็นฐานอย่างยั่งยืน (DCCAT) มี 2 ชุด คือ กลุ่มผู้นำชุมชนมี 14 องค์ประกอบความสามารถ (115 ข้อ) ประกอบด้วย  1)ด้านการจัดการสถานการณ์วิกฤต (9 ข้อ)  2)ด้านภาวะผู้นำส่วนบุคคล (12 ข้อ)  3)ด้านผู้ทำหน้าที่ด้านสาธารณสุข (8 ข้อ)  4)ด้านการประเมินความต้องการ (8 ข้อ)  5)ความรู้สึกร่วมกับชุมชน (11 ข้อ)  6)ด้านเครือข่ายของกลุ่มผู้นำชุมชน (11 ข้อ)  7)ด้านการสื่อสารข้อมูล (10 ข้อ)  8)ด้านภาวะผู้นำของคนในชุมชน (8 ข้อ)  9)ด้านผู้นำศาสนา (9 ข้อ)  10)ด้านเครือข่ายผู้นำชุมชนกับชุมชน (7 ข้อ)  11)ด้านการจัดการทรัพยากร (4 ข้อ)  12)ด้านกลุ่มแกนนำหลัก (6 ข้อ)  13)ด้านการมีส่วนร่วม (6 ข้อ)  และ 14)ด้านการทำกิจกรรมอย่างต่อเนื่อง (6 ข้อ)  สำหรับกลุ่มที่ไม่ใช่ผู้นำชุมชนมี 11 องค์ประกอบความสามารถ (83 ข้อ)  ประกอบด้วย 1)ด้านการจัดการสถานการณ์วิกฤต (13 ข้อ) 2)ด้านภาวะผู้นำส่วนบุคคล (8 ข้อ)  3)ด้านผู้นำศาสนา (10 ข้อ)  4)ด้านภาวะผู้นำของชุมชน (8 ข้อ)  5)ด้านผู้ทำหน้าที่ด้านสาธารณสุข (6 ข้อ)  6)ด้านความรู้สึกร่วมกับชุมชน (8 ข้อ)  7)ด้านการสื่อสารข้อมูล (7 ข้อ)  8)ด้านการทำกิจกรรมอย่างต่อเนื่อง (6 ข้อ)  9)ด้านกลุ่มแกนนำหลัก (7 ข้อ)  10)ด้านการจัดการทรัพยากร (5 ข้อ)  และ 11)ด้านการประเมินความต้องการ (5 ข้อ)  แนวทางในการนำเครื่องมือไปใช้ในชุมชนมี 5 ขั้นตอน คือ การเตรียมชุมชน การประเมินความสามารถ การประชุมร่วมกันของคนในชุมชน การวางแผนและการดำเนินการ และการประเมินความสามารถซ้ำ

ทั้งนี้การนำเครื่องมือไปใช้ต้องมีกลุ่มแกนนำโรคไข้เลือดออกเป็นทีมหลักในการดำเนินการ  และมีทีมสนับสนุนที่ประกอบด้วยเจ้าหน้าที่สาธารณสุข ผู้วิจัย และเจ้าหน้าที่ขององค์การบริหารส่วนท้องถิ่น  กลุ่มผู้เกี่ยวข้องในชุมชนควรใช้เครื่องมือประเมินความสามารถบนพื้นฐานความเข้าใจแนวคิดการสร้างสามารถของชุมชน และวัตถุประสงค์ของการประเมินความสามารถ ตลอดถึงบริบทของชุมชน  กรณีชุมชนที่มีปัญหาโรคไข้เลือดออกต้องการสร้างความสามารถในการป้องกันและควบคุมโรคไข้เลือดออกของชุมชน จำเป็นอย่างยิ่งที่ต้องทำการประเมินก่อนและหลังการดำเนินการ หรือทำการประเมินเป็นระยะๆ

สาขาวิชาวิจัยเพื่อการพัฒนาสุขภาพ          ลายมือชื่อนิสิต..................................................................
ปีการศึกษา 2551                              ลายมือชื่อ อ. ที่ปรึกษาวิทยานิพนธ์หลัก...............................
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                                              ลายมือชื่อ อ. ที่ปรึกษาวิทยานิพนธ์ร่วม...............................

# # 4889697020: RESEARCH FOR HEALTH DEVELOPMENT
KEYWORDS: COMMUNITY CAPACITY TOOL/ SUSTAINABLE/ DENGUE PREVENTION AND CONTROL/ SOUNTHERN  THAILAND

CHARUAI SUWANBAMRUNG: THE DEVELOPMENT OF A TOOL TO ASSESS COMMUNITY CAPACITY OF SUSTAINABLE COMMUNITY-BASED DENGUE PREVENTION AND CONTROL: A STUDY IN SOUTHERN THAILAND. ADVISOR : ASST. PROF. RATANA SOMRONGTHONG, Ph.D., CO-ADVISOR: ASSOC. PROF. PHECHNOY SINGCHUNGCHAI, Ph.D., ASSOC. PROF. LUECHAI SRINGERNYUANG, Ph.D., 216 pp.

Addressing the sustainability of community-based dengue prevention and control needs to require specific assessment tool, there are few studies have examined the dengue community capacity-assessment tools in Thai communities. The objectives of this study were development and testing tool and application of a new tool for defining practice guideline to assess community capacity of sustainable community-based dengue prevention and control.

Conducting on Southern Thailand, there were three phases: The first phase was defining meaning and themes of dengue community capacity domains by qualitative method, 10 initial dengue community domains were identified, by means of the three experts reviews with content analysis from literature reviews, in-depth interviews with 60 leaders, and 8 focus group discussions with 60 non–leaders, in 4 sub-districts of the 4 provinces. The second phase was developing items and testing tool phase. It was divided into dengue community capacity for leaders and non-leaders. Content validity was verified by a seven-expert review panel, which arrived at a total Content Validity Index (CVI) of leaders (0.90) and non-leaders (0.91). The items were measured with a 5-point rating scale. During the pilot-testing, the Cronbach alpha reliability coefficient for the leaders was 0.98 and the non-leaders it was 0.97. Items were revised leaders items 182 and non-leaders items 167. The testing tools were administered to 964 leaders and 1,248 non-leaders, throughout 8 sub-districts of the 8 provinces. Construct validity was analyzed by Exploratory Factor Analysis (EFA).  Factor loading was 0.5, the Eigenvalue was greater than 2, and all the domains together explained in leaders 57.58% and non-leaders 57.11 % of the variance. Finally, the third phase was the application of using tool used community participatory approach and conducted on a sub-district which a high incidence of dengue.

The findings were Dengue Community Capacity-Assessment Tool (DCCAT) of leaders and non-leaders. Assessment tool of leaders was 115 items within 14 domains i.e. 1)critical situation management (9-item), 2)personal leadership (12-item), 3)health care provider capacity (8-item), 4)needs assessment (8-tiem), 5)senses of community (11-item), 6)leader group networking (11-item), 7)communication of dengue information (10-item), 8)community leadership (8-item), 9)religious leader capacity (9-item), 10)leader group and community networking (7-item), 11)resources mobilization (4-item), 12)dengue working group (6-item), 13)community participation  (6-item), and 14)continuing activities (6-item). Assessment tool of non-leaders was 11 domains (83-item) i.e. 1)critical situation management (13-item), 2)personal leadership (8-item), 3)religious leader capacity  (10-item), 4)community leadership (8-item), 5)health care provider capacity  (6-item), 6)senses of community (8-item), 7)communication of dengue information (7-item), 8)continuing activities (6-item), 9)dengue working group (7-item), 10)resources mobilization (5-item), and 11)needs assessment (5-item). The practical guideline of DCCAT consisted of five steps: 1)community preparation, 2)assessment, 3)community consensus, 4)strategies plan and implementation and 5)re-assessment.

The Dengue Leader Group (DLG) was a key team which conducted on the application of the tool. Health care workers, researchers, and local administrative organization officers served as a support team. All stakeholders in community should use the new tool based on understanding of the dengue community capacity concept, measurement objectives and outcomes, and context of community. If the communities need develop dengue community capacity building, the designed pre-post intervention assessments or serial assessments are essential.

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|---|---|
| Field of Study: Research for Health Development | Student's Signature…………………… |
| Academic Year: 2008 | Advisor's Signature…………………… |
| | Co-Advisor's Signature………………... |
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# ACKNOWLEDGEMENTS

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| *Ae.* | *Aedes* |
| **BI** | Breteau Index |
| **CFA** | Confirmatory Factor Analysis |
| **CI** | Container Index |
| **CP** | Community Participation |
| **CVI** | Content Validity Index |
| **CWG** | Community Working Group |
| **DCCAT** | Dengue Community Capacity-Assessment Tool |
| **DCCAT of Leaders** | Dengue Community Capacity-Assessment Tool of Leaders |
| **DCCAT of Non-leaders** | Dengue Community Capacity-Assessment Tool of Non-leaders |
| **DEN** | Dengue virus |
| **DF** | Dengue Fever |
| **DHF** | Dengue Heamorrhagic Fever |
| **DLG** | Dengue Leader Group |
| **DSS** | Dengue Shock Syndrome |
| **EFA** | Exploratory Factor Analysis |
| **EIPs** | Extrinsic Incubation Periods |
| **FGDs** | Focus Group Discussions |
| **HI** | House Index |
| **IDIs** | In-Depth Interviews |
| **IMCI** | Integrated Management of Childhood Illness |
| **KMO** | Kaisor-Mayer-Olkin |
| **L** | Leaders Domain |
| **LAO** | Local Administrative Organization |
| **NGO** | Non-Government Organization |
| **NL** | Non-leaders Domain |
| **PCA** | Principle Component Analysis |
| **PHC** | Public Health Care |
| **VHV** | Village Health Volunteer |
| **VHVs** | Village Health Volunteers |
| **ULV** | Ultra Low Volume |
| **WHO** | World Health Organization |

# CHAPTER I

# INTRODUCTION

## Background

Dengue, which is considered community problem, is actually several diseases of varying severity: uncomplicated dengue fever (DF), dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) [1-4]. There is no specific treatment for the infection, and preventive vaccines, while still under development, are not yet available [5, 6]. Chemical insecticide applications have been ineffective as a method for elimination of adult vectors[7, 8]. The lack of efficacy of the chemical insecticide approach has led to a policy aimed at prevention and control of epidemic dengue [9-11]. Environmental changes, particularly those related to climate, directly affect the incidence and prevalence of most vector-borne diseases [12, 13]. Moreover, social factors, such as lifestyles and population density, particularly in the case of dengue, are also important [13-16]. Consequently, dengue is viewed as a community problem requiring community solution including an understanding of its epidemiology, flexible approaches, maintenance of the process of prevention and control, and the combination of health promotion approaches in order to change human behavior. The prevention and control of dengue infections in the community, community-based intervention[2, 4, 17], is the only currently available option. A new paradigm for changing its epidemiology  needs a community-based program[15, 18].  However, community-based dengue prevention and control has been generally shown to be weak [19].

In recent years, sustainability has become one of the most critical concepts of dengue prevention and control. Sustainability ensures an adaptive prevention system and continual innovation that can be integrated into ongoing operations to benefit diverse stakeholders [20]. Nevertheless, it is a continuing challenge and a major issue that must be defined according the characteristics of each specific setting [14, 21, 22]. Moreover, strategies for effective prevention and control are identified as basic adaptability of both control programs to the mosquito's changing behavior and of education programs of the public taking into account regional and local particularities as well as transdisciplinarity, community based intervention, the ability to apply lessons learned at the local level on the broach scale, and the capacity to learn from experience in order to achieve sustainability[9, 13-15, 19, 23, 24]. The ability of the community (people, groups and organizations) also is the most vital driving force for the development and maintenance of an effective and sustainable program [14].

To achieve sustainability for dengue prevention and control, community capacity building is one of the instrumental factors contributing to a healthy community outcome. Community capacity building, community capacity and community capacity domain are related. If building capacity of the community is to be undertaken, a tool for the assessment of capacity is required. From the literature reviewed, this study defines community capacity building as the process of enhancing a community's competence to define, evaluate, analyze and act on the dengue concerns of their members in that community [25-27]. Community capacity not only

includes prevention and control of communicable diseases, but also individual protection in the community. It is demonstrated in terms of community participation, community intervention, community-based approaches, and a multidisciplinary approach [28, 29]. In addition, this study proposes ten domains which have emerged from an extensive review of literature, and includes participation, leadership, community structure, needs assessment, information transfer, resource mobilization, sense of community, network partnerships, critical assessment and program management [24-26, 30-33].

The national dengue control and prevention program in Thailand has endorsed community-based control programs by encouraging residents to take responsibility for control activities in households. However, current dengue prevention and control activities have not had much impact in reducing dengue transmission at the national level. Southern Thailand is at high risk of dengue transmission because there are several factors which favor dengue incidence. A study, carried out between the years 1993 -2002 in Southern Thailand documented high incidence, partially due to more rainy days, greater total rainfall, higher average relative humidity, and warmer temperatures [34]. An important issue is that people need a better understanding of measures for the prevention and control of the disease and for continuing community participation [35-37]. According to the above studies mentioned, the high incidence of dengue in the Southern Thailand community requires a strengthening of community action by building the capacity of all affected groups in meeting the common needs.

The problem of dengue is a public problem, and as a community problem, it requires the community to solve this problem. Community capacity building can increase the community's ability to assess, define, analyze, implement and evaluate their dengue problem. It is a 'means and end concept' [38] and as a dynamic process, it must be part of the strategy for sustainability of the intervention from the beginning to the end of the outcome [24]. Nevertheless, without a means or standard for measurement, community health interventions result in increased sustainability and capacity for future problem solving. Thus, the identification and assessment of community capacity, as both process and outcome, is important to those striving to develop healthy communities. Fortunately, however, there are currently a few tools to assess capacity of the community for sustainable community-based dengue prevention and control.

To conduct appropriate community capacity building for sustainable community-based dengue prevention and control, the leaders and non-leaders in the community need to assess the capacity of the community; what are appropriate tools and how many community capacity domains there are. Although a new tool applied to assess community capacity for sustainable community-based dengue prevention and control is needed, such a tool is not currently available. Thus, the purpose of this study is to develop, test and apply a new tool designed to measure community capacity for sustainable community-based dengue prevention and control of leaders and non-leaders in the Southern Thailand community.

**Research Questions**

   1) How many domains of a tool are needed to assess community capacity of sustainable community-based dengue prevention and control of leaders and non-leaders?
   2) What are appropriate tools that can be applied in assessing community capacity of sustainable community-based dengue prevention and control?


**Research Objectives**

   1. To develop and test a new tool to assess community capacity of sustainable community-based dengue prevention and control of leaders and non-leaders.
   2. To apply this new tool to assess community capacity of sustainable community-based dengue prevention and control in community.


**Conceptual Framework**

   The conceptual framework of the study consisted of five aspects: Dengue as public and community health problem, community-based dengue prevention and control, sustainable dengue prevention and control, community capacity domains and the measurement of community capacity of sustainable dengue prevention [27, 30, 32, 39, 40].

   1. Dengue as Public and Community Health Problem
   Dengue is a critical problem as, at present, there is no specific treatment for infection or preventive vaccines which, although under development, are not yet available. Chemical insecticide applications have proven ineffective as a method of elimination for adult vectors. The lack of efficacy of the chemical insecticide approach has led to a policy aimed at the prevention and control of epidemic dengue [9, 11]. Consequently, dengue is now viewed as a community problem and thus requires a community solution consisting of such domains as creating an understanding of its epidemiology, taking flexible approaches, maintaining the process of prevention and control, and combining health promotion approaches in order to change human behavior. The prevention and control of dengue infections in the community, or community-based intervention, is now currently viewed as the only credible option [2, 17].

   2. Community-Based Dengue Prevention and Control
   A new paradigm for changing dengue's epidemiology needs a community-based program [15, 18]. However, community-based dengue prevention and control has been generally shown to be weak [19]. 'Community-based' was commonly understood to be the setting, targets, agents and resources of intervention [41] while 'dengue prevention and control' were activities to control and eliminate larval breeding sources, control of adult mosquitoes, personal protection, dengue symptom detection and outbreak prevention[2]. Then community-based dengue prevention and control, in this context, is defined as sub-district consisting of two groups for dengue prevention

and control in the community; the first group were the leaders who assumed the role as the "capacity building activities group" consisting of representative of dengue health promoters, local authority/organization networks, schools, temples, and village health volunteers. The second group were non-leaders group who acted as the "sustainable prevention and control activities group" which consisted of community members[2, 33]. Both groups had different demographic data. In addition, this community-based dengue prevention and control program continued to have a major problem with dengue and member activities for dengue prevention and control were conducted at community.

Community-based dengue prevention and control is a process by which the key stakeholders are able to become actively involved in preventing and controlling their problem with dengue. The strategies of dengue prevention and control at the sub-district level focus on vector control and transmission of infection to humans, based on the community as the setting, target, agent and resources for dengue activities [2, 41].

### 3. Sustainable Community-Based Dengue Prevention and Control

Sustainability has become one of the most critical concepts of dengue prevention and control. It is a continuing challenge and a major issue, and must be defined according to the characteristics of each specific setting [14, 22]. Community-based dengue prevention and control are human activities to control and eliminate larval breeding sources, control adult mosquitoes, provide personal protection, undertake dengue symptom detection and provide outbreak prevention[2]. It is measured by assessing the continuity of community capacity domains of dengue prevention and control behaviors as continuing evidence of implementing dengue strategies or activities, and the results of the such community-based activities as demonstrated by measurement of larval index (House Index: HI; Breteau Index: BI, and Container Index: CI) and epidemiological indices such as morbidity rate[2, 42-44].

### 4. Community Capacity Domain

In examining the domains of community capacity or the scopes of interest of community capacity, a number of researchers have attempted to develop a set of domains or characteristics of community capacity. The initial domains of community capacity that have emerged from an extensive literature review includes participation, leadership, community structure, needs assessment, information transfer, resource mobilization, sense of community, network partnerships, critical assessment, and program management [30, 32, 33, 45].

4.1 Participation is defined as a set of characteristics of participatory activities of the community for dengue prevention and control. Participatory activities of dengue prevention and control mean defining, planning, implementing and evaluating activities [27, 33, 38, 46].

4.2 Leadership is defined as characteristics of people within the community who have skill in identifying, developing, nurturing, and fostering community dengue prevention and control. In this study, effective leadership is measured by supporting, dealing with conflict, acknowledging and encouraging community members to voice their opinions, sharing leadership, bringing people with

diverse sets of skills together and   facilitating networks to build on community resources [25-27, 33, 47].

4.3 Community structure refers to the characteristic of groups of people involved in dengue prevention and control in community: 1) the capacity for delivery and building groups, and 2) the ability of the group to sustain dengue prevention and control [25, 27, 30, 33, 38, 46]. In the study community structure is defined as group of people in comunity who conducting dengue prevention and control activities.

4.4 Needs assessment in relations to this study is defined as the capacity of the community to identify the components of the problems due to dengue, potential solutions to these problems and actions by the community to resolve these problems. In this study, needs assessment capability will be measured by assessing the ability of the two groups to define and analyze the problems of prevention and control in the sub-district [25,27,30,33,38,46].

4.5 Information transfer capability is defined as the ability of a community to develop methods and channels of information about dengue within and between the people or groups in the community and outside the community. Information transfer can be measured by assessing dengue knowledge and skills based on programs such as entomology, epidemiology, ecology and sociology [14, 16, 48-50].

4.6 Resource mobilization capability is defined as the ability of the community to mobilize a variety of resources, such as local policy resources, human resources, financial resources and health resources. In this study, resource mobilization will be measured by the quantity and quality of the investment of those resources for dengue prevention and control [27, 38].

4.7 Sense of community refers to the perception of the benefit dengue intervention, shared community values, building and achieving trust with others and the community through the creation and reinforcement of a sentiment of local ownership. The sense of community can be shown in community effort in order to implement a dengue prevention and control project which can be measured by mobilizing and channeling household-level behaviors and capacities in elimination mosquito breeding sites, reducing exposure, and targeting efforts [14].

4.8 Network partnerships are defined as the relationship between groups and organizations within a community or network for building capacity of community-based dengue prevention and control. Community network partnerships are measured by the relationship between groups such as local politicians, public health units, schools, groups of parents and outside of community group [24,46].

4.9 Critical assessment is defined as the ability of the community to evaluate critical stages in developing appropriate personal and social changes in dengue intervention strategies. Critical assessment capacity is determined by measuring the ability of the community to identify and solve problems of individual and groups in the community [27, 33, 38].

4.10 Program management is defined as the ability of the community to manage dengue prevention and control activities in the sub-district area. It reviews the decisions made regarding planning, implementation, evaluation, finances, administration, and reporting and conflict resolution. Program management is measured by the clarity of the roles and responsibilities of all stakeholders who are involved in dengue prevention and control [27, 33, 38].

<u>5. Measurement of Community Capacity of Sustainable Dengue Prevention and Control</u>

Measurement is defined as the process of assigning to objects and phenomena a relative value to represent the attributes or characteristics possessed the objects or phenomena. It is of vital concern across a broad range of research contexts. We develop scales when we want to measure phenomena that we believe to exist because of our theoretical understanding of the world, but which we cannot assess directly. Measurements instrument that are collections of items combined into a composite score, and reveal levels of theoretical variables not readily observable by direct means, are often referred to as scales [51]. Then, measurement of community capacity of sustainable community-based dengue prevention and control is measured as the perceived condition of community capacity domains.

Consequently, community capacity of sustainable community-based dengue prevention and control is defined as a set of characteristics of community activities for prevention and control of dengue interventions in order to define, analyze, implement and evaluate which are continued by using community as setting, targets, agents and resources of that intervention. Assessment tools of community capacity measure the domains of community capacity, based on literature review, such as participation, leadership, community structure, needs assessment, information transfer, resource mobilization, sense of community, network partnerships, critical assessment, program management and so on [30, 32, 40, 41, 45, 52]. Then, this new tool to assess community capacity of sustainable community-based dengue prevention and control needs to explore the definition of domains. The conceptual framework of community capacity domains of the tool is shown in Figure 1.

**Figure 1** Conceptual framework of domains of new tool to assess community capacity of sustainable community-based dengue prevention and control
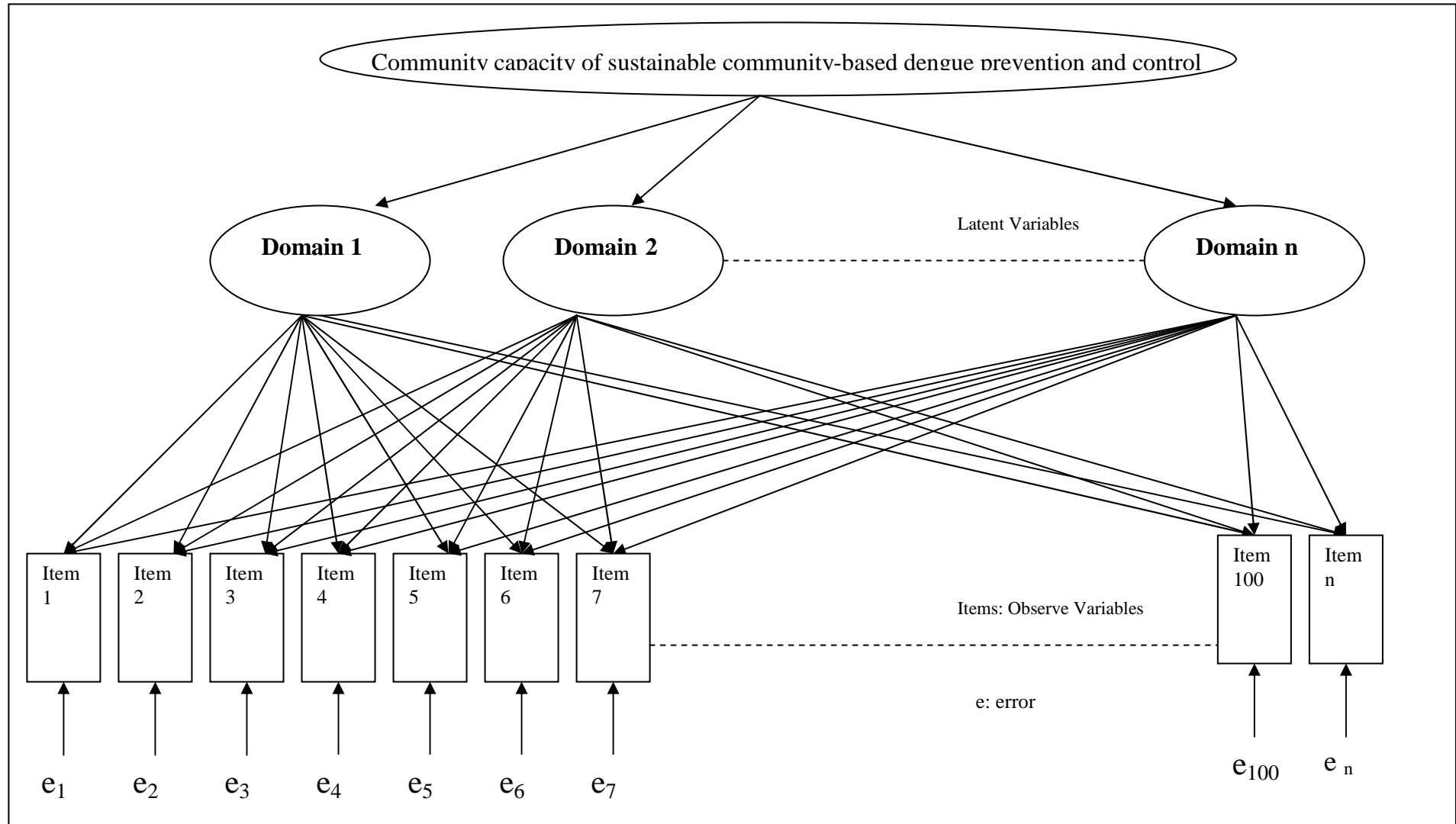
**Definition of Terms**

1. Community-Based Dengue Prevention and Control

Community-based dengue prevention and control is defined at a sub-district consisting of two groups for dengue prevention and control: the first group being leaders who act as "the capacity building activities group" consisting of representatives of dengue health promoters, local authority/organization networks, schools, temples, and village health volunteers. The second group is non-leaders whose role is to function as "the sustainable prevention and control activities group" and consists of community members.

2. Sustainable Community-Based Dengue Prevention and Control

Sustainable community-based dengue prevention and control is defined as the outcome of community capacity building for prevention and control and is measured by 1) community capacity of sustainable dengue prevention and control, 2) housing environment, 3) larval indices consisting of Breteau Index (BI), House Index (HI) and Container Index (CI) and 4) epidemiology index as morbidity rate and mortality rate of dengue.

3. Community Capacity Building

Dengue community capacity building is defined as the process of building community capacity for prevention and control in community that involved 4 steps such as 1) define community capacity domain and development appropriated tool, 2) assessment of community capacity; 3) developing a strategic plan and implementation steps and 4) reassessment.

4. Leader Group

The leaders group refers to the capacity of building and delivering dengue community capacity groups. They are actively activities of dengue prevention and control and accepted as community leaders from almost people in community. They activities are presenting in community such as situation dengue assessment, leading other persons, communication of dengue information, participating dengue activities, supporting resources and networking. Leaders group consisted of representatives of formal and informal position i.e. local administrative organizations (LAO) members, health care workers, school health teachers, community leaders, religious leaders, village health volunteers, students, community club members. The group is required to have resided in the community for more than one year, to be 18 or older, to be fluent in Thai, and to be available for this study.

5. Non-leaders Group

The non-leaders group refers to the ability of sustainable dengue prevention and control activities group. The participants in this group were representatives of households in the community, meaning they were involved with dengue prevention and control activities for their householdsas and community. The group is required to

have resided in the community for more than one year, to be 18 or older, to be fluent in Thai, and to be available for this study.

6. Dengue Community Capacity -Assessment Tool (DCCAT)

A community capacity assessment tool refers as set of questionnaires for assessment and re-assessment of the community capacity of people sub-district for sustainable dengue prevention and control. The DCCAT are divided into leaders group and non-leaders group included 4 parts i.e. 1) general characteristics, 2)dengue community capacity questionnaires, 3)housing environment observation form, and 4) larval indices survey forms.

7. Dengue Community Capacity of Leaders

Dengue community capacity of leaders is defined a set of characteristics of leader activities  for building capacity of dengue prevention and control that consisted of 14 domains i.e. critical situation management, personal leadership, health care provider capacity, needs assessment, senses of community, leader group networking, communication of dengue information, community leadership, religion capacity, community and leader group networking, resources mobilization, dengue working group, community participation, and continuing activities. These 14 domains are measured by questionnaires 115 items of dengue community capacity assessment tool (DCCAT) of leaders.

8. Dengue Community Capacity of Non-leaders

Dengue community capacity of non leader group is defined a set of characteristics of non-leaders activities for building capacity of dengue prevention and control that consisted of 11 domains i.e. critical situation management, personal leadership, religion capacity, community leadership, health care provider capacity, senses of community, communication of dengue information, continuing activities, dengue working group, resources mobilization, and needs assessment. These 11 domains are measured by questionnaires 83 items of dengue community capacity assessment tool (DCCAT) of non-leaders.

9. Larval Indices

The larval indices involved three traditional indicators, Breteau index, House index, and Container index [2]. The Thai Ministry of Public Health point out the guideline of larval indices to evaluate low risk is according to the Breteau Index (BI) <5, House Index (HI) <10 and Container Index (CI) <1 ).

1. House index (HI): percentage of houses infested with larvae and/or pupae.

$$HI = \frac{\text{Number of houses infested}}{\text{Number of houses inspected}} \times 100$$

2. Container index (CI): percentage of water-holding containers infested with larvae or pupae.

$$CI = \frac{\text{Number of positive containers}}{\text{Number of containers inspected}} \times 100$$

3. Breteau index (BI): number of positive containers per 100 houses inspected.

$$BI = \frac{\text{Number of positive containers}}{\text{Number of houses inspected}} \times 100$$

CHAPTER II

LITERATURE REVIEWS

This chapter presents the literature reviews summarizing the previous research conducted upon dengue as public health problem. It also discusses dengue as public health problem, community-based dengue prevention and control, the sustainability of community-based dengue prevention and control, the different domains of dengue community capacity, and measurement of community capacity. The purpose of the literature review was to identify gaps in the knowledge pertaining to community capacity for sustainable community-based dengue prevention and control, and appropriate tools to assess community capacity.

**Dengue as Public Health and Community Problem**

Dengue occurs as dengue fever (DF), dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS)[2, 11, 53, 54]. In this study, the use of the term "dengue" refers to the dengue infection caused by the *Aedes* mosquito, which covers the signs and symptoms of DF, DHF, and DSS. The transmission cycle of dengue consists of the host, the dengue virus, and the *Aedes* mosquito. Humans are the primary urban recipient of the virus [2]. Most people are aware that dengue fever is a severe, sometimes fatal disease characterized by hemorrhage and shock syndrome. Dengue infection is caused by dengue viruses (DEN-1, DEN-2, DEN-3, and DEN-4) transmitted from carriers to susceptible humans, mainly by the bite of the *Aedes aegypti* mosquito. Recombination has been demonstrated in all four serotypes, but the implications in terms of pathogenesis are unknown. Dengue viruses are members of the genus Flavivirus and family Flaviviridae. There are four virus serotypes, designated as DEN-1, DEN-2, DEN-3, and DEN-4. Infection with one serotype provides life-long immunity against re-infection by that same serotype, but not against the other serotypes[54]. All four serotypes also have antigens, which leads to cross-reaction and can result in cross protection for a short period of time. Thus, an antigen could help to protect a person from the other three serotypes, usually for about six to twelve months [2, 11]. Two associates to this study, the Bangkok Children's Hospital and the virus department of AFRIMS, determined that the second type of dengue infection (DEN-2) is responsible for 95-99% of dengue hemorrhagic fever patients. DEN-1 is contracted in a few cases by children under one year of age [55].

The *Aedes (stegomyia)* mosquito is the cause of dengue. Female mosquitoes feed on energy sources that provide protein-rich meals (i.e. blood) to stimulate egg laying. *Aedes aegypti* is the principal mosquito vector for dengue. Adult mosquitoes shelter indoors and bite during the daytime. They are adapted to breed around human dwellings, in water containers, vases, cans, old tires, and other discarded objects. A secondary vector for the dengue virus is *Aedes albopictus*, which contributes significantly to transmission in Asia and whose presence is spreading in Latin American countries. Dengue outbreaks have also been attributed to *Aedes polynesiensis* and *Aedes scutellaris*, but to a lesser extent. Uninfected mosquitoes acquire the virus when they feed on a virus-carrying individual. The virus develops in

the mosquito for one to two weeks, and once it reaches the salivary glands, it can be transmitted to humans during feeding attempts, which may occur several times a day over the rest of the mosquito's lifetime of one to four weeks (total). The virus has a significant transmission potential in same areas. After an infectious mosquito bite, the virus replicates in local lymph nodes and within two to three days disseminates via the blood to various tissues. The virus circulates in the blood, typically for four to five days during the febrile phase, and is cleared from the body within a day of defervescence.

The pathogenesis of severe dengue is not well understood. The risk factors to a host depend on age, immune status of the host, and the virus strain. There are two differentials: asymptomatic and symptomatic. Important symptomatic types include[11]: 1) Undifferentiated fever (viral infection), which occurs when a host is infected with the virus for the first time (primary dengue infection). This type often appears in children, with the clinical symptoms including fever and maculopapulation rashes; 2) Dengue fever (DF), which is most common in older children and adults. It is generally an acute biphasic fever involving headaches, myalgias, arthralgias, rashes, and leucopenia as its symptoms; 3) Dengue hemorrhagic fever (DHF), which is common in both children less than fifteen years of age and in adults. DHF clinical symptoms include acute onset of fever, a positive tourniquet test, hemorrhage, hepatomegaly, and circulatory failure. Significant pathological factors include an increase in vascular permeability resulting in plasma leakage; hypovolaemia; shock; and abnormal haemostasis due to vasculopathy, thrombocytopenia, and coagulophathy, leading to various haemorrhagic manifestations; 4) Dengue shock syndrome (DSS), which can be a symptom of DHF, but as its own type includes additional symptoms, such as low blood pressure, rapid and weak pulses resulting from the lower blood pressure (pulse pressure less than 20 mmHg.), sever bleeding, and an electrolyte imbalance.

Environmental changes, particularly those related to climate, directly affect the incidence and prevalence of vector-borne diseases. Climate is a significant factor affecting the dengue problem; this has been proven by the results of previous studies. All mosquitoes have aquatic larval and pupal stages in their lifecycles, and require water for breeding, so rainy days are positively correlated with dengue incidence. Warmer temperatures are a factor which can increase the transmission rates of dengue in various ways. First, warmer temperatures cause mosquitoes to reach maturity much faster than lower temperatures do. Second, warmer temperatures may reduce the size of mosquito larvae, resulting in smaller adults that have higher metabolism rates, require more frequent blood meals, and need to lay eggs more often[56]. Third, ambient temperature has a marked effect on the length of the extrinsic incubation periods of arboviruses in their vectors. Higher temperatures may reduce the length of viral extrinsic incubation periods (EIPs) in mosquitoes. At 30° C, the duration of the dengue virus' EIP is twelve days, compared with only seven days at 32-35° C. Humidity also has an influence on longevity, mating, dispersal, feeding behavior, and the oviposition of mosquitoes[56, 57]. However, human social factors, such as lifestyles and population density, are also important. Empirical models have been developed which show that population, climate change, unplanned urbanization (and its commonly-associated deficiencies in water supplies and solid-waste management), and increasing international travel all affect the global distribution of dengue fever

incidences. Thus, dengue has become a health problem in several different geographical areas.

Dengue epidemics are known to have occurred in tropical, subtropical and temperate areas, and dengue is the most widespread mosquito-borne viral disease in the world [2]. In the past fifty years, its incidence has increased and significant outbreaks have occurred in five of the six designated World Health Organization (WHO) regions. Annually, 50-100 million cases of dengue fever and half a million cases of dengue haemorrhagic fever occur worldwide, from which 25,000 patients die. Ninety percent of DHF subjects are children less than fifteen years of age [1-4]. It is estimated that 500,000 cases of dengue require hospitalization each year, of which a very large proportion is children. At least 2.5% of dengue patients die, although case fatality could be twice as high. The countries belonging to the WHO South-East Asian Region (SEAR) are stratified in terms of dengue endemicity [54]. In Indonesia, Myanmar, and Thailand, epidemics have been caused by all four virus serotypes during the past twenty years.

In Thailand, dengue has been a significant public health problem for the past thirty years. Although the effectiveness of dengue treatment has improved, the mortality rate is still higher than the Ministry of Public Health's disease standard, dengue is still the leading cause of child hospitalization, and the dengue problem continues to be a high cost to the regional economy: fifteen to twenty million baht per year in Thailand. The Ministry of Public Health's most recent plan calls for a morbidity rate that does not exceed twenty cases per 100,000 people and a mortality rate which does not exceed 0.2%. This was the Ministry of Public Health's "Plan 9," in line with the 9th National Social and Economic Development Plan for 2002-2006.

Due to the changing nature of dengue in Thailand, the disease is difficult to manage by case management. Although the mortality rate has decreased in hospitals, the morbidity rate has unfortunately increased in all areas. There have been changes in the infection rates of DHF and DF, but the rate of DSS has remained steady. Almost all DHF patients were children less than fourteen years of age; for those five to nine years old, the morbidity rate was highest [58]. Dengue is a major communicable disease in the south of Thailand. There are many factors which influence dengue incidence. Especially, behaviors or abilities of people are important for prevention and control.

**Dengue Prevention and Control**

Prevention and control is one of the best strategies for dengue management. Dengue prevention and control is defined as a group of strategies for dengue management which focus on vector control (controlling and eliminating larval breeding sources and adult mosquito control and elimination) and control of transmission and human infection (personal protection and dengue symptom detection and outbreak prevention).

There is no specific cure for the dengue infection and vaccines remain commercially unavailable; vector control is considered the only viable strategy for prevention and control of the disease[59]. There is, therefore, a need to adopt an integrated approach to mosquito control by including all appropriate strategies (environmental, biological, and chemical) which are safe, cost-effective, and

environmentally acceptable. Epidemiological surveillance of dengue and entomological, or vector, surveillance are two of these strategies [9].

#### 1. Epidemiology Surveillance

Disease and case surveillance involves monitoring endemic transmission and achieving early recognition of impending epidemics. Accurate clinical and laboratory diagnoses are important for the reporting system. Case surveillance is of two types: routine and active. Routine surveillance is based on standardized case definitions and the formal reports of the WHO. Active surveillance, on the other hand, involves health authorities monitoring dengue transmission at the community level. Hence, these types of surveillance require both a laboratory for clinical investigation and a team of experts on the ground for physical verification of dengue incidents.

#### 2. Entomological or Vector Surveillance

Vector surveillance is important for determining several risk factors related to dengue transmission, including distribution, population density, major larval habitats, spatial and temporal risk factors, levels of insecticide necessary, and vector susceptibility or resistance to said insecticide[2]. The two important types of surveillance are larval surveillance and adult surveys. Standard larval surveys [48] as epidemiologic indicators of dengue transmission should be viewed with caution.

2.1 Larval Indices. Larval indices have three traditional indicators: the Breteau index, House index, and Container index.

House index (HI): percentage of houses infested with larvae and/or pupae.

$$HI = \frac{\text{Number of houses infested}}{\text{Number of houses inspected}} \times 100$$

Container index (CI): percentage of water-holding containers infested with larvae or pupae.

$$CI = \frac{\text{Number of positive containers}}{\text{Number of containers inspected}} \times 100$$

Breteau index (BI): number of positive containers per 100 houses inspected.

$$BI = \frac{\text{Number of positive containers}}{\text{Number of houses inspected}} \times 100$$

2.2 Sample size of the dengue larval surveys. The effectiveness of larval surveillance depends on continuous monitoring. This makes its success dependent on the people on the "front lines," such as housewives, who are vital for obtaining an accurate measure of the House Index every three months[60]. In addition, larval surveys conducted to compute the Household and Breteau indices must be conducted by special vector control teams at selected sites to reinforce community mobilization and participation[61].

Concerning the sample size in dengue larval surveys, the WHO states that the greater the number of houses inspected in each locality, the more precise will be the results concerning level of infestation[2].

2.3 Level and types of vector surveillance

Control programs using integrated strategies do not require sampling at frequent intervals to assess the impact of the applied control measures. This is especially true where the effect of the alternative strategies outlasts residual insecticides. For example, larval indices are high (HI greater than 10%). On the other hand, feedback on at least a monthly basis may be desirable to monitor and guide community activities and to identify the issues that need more scrutiny, especially when the HI is 10% or lower. For specific research studies, it may be necessary to sample on a weekly, a daily, or even an hourly basis. In summary, it was found that there was a high risk of dengue transmission when the BI was $\geq 50$ and the HI was $\geq 10$. Alternatively, it was found that the risk of transmission was low when the BI was $\leq 5$ and the HI was $\leq 1$.

The WHO Regional Office for South-East Asia[62] suggests that the density of dengue surveys should be similar to that for yellow fever surveys in Africa, which concern a disease that is in the same group as the dengue virus. If the density figure is above five, there is a higher possible chance of the disease spreading. The comparison of larval density figures and indices used in the measurement of mosquito breeding places and population density can be seen in Table 1.

**Table** 1 Comparison of larval density figures and indices used in the measurement of mosquito breeding places and population density[62].

| Density figure | Number of mosquitoes/km | Breteau Index | House Index | Container Index |
|---|---|---|---|---|
| 1 | 100,000 | 1-3 | 1-3 | 1-2 |
| 2 | 200,000 | 4-9 | 4-7 | 3-5 |
| 3 | 300,000 | 10-19 | 8-17 | 6-9 |
| 4 | 400,000 | 20-43 | 18-28 | 10-14 |
| 5 | 500,000 | 35-49 | 29-37 | 15-20 |
| 6 | 600,000 | 50-74 | 38-49 | 21-27 |
| 7 | 700,000 | 75-99 | 50-59 | 28-31 |
| 8 | 800,000 | 100-199 | 60-76 | 32-40 |
| 9 | 900,000 | Above 200 | Above 77 | Above 41 |

3. Case Management.

Guidelines for the treatment of dengue were developed by Nimmannitya and others in Bangkok, and these later evolved into the WHO guidelines of 1974, updated again in 1986, 1994, and 1997[10]. The general treatment premise of these guidelines is for a patient to receive particularly intensive fluid replacement and monitoring, and this treatment method has reduced case fatality rates from around 20% to less than 1% in hospitals with facilities for intravenous resuscitation and monitoring[63]. The guidelines have since been modified and placed in a format easier to use by health workers in small hospitals in developing countries. The Integrated Management of Childhood Illness (IMCI) is a strategy used to assist health workers at ground zero facilities in developing countries on the out-patient management of children less than five years of age[11].

Case management for dengue involves the use of symptomatic treatments, such as fluid or plasma replacement, blood transfusion, and the prevention of shock and bleeding. Currently, although the mortality rate has decreased, management must remain alert to achieve early diagnosis, and must rapidly refer patients from primary care to secondary care. In addition to the dengue competency of people, an assessment of the signs and symptoms of dengue can help prevent or lessen the severity of dengue shock syndrome[2, 11].

4. Vaccine Development.

The occurrence of dengue in children and adults with previous dengue antibodies has been the greatest challenge in the development of a dengue vaccine. It is generally agreed that a dengue vaccine must confer long-lasting protection against the four dengue serotypes. Currently, researchers are following different strategies in the development of several vaccine candidates, so efforts are not coordinated and it is likely to be a long time before a vaccine becomes commercially viable. As a result, people at the ground level should continue their efforts at prevention and control of the dengue vector[59].

5. Vector Control.

Vector control remains the only available strategy against dengue. Selective, integrated vector control must include community and inter-sector participation, active disease surveillance based on a strong health information system, emergency preparedness, capacity building and training, and vector control research. These are the major elements of the WHO's global strategy for dengue prevention and control.

5.1 Environmental Management. Prevention and control of dengue takes three perspectives on the environment: management, modification and manipulation. Environmental management is involved with detecting any change that prevents or minimizes vector breeding and hence reduces human-vector contact.

5.1.1 Environmental Methods. The methods used are meant to control *Ades aegypti* and *Aedes albopictus*, and to reduce man-vector contact. They include source reduction, solid waste management, modification of manmade breeding sites, and improved house design. The major environmental management method is to control the immature stages of dengue vector development.

5.1.2 Environmental Modification: Improving the water supply by storing water in various types of containers is encouraged because otherwise conditions lead to increased *Aedes* breeding. It is essential that potable water supplies be delivered in sufficient quantity, quality, and consistency to reduce the necessity and use of water storage containers that serve as the most productive larval habitats.

5.1.3 Environmental Manipulation. There are several manipulations that must be done to water containers. For example:

-Flowerpots, vases, and ant traps: Flowerpots, vases, and ant traps are common sources of *Aedes aegypti* breeding. They should be punctured to produce a drain hole. Alternatively, live flowers can be placed in a mixture of sand and water. Flowers should be removed and discarded weekly and vases scrubbed and cleaned before reuse.

-Tire management: Tire depots should always be kept under cover to prevent the collection of rain water in the tires.

- Building exteriors: The design of buildings is important to prevent *Aedes* breeding. Drainage pipes from rooftops, sunshades, and porticos often get blocked and become breeding sites for *Aedes* mosquitoes.

5.2 Personal Protection. Personal protection, such as clothing, mats, coils, and aerosols, reduces the risk of mosquito bites. Repellents are a common means of personal protection against mosquitoes, as are insecticide-treated mosquito nets and curtains[2].

5.3 Biological. The application of biological control agents which are directed against the larval stages of dengue vectors is extremely important. A combination of dengue prevention practices in the community and *Mesocyclops* can be an effective method of *Aedes aegypti* control, but to achieve community acceptance and maintenance requires several key elements[21]. Some areas of Southeast Asia have used larva-eating fish (*Gambusia affinis* and *Poecilia reticulata*) extensively for the control of *An. stephensi* and/or *Aedes aegypti* in large water bodies or large water containers.

5.4 Chemical Protection. Chemicals have been used to control *Aedes aegypti* since the turn of the century. Several types of chemicals can be used for dengue vector control. Larviciding, or "focal" control, of *Aedes aegypti* is usually limited to domestic-use containers that cannot be destroyed, eliminated, or otherwise managed. It is difficult and expensive to apply chemical larvicides on a long-term basis. Therefore these chemicals are best used in situations where vector surveillance indicates that certain periods of high risk occur, and in localities where outbreaks might occur. Establishing precise timing and location are essential for maximum effectiveness. For example[2, 11, 62]: (1)Temephos (Abate) 1% sand granules: One percent Temephos sand granules are applied to containers using a calibrated plastic spoon to administer a dosage of 1 ppm. This dosage has been found to be effective for 8-12 weeks. (2) space sprays: Space spraying involves the application of small droplets of insecticide into the air in an attempt to kill adult mosquitoes. (3) Thermal fogs: Thermal fogs containing insecticides are normally produced when a suitable formulation condenses after being vaporized at a high temperature. (4) Ultra-low volume (ULV) aerosols (cold fogs) and mists: ULV involves the application of a small quantity of concentrated liquid insecticides. (5) Vehicle-mounted fogging:

Vehicle-mounted aerosol generators can be used in urban or suburban areas with a good road system.

Concerning these methods for the prevention and control of dengue, there are many implementation problems in each situation, such as management of the quality of insecticides, the performance of workers, and the evaluation and sustainability. For example, the results of using Temephos sand granules were actually increased levels of resistance by *Aedes aegypti*. This situation is currently a reality in some countries, including Brazil and several Caribbean islands. Moreover, there has been a reported resistance of adult mosquitoes to malathion and pyrethroids in the Americas and in Asia,[62] and this is likely to reduce the efficacy of space spraying.

In summary, critical factors contributing to the achievement of anti-dengue efforts are a strong dengue surveillance system, which integrates environmental, entomological, epidemiological, clinical, and virological surveillance in conjunction with the public health infrastructure, and a strong vector-control program, along with good inter-sector coordination, active community involvement, and a strong political commitment.

## Community-Based Dengue Prevention and Control

Community is a term which comes from two root words: common and unity. To be "in community" is to share a common oneness with other people. The community is important because relationships and conditions in a community give rise to health problems. There are some community jobs that individuals must do and some jobs which must be done collectively.  In this study, community is defined as a group of heterogeneous individuals who share common interests and needs, and who also share the responsibility to mobilize and organize themselves to achieve social and political change[45].

Community-based intervention refers to the community as the setting, target, agent, and resource owner for intervention efforts. As a setting, community is primarily defined geographically and is the location in which interventions are implemented. Community may be citywide, including neighborhoods, schools, churches, work sites, volunteer agencies, and other organizations. The community as a target refers to the health-related goal of community intervention. The community as a resource owner highlights the internal and external resources and actors that communities must employ to strengthen healthcare efforts. The goal of community-based intervention is focused on changing individuals' behaviors in order to reduce the population's risk of disease. Communities are increasingly being pushed to take responsibility for dengue control programs by recognizing the fundamental importance of mobilizing and channeling household-level behaviors and capacities to eliminate mosquito breeding sites, reduce peoples' exposure, and meet situational targets and goals[14].

**Stakeholders in Community-Based Dengue Prevention and Control**

According to eight cases of community-based intervention and social mobilization for dengue management[64], it was found that *Aedes aegypti* control is not a problem that can be resolved by the health sector on its own, but rather it is an issue that requires "shared responsibilities." A study on dengue prevention and control in Mexico, which focused on using education and household intervention to tackle breeding containers, suggested that the participation of both the municipal government and the education system, along with household responsibility for domestic containers, is vital for effective, sustained *Aedes aegypti* control[65]. In addition, even greater emphasis was placed on community equity stakeholders[65]. Community actions require actors at each level to take a role in community participation. For a successful and sustainable dengue prevention and control program, the actions of communities are vital, as shown in Figure 2 [2].

**Figure 2** Study group on a community capacity development and assessment tool
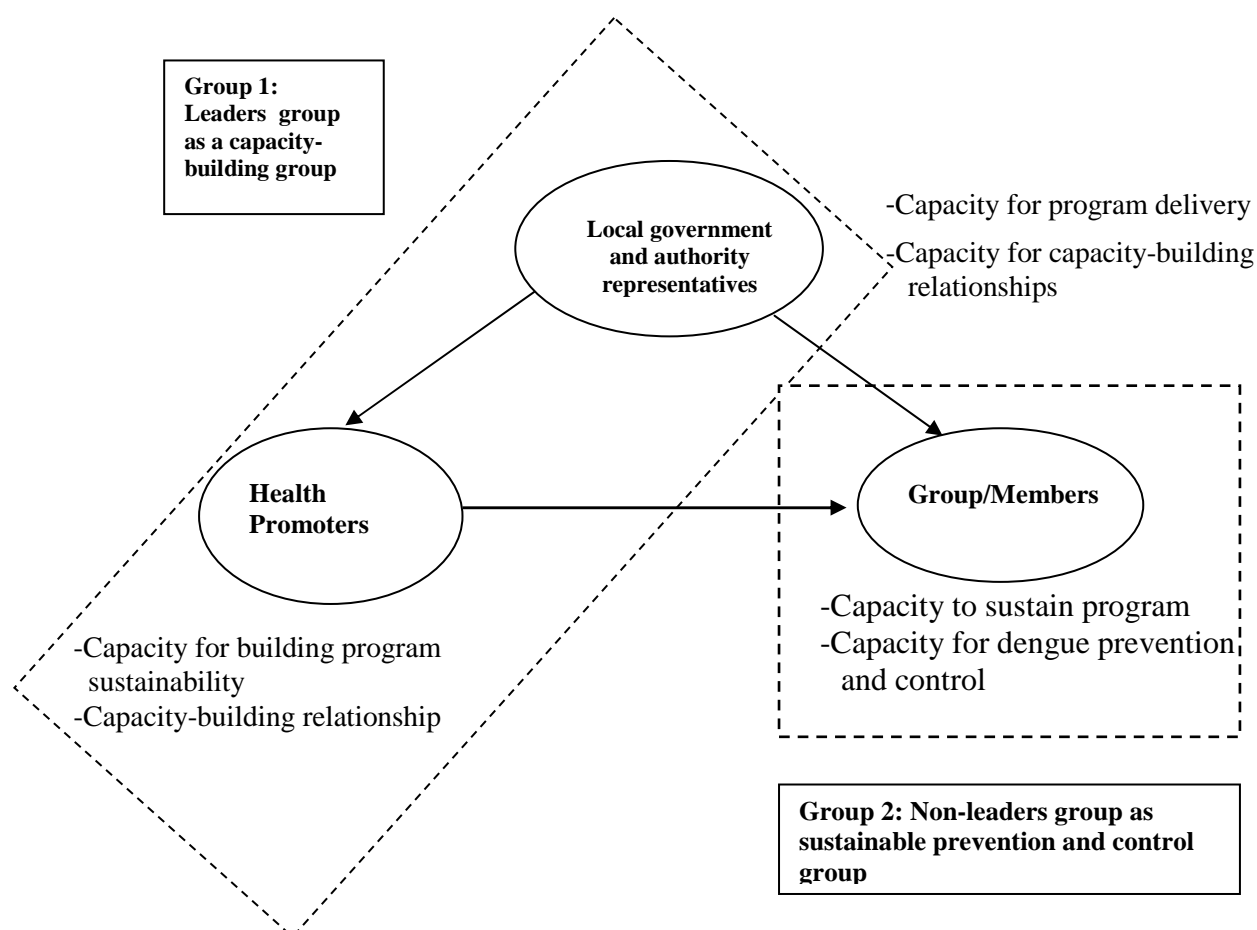
**Group 1: Leaders as a Capacity-Building and Delivering Group**

According to the concept of actors responsibility in dengue problem[2] and actors of capacity building relationship of health promotion [33], leaders group referred group of people in community who building and delivery  dengue community capacity consisted of representative of local government and authority and health promoter. For the representative of local government and authority in community are local administrative organization (LAO) members, health care workers, village health volunteers, school health teachers, community leaders (head of village and head of sub-districts), community club members, religious leaders and other persons who showed activities of dengue prevention and control.

**Local Administrative Organization**

The Local Administrative Organization (LAO) refers to local government structures in Thailand. The institutional framework of local Thai governments is classified into two main categories: general and specific. In the general form, there are three types of local authorities located throughout all seventy-five provinces (excluding Bangkok). They are the: (i) Provincial Administrative Organization (PAO, seventy-five units), (ii) Municipality (1,136 units), and (iii) Sub-district, or Tambon Administrative Organization (TAO, 6,740 units).

According to two major laws, the constitution of 1997 and the decentralization plan and process act of 1999, several tasks and responsibilities are mandated to local government:

(1)      Local community planning and development.

(2)      Promotion of local economic development, investment, employment, trade, and tourism.

(3)      Provision of local public services, including local roads, walkways, public transportation systems, traffic light engineering, public markets, ports and docks, waste treatment, the water drainage system, public utilities, parks and recreation, garbage collection, pet controls, slaughtering, public safety,  and natural disasters.

(4)      Resource and environmental protection, disaster control, sanitation, and cremation services.

(5)      Social welfare services provision, including education; social welfare for children, the elderly, and the disabled; primary health care and medical services; housing and restoration; and arts and culture.

(6)      Promotion of democratic values, civil rights, public participation, law and order, and conflict resolution.

The LAO, as the main organization conducting local management, is generally viewed as both a step forward in the realization of a local self-management body as well as a milestone in the decentralization policy. The main idea is participation, which is aided by decentralization and localization: localization as opposed to globalization, the bottom-up as opposed to the top-down approach, decentralization as opposed to centralization. Therefore, the best anti-dengue

approach is a community-based bottom-up approach, aided when necessary with a top-down strategy. The sub-district or Tambon Council has the powers and duties of developing plans, projects, and budgets for its area; making administrative recommendations to its subagents; and further developing itself.

**Health Care Workers in the Community**

A descriptive study evaluating the effectiveness of dengue hemorrhagic fever prevention and control among district healthcare workers found that the following variables (ranked in order of importance) were necessary to successfully classify results: leadership, physical resources, human resources, and organization [66].

1. Health Workers
For health workers, environmental protection is routine. Their role as representatives of the Ministry of Environment can help the Ministry of Health to collect data and information on ecosystems and habitats in or around cities with a high risk of dengue. Data and information on local geology and climate, land usage, forest coverage, surface water, and human population are useful in planning control measures for specific ecosystems and habitats.

Information directed at the community at large is best achieved through mass media, such as television, radio, and newspapers. Consequently, mass media sources should be approached to coordinate the release of informational messages developed by public health specialists on the prevention and control of dengue.

2. Village Health Volunteers
All Thai provinces have Village Health Volunteers (VHV), who are the backbone of the health care delivery system, supporting the concept of community involvement as the heart and soul of public health care (PHC) activities[67]. They are selected by the members of the village and receive brief training in health promotion and disease prevention, the fundamentals of PHC.

The role of village health volunteers in Northeast Thailand has changed, according to an ethnographic field study, which included interviews and focus groups. The results showed that the majority of people who were interviewed did not know who the VHVs in their communities were. The role of Village Health Volunteer needs to continually change, just as the health care needs of the community do. However, they have always been key players in the public health care model because of their ground-level knowledge of their individual communities and their socio-cultural belief systems, as well as their primary focus on prevention[68]. The Responsibilities of VHVs include:
- Informing villagers about issues related to health,
- Collecting vital statistics on pregnancies, deaths, and migration,
- Conducting a needs assessment of their villages,
- Teaching and advising villagers in all aspects of PHC,
- Carrying out and coordinating village-specific development activities in conjunction with other inter-sector development activities,

- Weighing pre-school age children and distributing supplementary foods to malnourished children,
- Providing simple symptomatic medical care by using home remedies or medicines approved by the Ministry of Public Health,
- Providing first aid treatment for accidental wounds and injuries, and
- Distributing birth control pills and condoms to villagers.

Given the responsibilities of VHVs, to be eligible for selection, one must be able to read and write, live and work in the village, show regular participation in village community development programs, be trusted by village members, have one's own occupation to earn a living, live in a house accessible to the village, and not be a government official or village headman.

### Non-Governmental Organizations (NGO)

Representatives of Non-Governmental Organizations (NGO) can play an important role in promoting community participation and implementing environmental strategies for dengue vector control. NGO groups in communities may be informal neighborhood groups or formal private voluntary organizations such as service clubs, religious group, or environmental groups. For instance, NGOs can help collect discarded containers such as tires, bottles, etc. In this study, NGOs can also refer to a private for-profit organization, group, or association which provides resources to help prevent and control dengue. Examples could include merchants, tire shops, and flowerpot shops.

### Schools: School Health Teachers and Students

Schools, as part of the Ministry of Education, should work closely with the Ministry of Health to develop a health education component targeted at school children, and to devise and communicate appropriate health messages. Health education models can be jointly developed, tested, implemented, and evaluated for various age groups. Schools can be a major representative of the Ministry of Public Health in communities. This was done in a community-based dengue prevention program in Puerto Rico. Students' exposure to the elementary school health program there was associated with slightly lower indices of residential mosquito infestation. The program resulted in high levels of awareness, some behavior changes, and slight changes in larval indices. In Thailand, a greater emphasis on the skills necessary for community members to keep containers free of mosquito larvae would increase the program's effectiveness. This study documented the changing behavior of parents after they were involved in school-based dengue activities. Another reason for their change was the communication of dengue messages to them by their children. Schools must therefore present dengue knowledge to students in the classroom.

**Community Club Member**

Group of community club refer representatives of several clubs in community who as group for doing activities such as aging club, occupation club, women club and exercise club. These groups can support the dengue activities.

**Group 2: Non-leaders Group**

Non-leaders were representative of household in community who involved dengue prevention and control activities. Household in the communities as the bottom-up group are one of the most important key stakeholders. The success of the community participation strategy depends on the community population's devotion to dengue prevention and control. Individual responsibility for dengue prevention and control in each community consequently depends on the individual villagers in each household, who must help in both dengue source reduction and implementation of personal protection.

In summary, community-based dengue prevention and control consists of two groups, leaders and non-leaders, who have the responsibilities for dengue prevention and control.

**Sustainability of Community-Based Dengue Prevention and Control**

Sustainability is a major challenge point for community-based dengue prevention and control. There have been many instances of community-based approaches, and in all areas, such as participation, social mobilization, government commitment, trans-disciplinary areas, inter-sector areas, infrastructure, empowerment, and behavioral change. Although their outcomes were evaluated as successful, the sustainability of these programs and their approaches was not clear successful [14, 21, 60, 64, 69-71]. The Stronger Families and Communities Strategy of 2000-2004 defined sustainability as the benefit of a project or program to a community and its member after the initial funding ceases. It was further described as having four necessary goals: sustaining participation, sustaining community capacity, sustaining program outcome, and sustaining the preparation of the sustainability phase itself.

Thus, sustainability in this study is identified as a necessary part of community capacity for successful community-based dengue programs, which must include individuals, groups, organizations, and networks. These must be evaluated by ongoing activities, as well as at the outcome of the program [2, 72, 73].

**Aspects of Sustainable Community-Based Dengue Prevention and Control Intervention**

Community-based intervention activities for the prevention and control of dengue use the community as a setting, target, agent, and contributor of resources. There are several strategies or approaches to sustain dengue prevention and control activities, as shown as Table 2[2,42-44].

**Table** 2 Comparison of sustainable dengue prevention and control activities

| Sustainable prevention and control measure [2] | Mission of the dengue task force (GT-Dengue), [42] | Routine prevention [44] p: 26 | Prevention and control [43] p: 27 |
|---|---|---|---|
| - Community participation <br>   *showing concern <br>   *initial dialogue <br>   *creating community ownership <br> * health education based on three levels: community level, systems level and policy level <br> - Inter-sector coordination <br>   * resource sharing <br>   * policy adjustment <br>   * role of health sectors <br>   *role of non-health sectors <br>   * role of NGOs | -Effective community participation <br><br> -Environmental management <br><br> - Advocacy and inter-sector action <br><br> -Patient care <br><br> -Case reporting <br><br> -Education | -Education program <br><br> - Education media | - Resistance management program <br><br> - Health education, public information, and human behavior changes <br><br> -Target prevention |
| Defining community action <br>   * individual <br>   * community <br>   * organization <br>   * school <br>   * private sector <br>   * integrate with other programs <br><br> -Model development <br> -Social mobilization <br> -Health education <br> -Legislative support | system <br><br> -Critical analysis of the function of insecticides <br> -Training <br> - Emergency system, outbreaks, and epidemics | - Training sessions <br><br> -One to one education | -Partnership <br> - Community mobilization <br> - Research and program development |

**Community Participation (CP)**

Community participation (CP) can be considered the most important strategy in dengue management [2, 46]. Community participation has been defined as "a process whereby individual families and communities are involved in the planning and conduct of local vector control activities so as to ensure that the program meets the local needs and priorities of the people who live in the community; a process which promotes a community's self-reliance in respect to development" [2]. The prevention and control of dengue requires close collaboration.

**Intersectoral Cooperation**

There are two main components of intersectoral cooperation: resource sharing and policy adjustment. This concept emphasizes sharing and the role of the ministry in public works, education, and the environment. Moreover, communities may make use of the services of nongovernmental organizations (NGOs), such as women clubs and the rotary foundation.

Intersectoral collaboration is most often defined as an alliance between professionals and experts from several sectors, all working together to achieve a common purpose. These could include social scientists, medical doctors, geographers, and university biologists. The most technical experts are usually family doctors, and two special training courses they receive are in *Aedes aegypti* control and in communication and participation techniques. However, there is a general need for strengthening the technical expertise of all these professionals, especially in communication and education.

For example, an inter-sector study on prevention and control of dengue [74] using a quasi-experimental design included biweekly meetings of inter-sector health councils from the intervention area. The participants were divided into two groups: as inter-sector experts and technical experts. The results were recommended using communication and social mobilization strategies for dengue control, which consisted of the strategies of eliminating unusual containers in houses and surroundings, covering tanks, and cleaning public and inhabited areas. The results showed that inhabitants in the intervention areas had accurate knowledge about breeding sites and disease symptoms. It is clear that inter-sector management and communication between all stakeholders facilitates social mobilization and leads to significant changes in knowledge, attitudes and dengue practices in communities.

**Community Mobilization**

Advocacy meetings should be conducted to attain a political commitment for mass clean-up campaigns and environmental sanitation. Retraining of health workers should be conducted to improve their technical capabilities and their ability to supervise prevention and control activities.

1. Health education.

Health education is very important to achieving full community participation. It is a long-term process aimed at causing positive human behavioral

changes, which are necessary to cultivate in a community. School children and woman are recommended as the main target groups for receiving dengue health education if a community has limited resources.

2. Legislative support.

Legislative support is an essential issue for the success of a dengue prevention and control program. Several countries have legislation addressing the control of epidemic diseases which authorizes health officers to take necessary actions within communities to control epidemics. Examples of enforcement methods are as follows: ordinances that require mosquito-proofing of cisterns, water storage tanks, wells, and septic tanks; ordinances that require the removal of junk cars and other scrap; and ordinances requiring all neighborhood households to collect and dispose of their solid waste and keep their yards free of junk and litter [2, 75].

### Continuous Monitoring

The evidence from previous studies points out that there are many methods of approach for sustaining dengue-elimination programs, but this study emphasizes the necessity of a continuous monitoring program, which depends on stakeholder responsibility, as well as other facilitating factors.

The study which used social mobilization strategies, education, and communication as a three-pronged approach for the prevention of dengue in Columbia suggested that to develop a behavioral-change project, it is necessary to put in at least three years of continuous effort before any significant changes are observed[60]. Moreover, the planners need insight into how the social mobilization and communication plan has been implemented to date, and must link research with implementation in order to move from small-scale to large-scale implementation [70]. The same study showed that one result from the three-year intervention effort was effective inter-sector community mobilization [74, 76, 77].

### Community Responsibility

The sustainability of a program can be successful if it possesses the following components: 1) A small group of committed and dedicated people that can plan and execute a project, 2) Communities and households which will readily get involved if the behavioral targets set are reasonable and achievable, and 3) The ability to sustain the interest of the volunteers, which is fundamental to the overall plan [78].

### The Facilitating Factors

The facilitating factors for the creation of a successful anti-dengue partnership included the following: a leadership role for the community health centre, a clarity of mandate from the representative organization so as to develop a sense of duty to the project, a positive atmosphere and positive relationships within the partnership, efforts to maintain and improve health care, group motivation, and personal satisfaction. This

last item would be enhanced though the development of individual competencies, participation in the group-process dynamic, and involvement in the community[41].

## Barriers to a Sustainable Community-Based Dengue Program

There are several barriers to the creation of a productive partnership, which are listed below:

-Inadequate involvement from the health sector due to a lack of interest by health professionals (there are not enough physicians that believe in prevention yet). This led to excessive work in targeting their practices and convincing them of the value of prevention activities,

- Poor representation from the municipal sector, which led to difficulties in expanding projects to the other municipalities,

-Partners who lack experience working with each other. The bureaucratic, Centralized style of community health centers was a source of frustration for some partners,

-The lack of a common vision of the project, or the presence of conflicting agendas, among partners was also cited as a barrier to the process,

-The lack of an explicit link between community mobilization and project sustainability,

-The lack of feedback on project activities or results, in terms of health behavior change, sometime left partners without a sense of progress,

-Lack of support from community organizations, and

-A high participant turnover rate from community members.

There is no clear endpoint for the study, because sustainability is ongoing. The challenge of the final phase of implementation is how to sustain a needed program for a longer period. Some techniques to help researchers sustain a program for a longer time include: having community dengue committees in place as working institutions, advocating for the program, partnering with other organizations, revisiting and revising the program, and facilitating a partnership between government control agencies and the community.

In conclusion, sustainability of community-based dengue prevention and control intervention in communities depends on the strategies and approaches of organizations which take a role in the dengue problem, as well as bridges and barriers encountered when conducting the program. Although there are many concepts of community dengue prevention and control, this study assumes the sustainability of community-based dengue prevention and control depends on community capacity, intersectoral cooperation, health education, community mobilization, community activities, and more.

**Domains of Dengue Community Capacity**

### Definition of Community Capacity

Several definitions of community capacity have been offered in public health information. For instance, community capacity can be considered an essential strategy for sustaining programs and health improvements long after grant funding periods have ended because organizational infrastructure and community commitment for continuation have been created. Laverack described it as a process that increases the assets and attributes that a community is able to draw upon in order to improve its peoples' lives [30]. This is similar to the definition put forward by Smith et al.: "the ability of people and communities to do the necessary work in order to mitigate detriments to the health of people in that community." [32] Moreover, Bush et al. and Goodman et al. [79] offer a joint definition of community capacity as a collection of characteristics and research which, when combined, improve the ability of a community to recognize, evaluate, and address key problems [79, 80] and which provide information to community insiders concerning what they need to have, know, do, and be in order to effectively tackle the primary health detriments that are affecting them [81]. In addition, community capacity can be regarded as a set of dynamic community traits, resources, and associational patterns that can be brought to bear for community building and community health improvement.

Concerning the areas of interest in community capacity, a number of researchers attempted to develop a set of "domains," or characteristics, of community capacity. In this study, the author reviews ten main domains. The ten domains of a community's capacity to sustain community-based dengue prevention and control intervention are participation, leadership, community structure, a needs assessment, information transfer, a sense of community, resource management, network partnerships, a critical assessment, and program management. The details for each of these are below [26, 27, 30, 32, 39, 40, 47].

Sustainability has become a challenging issue in public health intervention. It is the continuation of programs, program activities, and structures beyond their initial launching [41]. Dengue programs require sustainability, as their success depends on the ability of such programs to maintain activities and continue delivering benefits after external assistance ends. Community-based dengue intervention programs simply must have sustainability as an aspect of their intervention programs, as was repeatedly shown in previous studies [19, 21, 22, 82, 83].

Community-based intervention refers to the concept of the community as the setting, target, agent, and resource provider for intervention efforts. As a setting, a community is primarily defined geographically and is the location in which interventions are implemented. A community may be an entire city, or specific parts of a city, such as neighborhoods, schools, churches, work sites, volunteer agencies, or other organizations. The community as a target refers to the goal of community responsibility for things such as health level indicators. The community as a resource provider means it must procure both internal and external resources and actors in order to strengthen healthcare results. Community as an agent means the representatives of the people within a community must be involved in solving the problems of their own community[41].

## Domains of Community Capacity

Domains are the areas of interest in the concept of community capacity, and a number of researchers have attempted to develop and define a set of domains. The concept and definition of community capacity can be made more specific by specifying domains, or components. There are several ways which domains were defined and differentiated from each other. The researcher grouped themes with similar meanings from nine articles from the literature review. These articles discussed possible domain definitions and how to group them. After an extensive literature review, it became apparent that community capacity could be divided into ten domains: participation, leadership, community structure, a needs assessment, information transfer, resources mobilization, a sense of community, network partnerships, a critical assessment, and program management. These are explained in the paragraphs that follow.

### Participation

Participation is fundamental to community capacity. Only by participating in small groups or large organizations can individual community members better define, analyze, and act on issues of general concern to the broader community [27, 33, 38]. Community participation (CP) is therefore recommended as the most important strategy in dengue management. It has been defined as "a process whereby individual families and communities are involved in the planning and conduct of local vector control activities so as to ensure that the programs meet local needs and the priorities of the people who live in the community, and promote the community's self-reliance in respect to development [2, 46]." Participation efforts based on urging people to attend classroom-style education sessions is less likely to be successful than organizing events based around community members' interests. A program could organize people with outdoor picnics and neighborhood tours [25]. Given these ideas, Toledo et al. pointed out that participation in a project is an element in all the different steps of the project, and must be by both formal and informal leaders, as well as health promoters[24]. Thus, community participation remains a guiding principle in combating this tropical disease. It spans the entire spectrum, which is composed of the elements of process, organization, planning, evaluation, cooperation, and contribution of time and resources, according to Ahmed (1978)[46].

In summary, participation is defined as a set of activities conducted by community members for dengue prevention and control. Participating in activities for dengue prevention and control means being involved in multiple activities, such as defining, planning, implementing, and evaluating [27, 33, 38, 46].

### Leadership

Leadership is critical in identifying problems, fostering change in community activities, and providing opportunities for citizen participation [47]. Leadership requires a strong participant base, just as participation requires the direction and structure of strong leadership, so the leadership and participation domains are closely linked [27, 33, 38]. Leadership is a function of training, experience, and personality. Leadership is found in people who are system thinkers and future orientated, and who search out opportunities to change and grow, enable others to act by delegating power, and set an example by behaving in a way that is consistent with shared values [31].

From a workshop, it was determined that developing local leaders means working with candidates' existing strengths and providing positive rewards for their efforts. The local women were good at networking, organizing, and planning programs. They became new local leaders for a health promotion project [25]. In a dengue prevention program, it is mandatory that a local group be the one which spearheads the process of social mobilization and human resource development[24] [24].

Leadership at the local level is necessary for successful establishment and follow-through efforts of the intervention process. Formal and informal local leaders have the necessary insider knowledge of neighborhood practices to make the dengue program a success, but they must be willing to invest their time [14].

Moreover, local government must be a full partner and provide competent leadership in initiating control activities and facilitating community participation. Previously, the lack of political will to maintain effective programs was the greatest barrier to dengue prevention and control programs. Government-sponsored vector control still exists in high-risk areas, which actually try to change to community ownership of the dengue control program [14].

In Thailand, key people with leadership standing in each community are a particularly important driving force for the development and maintenance of an effective and sustainable dengue program. Such people include school teachers, village health volunteers, and previous female organizers.

In summary, leadership is defined as a characteristic of people in communities who are skilled in identifying, developing, nurturing, and fostering community dengue prevention and control. In this study, effective leadership of a person is measured by their skill in supporting, dealing with conflict, acknowledge and encouraging community members' voices, sharing leadership, bringing people with diverse skill sets together, and networks to build on existing community resources [25-27, 31, 33, 47].

### Community Structure

Community structure refers to formal groups and committees that foster belonging and give community members a chance to express views and exchange information (a feature of community capacity). In a community, organizational structures include small groups, such as committees, churches, and youth groups. These are the organizational elements that represent the ways in which people come together to address problems [27, 33]. Organizational structure is important for getting people to participate in planned activities in a community. It can come from outside the community, but this risks paternalism and an imposition of ideas or issues that do

not appeal to local people and so fail to motivate them to participate [38]. A sufficient number of organizations with good internal processes and ample participation most likely already exist locally [25]. The problem is that communities where vector-borne diseases are endemic lack institutional systems and structures to encourage these organizations to participate in control strategies, or in the case of the few that do, they do not function adequately [46].

The results of this study demonstrated that a new organizational structure was necessary to serve as a coordinator of groups at the municipal, provincial, and community levels. Anti-dengue programs will not succeed if they ignore the domain of community structure [14].

In summary, community structure is defined as an organizational strategy uniting those involved in dengue prevention and control in a community. It must include the "capacity for delivery and building group" and the "ability to sustain dengue prevention and control group." Community structure divides community representatives into two groups: 1) the leaders group, which addresses the capacity for delivery and building (dengue health promoters, local organizations, and networks) and 2) the non-leaders group, which can be defined as the "capacity to sustain dengue prevention and control group [25, 27, 30, 33, 38, 46] ".

## Needs Assessment

In term of assessing the problem, a needs assessment for capacity building (empowerment) presumes that identifying the problems, finding solutions to the problems, and taking actions to resolve the problems are all conducted by the community members. The process will help communities to develop a sense of self-determination and capacity [27, 33, 38]. Problem solving is the ability of groups and organizations within a community, and the community itself, to use well recognized methods to identify and solve problems that arise in the development or implementation of an activity or program.

In summary, a needs assessment is defined as the capacity of a community to identify the components of a dengue problem, potential solutions to the dengue problem, and actions it can take to resolve the problem. In this study, needs assessment will be measured by assessing the ability of the two groups to define and analyze the problems of prevention and control in the sub-districts [25,27,30,33,38,46].

## Knowledge Transfer

Knowledge resources about health problems and curative resources are needed to keep those conducting strategic and tactical planning well-informed. The ability to acquire information is influenced by accessibility, quantity, consistency, and relevance [50]. Knowledge transfer is the development, exchange, and use of information within and between groups and organizations within a community.

This study focused on educational campaigns for local stakeholders, adapted seasonally to potentially changing ecologies both human and mosquito. In dengue prevention and control, the effectiveness of larval elimination, adaptability of the mosquito, failure rate of adult mosquito insecticide, and varying cost of chemicals

are all aspects of dengue knowledge which community members need to possess in order to plan for mosquito control [14]. Surveillance of dengue incidence areas and the responsible vectors is likewise a critically important issue. Community members must understand that routine activities are not permanently effective because vector indices and dengue epidemics are not always correlated. For instance, the house index may indicate greater dengue risk than the container index, and the papal index may be more closely correlated with dengue transmission than the more familiar larval indices [2, 4, 84]. In addition, the local community leader must possess knowledge of how to best obtain community participation and identify breeding sites. Information on dengue prevention and control needs integrate several disciplines: environmental surveillance, improving the identification and stratification of risk for *Aedes aegypti* breeding sites; entomological surveillance, active surveillance of infestation areas and epidemic foci; and epidemiology/clinical surveillance, collecting and analyzing information on individual risks and serology surveillance [16].

In summary, knowledge transfer is defined as the ability of a community to develop information collection methods and to channel information about dengue within and between the people and groups inside and outside of the community. It can be measured by assessing parties' dengue knowledge and skills, especially in such fields as entomology, epidemiology, ecology, and sociology [14, 16, 48, 50].

### Resource Mobilization

The ability of a community to mobilize resources from within, together with its ability to negotiate the acquisition of resources from the outside, is itself is an important factor in the community's ability to achieve success in its efforts [27, 38]. Resources include those things needed to support programs, such as people, physical space, administrative support, planning tools, and financial support [31]. Dengue epidemics give rise to serious public concern and alarm. The disease is easily transmittable through travelers moving from area to area, and the ineffectiveness of chemical control for adult mosquitoes has become apparent. The public must be kept informed to heighten people's awareness, which should motivate the entire community agree to accept responsibility for preventing mosquito breeding.

A previous study pointed out the importance of a community, or an inter-sector group, being able to mobilize resources through negotiation at different levels. Resources to be mobilized were categorized into three main groups: 1) human resources, people with competency in human resource management are needed to maintain a harmonious working environment, 2) physical resources, access to basic equipment and appropriate facilities will contribute to staff moral and a willingness to actively pursue the program, and 3) financial resources, skills such as preparing financial reports; managing budgets, payrolls, invoicing, and payments; and applying for funding are vital[50].

In summary, resource mobilization is defined as the ability of a community to mobilize a variety of resources, such as local administrative resources, human resources, financial resources, and health resources. In this study, resource mobilization will be measured by the quantity and quality of the investment of those resources in dengue prevention and control activities [27, 31, 38].

**Senses of Community**

Senses of community are fostered through building trust with others. Community projects can strengthen sense of community as people come together to work on shared community problems. The result of this study on a community's ability for, and commitment to, organizational action indicated that people become genuinely committed to their community when: they see that a situation has a vital impact on their lives and the values they cherish, they find that they have a recognized and significant role in a project, and they see positive results from their efforts to participate [85].

A related study pointed out that community ownership was an aspect of sense of community and that community engagement was best achieved through the creation and reinforcement of local ownership for dengue control projects. The differing values of householders, communities, social units, the public health workforce, and policymakers must all be considered because of the necessary reliance on community mobilization strategies to achieve larval control [14].

In summary, sense of community is defined as the perception of benefits to dengue intervention efforts, shared community values, and trust which is developed between stakeholders through the creation and reinforcement of local ownership. Sense of community can be measured by a community's degree of mobilization, and by the effectiveness of channeling household-level behaviors and capacities to eliminate mosquito breeding sites, reduce dengue exposure, and improve targeting efforts [14].

**Network Partnerships**

Network Partnerships are links with people and organizations, including partnerships, coalitions, and voluntary alliances between a community and other parties [25, 27, 33]. Building capacity requires that communities not only work well internally, but that there is collaboration between them[31]. Bush et al. (2002) described network partnerships as the relationships between groups and organizations within a community or network. They confirmed the existence of mutual benefits for network partners, and that a partnership increases the sustainability of the capacity to achieve health development [49].

This study found that partnerships, as links between communities, control programs, and governmental structures, are mainly based on negotiation. This is in contrast to the links between control programs and governmental structures, which are mainly collaborative. Government needs to coordinate "bottom-up" and "top-down" approaches, the successful implementation of which is likely to lead to sustained dengue control. In addition, government needs to coordinate clinical-epidemiological areas and manage dengue information to provide timely feedback when there is a dengue incidence [14].

Community ownership is increasingly being touted as the key to successful programs, as a community can best take into account the social, geographical, and political factors specific to its local context. Effective partnership with government and the achievement of a sustainable dengue prevention and control program cannot occur without coordination between the top-down and bottom-up approaches.

In summary, network partnerships are defined as the relationship between groups and organizations within a community or network for building its capacity for community-based dengue prevention and control. Community network partnerships are measured by the quality of relationships between groups, such as local politicians, public health units, schools, groups of parents, and external organizations [24,46,80].

**Critical Assessment**

Critical assessment involves asking what means and abilities a community has to critically assess its social, political, economic, and miscellaneous factors related to dengue control. It is a crucial stage towards developing appropriate personnel and social change strategies [27, 33, 38]. It refers to a process whereby a community comes together to critically assess its social, political, and economic influences.

The critical assessment process is a reflection by a community to improve itself. One study suggests that action plans be devised, implemented, and evaluated by local groups who are key participants in their community. Intervention areas can be tackled based on decisions made by these participants and negotiated with the government.

In summary, critical assessment is defined as the ability of a community to evaluate critical stages in developing appropriate personnel and making social changes to better improve dengue intervention strategies. Critical assessment capacity will be measured by measuring the ability of a community to identify and solve the problems of individuals and groups in that community [27, 33, 38].

**Program Management**

Program management was described as the control by primary community stakeholders over decision planning, implementation, evaluation, financing, administration, reporting, and conflict resolution. Clearly, the roles and responsibilities of all stakeholders are dependent on effective program management [27, 33, 38]. The study monitored project implementation and results by groups of coordinators. A community must monitor changes in behaviors and in the environment by itself[24]. The program management is the key elements to consider for whether successful and sustainable intervention for dengue prevention and control [14].

Dengue programs based on legal mandates were successful in some areas, such as Singapore's program for dengue prevention and control, which involved a strong surveillance effort and an extensive public education program [14].

In summary, program management is defined as the ability of a community to manage dengue prevention and control activities in its sub-district area. The community must make its own decisions regarding planning, implementation, evaluation, financing, administration, reporting, and conflict resolution. Program management will be measured by the clarity of these roles and by the effective assumption of responsibilities by all stakeholders  who are involved in dengue prevention and control efforts [27, 33, 38].

In conclusion, the domains of dengue community capacity numbered ten were based on a review of the literature reviews. The main domains were grouped using the concepts of Laverack, Labonte, & Laverack [52, 86]. Their concepts were well-described and have been used in several studies, such as the title study about community-based dengue prevention and control: "Cuba Achieving Sustainability of Community-Based Dengue Control in Santiago de Cuba"[24] and the references in it about measurement scales for community-based intervention: "Development of Scales Measuring the Capacity of Community-Based Initiatives." However all concepts of community capacity domain were cited in outside, they did not present in dengue prevention and control and Thailand. These 9 articles were reviewed as showed in Table 3.

**Table** 3 The literature reviews of 9 articles were involved community capacity domains

| Community capacity | 1. Smite et al., 2003[32] | 2. Gipbon et al, 2002[33] | 3. Chakin, 2001[39] | 4. Laverack, 2006[30] | 5. Laverack, 2001; 2003[45, 87] | 6.Labonte & Laverack, 2001[52] | 7. Hawe et al., 2000[88] | 8. Norton et al, 2002[47] | 9.Toledo et al., 2007[24] |
|---|---|---|---|---|---|---|---|---|---|
| **10 Domains** | **8 Domains** | **8 Domains** | **4 Domains** | **8 Domains** | **9 Domains** | **8 Domains** | **8 Domains** | **6 Domains** | **8 Domains** |
| **1. Sense of community** | Sense of community | | Sense of community | | | | Coalition | Value system | |
| **2.Participation** | Participation | Participation | | Participation | Participation | Participation | | Civil participation | Participation |
| **3. Leadership** | Shared vision | Leadership | Commitment / Responsibility | Leadership | Leadership | Leadership | The capacity of partnership | | Leadership |
| **4. Resources mobilization** | Resources skill | Fund mobilization | Access to resources | Resources mobilization | Resource mobilization | Resources | | Skill and resource | Resources mobilization |
| **5. Information transfer** | Knowledge communication | | | | | | | Leaning culture | |
| **6. Needs assessment** | | Needs assessment | | Problem assessment | Problem assessment | Assessment/ Analysis | -Assessing the quality of program planning | | Needs assessment |
| **7. Partnership networking** | Ongoing leaning | Linkages | Ability to solve problem | External linking | Link with others | Links | Leaning among health workers | Nature of social relationships | Linkage |
| **8. Community structure** | | Group dynamics | | Organizational structure | Organizational structure | Organizational structure | Project group | Structures | Organization structure |
| **9. Critical assessment** | | Implementation | | Critical Assessment | -Asking Why -Role of the outside agents | Outside agents | Organizational learning | | Implementa-tion |
| **10. Program management** | | Management | | | Program management | Program control | Sustainability | | Management |

**Measurement Model**

Measurement is defined as the process of assigning values to objects to represent the attributes or characteristics possessed by the objects. It is of vital concern across a broad range of research contexts. Scales are developed when it is necessary to measure phenomena that are believed to exist because of theoretical understanding of the world, but which cannot be accessed directly. Measurements are combined into a composite score, which reveals levels of theoretical variables not readily observable by direct means; these are often referred to as scales [51].

There are two broad categories of measurement: psychometric and physical. Psychometric measures involve measurement of attributes such as intelligence, self-esteem, and quality of life. Physical measures involve measurement of attributes such as blood pressure, heart rate, and respiratory rate.

The goal of measurement is to achieve accurate results, but this is not completely possible because measurement error, to some extent, is introduced into all measuring procedures[89]. There are two basic types of errors that affect the precision of empirical indicators: random error and systemic error. Random error, or chance error, is caused by chance factors that confound the measurement of phenomenon. Therefore, random error primarily affects the reliability, i.e. consistency, of measurements, and consequently validity as well, because reliability is a necessary prerequisite for validity. Systemic error, the second type of error that affects empirical measurements, brings a systematic bias to measuring procedures. Thus, the validity of measurement is more threatened by the occurrence of systemic error [89]. Issues of reliability and validity are of central concern to research. Particularly in the development of new tools, establishing the reliability and validity of the tool is very challenging. Validity is concerned with systematic error, whereas reliability is concerned with random error [90].

**Reliability**

Reliability refers to the consistency with which a measuring device assesses a contextual domain. It is concerned with the consistency of a measurement technique. Reliability of measure refers to the measurement's ability to detect the true score with a minimum of measurement error. It may also be defined as the closeness of fit between a true score and an obtained score. There are several approaches for determining the reliability of an instrument, which includes its internal consistency and multiple-measurement consistency, and these approaches have several variations. Reliability testing is focused on three aspects of reliability: stability, equivalence, and homogeneity.

Stability is an assessment of the consistency of repeated measures. The most commonly used approach to a stability test is test-retest reliability. This measure of reliability is generally used with physical measures, technological measures, and paper and pencil scales. Use of this technique requires the assumption that the factor measured remains the same between the two testing occurrences. A high correlation coefficient between the test and retest results indicates high reliability.

Equivalence, or inter-rater reliability, is an assessment of the agreement between measurements made by two or more observers who have measured the same

event. Inter-rater reliability values should be reported in any study in which observational data are collected or judgments are made by two or more data gatherers.

Homogeneity is used primarily with paper-and-pencil tests and addresses the correlation of various items within the instrument. The original approach to determining homogeneity was split-half reliability, which was a method of assessing test-retest reliability without administering the test twice. More recently, testing the homogeneity of all the items in the instrument has been considered a better approach to determining reliability. This procedure examines the extent to which all items in an instrument consistently measure the construct. It is a test of internal consistency. The statistical procedure used for this process is Cronbach alpha coefficient.

### Cronbach Alpha Coefficient

Internal consistency is typically equated with Cronbach alpha coefficient. This research will examine Cronbach alpha coefficient in detail for several reasons. First, it is widely used as a measure of reliability. Second, its connection to the definition of reliability may be less self-evident than is the case for other measures of reliability. Finally, Cronbach alpha coefficient is an exploration of the logic underlying the computation of Cronbach alpha coefficient provides a sound basis for comparing how other computational methods capture the essence of what the reliability meant [51].

Alpha ranges from 0.00 to 1.00, with higher scores indicating greater internal consistency of the scale. The ranges of research reliability are as follows: unacceptable, below 0.60; undesirable, between 0.60-0.65; minimally acceptable, between 0.65-0.70; respectable, between 0.70-0.80; very good, between 0.80-0.90; and above 0.90 [51]. Various researchers have made different recommendations regarding the minimum accepted level of reliability. When research subjects answer consistently across items within an instrument, it is said to have item homogeneity. In order for items to be homogenous, they must measure the same characteristics. The internal consistency coefficient is an index of both item content homogeneity and item quality.

**Validity**

Whereas reliability is concerned with how much a variable influences a set of items, validity concerns whether the variable is the underlying cause of the item's co-variation [51]. Validity refers to whether a measurement instrument accurately measures what it is supposed to measure. When an instrument is valid, it truly reflects the concept it is supposed to measure.

According to the more conventional interpretation, validity is inferred from the manner in which a scale is constructed, its ability to predict specific events, and its relationship to measures of other constructs. There are essentially three types of validity: content, criterion-related, and construct validity [51].

1. Content Validity

Content validity is concerned with item sampling adequacy - that is, the extent to which a specific set of items reflects a content domain. Content validity is easiest to evaluate when the domain is well defined. The issue is more subtle when measuring attributes, such as beliefs and attitudes, because it is difficult to determine exactly what the rank of potential items is and when a sample of items is representative. In theory, a scale has content validity when its items are a randomly chosen subset of the universe of appropriate items. If the researcher needs to develop a measure contrasting expected outcomes with desired outcomes, it might be desirable for her or him to establish that all relevant outcomes were represented in the items. To achieve content validity, the researcher might ask experts familiar with the context of the research to review an initial list of items and suggest content areas that have been omitted but should be included. Items reflecting this content could then be added [51]. The most frequently approach uses content specialists to assess the quality of items. Content specialists examine the format and content of domains of interest, as determined by test specifications. The Content Validity Index (CVI) indicates the percentage of agreement between experts for each item and subscale. The CVI was defined as the proportion of items given a rating of "quite relevant" or "very relevant" by both experts involved. The four ratings possible are: (1) not relevant, (2) somewhat relevant, (3) quite relevant, and (4) very relevant[89]. After the items are examined, the CVI is created. The CVI for each item is determined by the proportion of experts who rate it as content valid (quite or very relevant; a rating of 3 or 4), and the CVI for the entire instrument is the proportion of total items judged content valid. A CVI above 0.80 is considered acceptable [91, 92].

2. Criterion-related Validity

Criterion-related validity indicates to what degree a subject's performance on a measurement tool and the subject's actual behavior are related. This validity is usually the second measure, which assesses the same concept under study. Criterion-related validity per se is more of a practical issue than a scientific one, because it is concerned not with understanding a process but merely with predicting it. It fact, criterion-related validity is often referred to as predictive validity. There are two forms of criterion-related validity: concurrent validity and predictive validity.

2.1 Concurrent validity refers to the degree of correlation of two measures of a concept, administered at the same time. A high correlation coefficient indicates agreement between the two measures.

2.2 Prediction validity refers to the degree of correlation between the measurement of a concept and some future measurement of the same concept.

3. <u>Construct Validity</u>

Construct validity reflects the ability of an instrument to measure an abstract construct (or concept). Construct validity is directly concerned with the theoretical relationship of a variable (e.g. a score on some scale) to other variables [51]. Constructs are not real; that is, they are not directly observable, and exist only as ideas that are constructed to represent an abstract trait. The establishment of construct validity is a complex process, often involving several studies and several approaches, such as the Factor Analysis approach [93].

**A Tool to Assess Community Capacity**

One of the goals of assessment is to create an index of community capacity that is easily measured and useful for funding decisions and assessing outcomes across different communities. Nowadays, there are multiple measures and a lack of standards, which has made it difficult for organizations to make funding decisions[32]. Thus, this study seeks to develop measurements of capacity, for both inputs and outcomes of community-based intervention. High levels of community capacity may become an additional criterion for funding decisions. On the other hand, a low capacity could lead to the development of antecedent interventions. Consequently, a lack of community capacity can be addressed by interventions developed as part of a health improvement strategy.

For community-based dengue prevention and control intervention, a systematic review of related articles from 1992 to 2005 was conducted. The results of eleven articles demonstrated that most intervention programs had certain weaknesses, whether they used only one approach or combined many approaches [94]. Moreover, not all articles showed that the sustainability of intervention and measurement of community-based intervention were possible. In addition to community-based dengue intervention in Cuba , the research used the community capacity guidelines of Laverack [52] to measure the capacity of communities which had been carrying out a dengue program for three years. The results reported effectiveness for all domains of community capacity, but the paper did not discuss the measurement methods, or the validity and reliability of those instruments. In Thailand, a few studies have published papers about community-based dengue prevention and control intervention programs, such as the study by Swaddiwudhpong entitled "The effects of health education on community participation in the control of dengue hemorrhagic fever in an urban area of Thailand[22]." The results of the study did not point out the evaluation of community capacity. They presented only information about entomological indices and kinds of prevention and control methods for larvae.

Norton et al.[47]proposed that community capacity measurement is interesting, but effective application is limited because measurement of community capacity is still in its infancy. They suggest "A significant direction for future research entails refining the dimensions of community capacity, increasing our understanding of their interactions, and developing tools for measuring them."

From the above mentioned points, it can be seen that a community capacity tool is important to development because it will not only provide the benefit of helping to evaluate a program, but will also help community members to understand and develop that program. A community capacity tool is directly related to the sustainability of health improvement and is believed to possess inherent health benefits for individuals and the community. This research attempts to develop a framework for understanding the components of a community capacity assessment tool for validly measuring community-based dengue prevention and control intervention.

## Steps of Tool Development

Tool or instrument development should be based on guidelines for developing measurement scales [51] and on Classical Measurement Theory. In addition, the community capacity-building process points out five steps to help develop community capacity.

DeVillis [51] provides a set of special guidelines for developing measurement scales, as follows:
Step 1: Determine clearly what it is to be measured
Step 2: Generate an item pool
Step 3: Determine the format for measurement
Step 4: Have the initial item pool reviewed by experts
Step 5: Consider inclusion of validation items
Step 6: Administrative items to develop the sample
Step 7: Evaluate the items
Step 8: Optimize the scale length for reliability

Burn and Grove [95] point out some important points about constructing a scale using Classical Test Theory. They include ten steps: define the concept, design the scale, seek item review, conduct preliminary item tryout, perform a field test, conduct item analysis, select items to retain, conduct validity studies, evaluate the reliability of the scale, and compile norms for the scale.

There are five stages to develop community capacity. These come from the literature review, the field studies, synthesis, reviews by experts, and improvement [80], and can be seen below:
Stage I: Review the literature to identify common indicators of capacity.
Stage II: Conduct a field study to collect information following a district trial of a health promotion program in a community.
Stage III: Synthesize case study research findings and field study findings.
Stage IV: Have experts review the capacity index.
Stage V: Make improvements to the capacity index and further field trials.

In conclusion, the study used the development tool concept integrated from mixed methods, qualitative concepts, and quantitative concepts. The first phase defined clearly what it is the study attempted to measure by qualitative methods, such as a review of the literature, in-depth interviews, and focus group discussions. The second phase consisted of item development and testing tools, also using qualitative methods. The final phase involved applying a new tool, designed for measuring participation.

**The Application of a Tool to Assess Community Capacity**

The purpose of community capacity building is to strengthen the characteristics of communities that enable them to plan, develop, implement, and sustain effective community programs. The application of a tool to be used to describe the methodology of community capacity building consists of four phases [27], enumerated below.

1. Preparation (develops the operational domain and prepare to assess the community's capacity).
    2. Assessment
        2.1 Assessment of each operational domain
        2.2 The recording of the reasons for the assessment
    3. Development of a strategic plan for community empowerment
        3.1 Discussions on how to improve the present situation
        3.2 The development of a strategy to improve the present situation
        3.3 Assessment of resources
    4. Follow-up and reassessment

Concerning the frequency of measurement, while single assessments may be the most useful for funding decisions, they do not necessarily help in developing capacity. Conducting multiple measurements across time is essential because these continuing assessments will provide feedback that will help the community toward the goal of improving its capacity.

In summary, the main method of community capacity-building involves four steps: 1) preparing tools and the community 2) assessing community capacity, 3) planning and implementing, and 4) reassessing.

**Summary**

The literature review examined the dengue as public health problem, community-based dengue prevention and control, the sustainability of community-based dengue prevention and control, domains of dengue community capacity, and measurement development. Sustainability has thus far been a major gap in community-based dengue prevention and control. Community capacity-building must not only build the capacity of a community, but must also be sustainable, something which was not found to occur in previous studies on dengue prevention and control. Moreover, a tool to assess a community's capacity for sustainable dengue prevention

and control needs to be developed, because such a tool will be a vital part of the community capacity-building process.

The initial definitions of the ten domains of dengue community capacity, from the literature reviews, were participation, leadership, community structure, needs assessment, information transfer, senses of community, resources mobilization, network partnerships, critical assessment, and program management, and were used to build the conceptual framework for the study. These initial domains were aid in developing questionnaire guidelines for qualitative research methods.

# CHAPTER III

# RESEARCH METHODOLOGY

The study's aim was to develop a community capacity assessment tool for sustainable community-based dengue prevention and control intervention in Southern Thailand. This methodology of study used step of scale developments integrated [55,97,103,105] with concept measuring of community capacity [32]. This chapter describes the research methodology employed in the study including research design, research setting, study population, development instrument phase, and a summary.

## Research Design

Descriptive design was mixed methodology of qualitative and quantitative method for developing, testing and applying a community capacity assessment tool of sustainable community-based dengue prevention and control. This study was divided into three phases, defining meaning and themes of dengue prevention and control by qualitative method, items development and testing assessment tool by quantitative method and application of using assessment tool [32, 51, 80, 87].

## Research Setting

The setting area in each phase defines "community" as sub-districts with high risks of dengue. The criteria of high dengue incidence area were set according to WHO [62]. This study selected eight provinces in Southern Thailand to examine due to certain criteria.

First of all, these provinces were areas with high dengue incidence in Southern Thailand. From 1997 to 2006, although the dengue morbidity and mortality rates have tended to decrease, their levels were higher in these provinces than the national average. Southern Thailand has a higher morbidity rate than other areas. The median morbidity rate over the past ten years (1997-2006) was 88.88 per 100,000 people, and the mortality rate 0.19 % [58]. The Thai Ministry of Public Health in 2007, issued guidelines of larval indices to evaluate low dengue incidence areas in accordance with the Breteau Index (BI) <5, the House Index (HI) <10 and the Container Index (CI) <1. The larval indices were different in each collection area, hence, only one criterion was used in this phase: the median morbidity rate over ten years (1997-2006) for high and low morbidity rate sub-districts in each group. The median morbidity rate of the 14 provinces was, 88.88 per 100,000 residents. The morbidity rates of the various regions are shown in Figure 3.

**Figure** 3: Morbidity rate of dengue in four areas of Thailand from 1997 to 2006
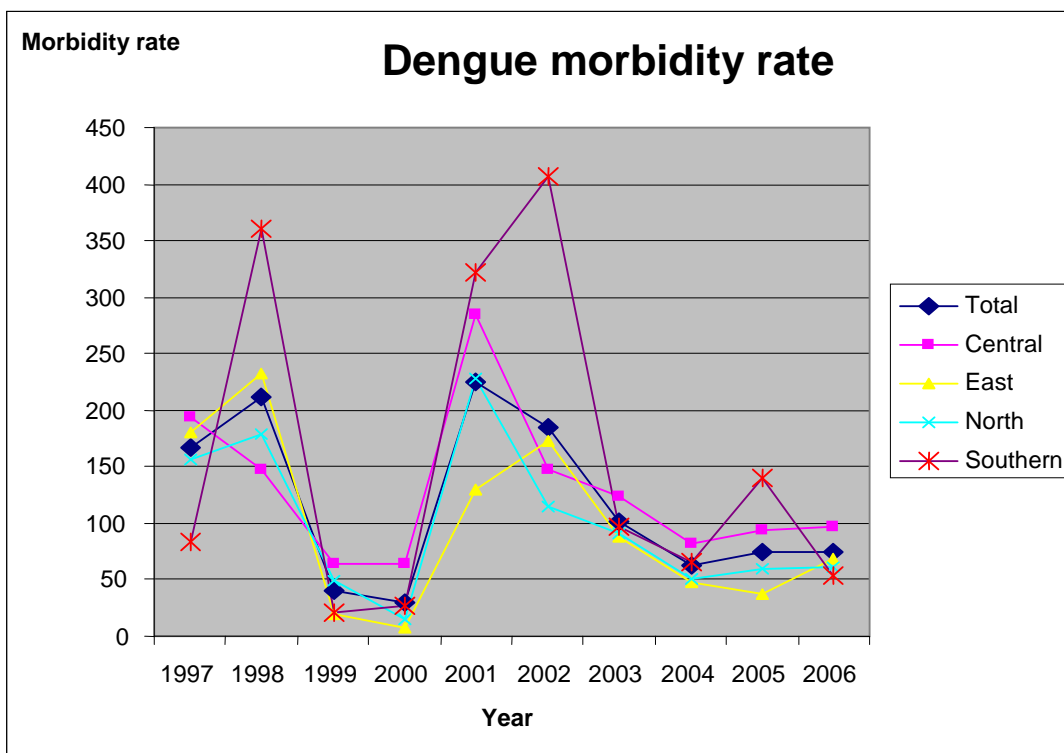


Second, there were many factors associated with dengue in Southern Thailand. The literature provides data for the years 1993-2002. In the fourteen southern provinces during this time, there was high dengue incidence, due to many rainy days, higher average rainfall, higher average relative humidity, and warmer temperatures (means: $10.81 \pm 19.61/100000$, $14.0 \pm 5.8$, $219 \pm 210$ mm., $81.0 \pm 3.7\%$, and $27.0° \pm 1.0°C$)[34]. These important climatic factors, rainy days, warmer temperatures, and humidity, influenced the abundance and distribution of mosquito vectors/intermediate hosts. The fourteen southern provinces have thus had high morbidity rates for at least the past ten years. There were dengue outbreaks yearly for three years, followed by a year with decreased incidence.

Exclude criteria was impossible for researchers to collect data, political insecurity in Yala, Pattani, and Narathiwat. Then, the study was conducted in eight provinces in Southern Thailand where there was a high incidence of dengue and data collection was possible. Data was collected in eight provinces: Surat Thani, Nakhon Si Thammarat, Trang, Pang-nga, Ranong, Chum Porn, Krabi and Songklha because of the high incidence of dengue and the availability of data. (Details are shown in Appendix A).

**Research Population**

The study population includes people in sub-district communities where the dengue intervention programmes are trying to bring about behaviour change. Communities include local government representatives or local authority organizations (Tambon administrative organization; TAO), practitioners who have a role in dengue prevention and control in the community (health workers, teachers, etc.) and groups/community members (both household and public) the process and results are aimed at community groups/members. Thus, this study emphasizes the household as community capacity focus of community-based dengue prevention and control as most appropriate to sustain grass-roots programmes.

According to dengue actors' responsibilities in the community [2, 33], the responsibilities for dengue prevention and control intervention are divided into two groups. The study population included people in sub-district communities where dengue intervention programmes were attempting to bring about behavioral changes. The responsibilities for dengue prevention and control intervention were divided into two groups: leaders and non-leaders [4, 33] as followed:

1) The leaders group was required to have the capacity to build and deliver groups. It consisted of representatives of local administrative organizations (LAO) officers, health workers, school health teachers, community leaders, religious leaders, village health volunteers, students, community club members. The group participants were required to have resided in the community for more than one year, to be 18 or older, to be fluent in Thai, and to be available for this study.

2) The non-leaders group was required to be able to sustain dengue prevention and control group. The participants in this group were representatives of households in the community, meaning they were involved with dengue prevention and control activities for their householdsas. The same inclusion criteria were used for this group as for the first group.

In summary, community-based dengue prevention and control consists of two groups, leaders and non-leaders, who have the responsibilities for dengue prevention and control as showed in Table 4:

**Table** 4 Study population groups

| Actors responsibility [2] | Actors of capacity building relationship [33, 96] | Study population group | |
|---|---|---|---|
| Local government and authority representative (Local authority and organization and Private Organizations) | Local government and authority representative | Representative of dengue local authority -LAO member -Schools (Teachers) -Community leaders -Religious leaders -Community club member | **Group 1: Leaders as capacity building group** |
| | Health promoters in community | Dengue health promoters - Health workers -Village health volunteers | |
| Individual in community (formal and informal) | Group/ members | Dengue community member -Households representatives | **Group 2: Non-leaders as sustainable prevention and control group** |

## Instrument Development Phase

The Instrument Development Phase consisted of three parts: defining domains, developing items and testing and using the assessment tools [51, 80]. The first phase identified points to study to be measured by the qualitative method such as reviewing pertinent literature and field studies for in-depth interviews and focus group discussions. The second phase consisted of developing items and testing tool by the qualitative method. The third phase conducted application of using tool by community participatory approach.

## Phase I: Defining Meaning and Themes of Dengue Community Capacity

The first phase was exploring the meaning and themes of community capacity for sustainable community-based dengue prevention and control. This phase conducted by qualitative exploration of the themes of dengue community capacity included literature reviews, field studies and content analysis and reported to a review panel of three experts.

### Literature Reviews

According to the pertinent literature reviews, there are five concepts; dengue as public and community problem, community capacity building, sustainable dengue prevention and control, community-based intervention and measurement development. Ten initial domains of community capacity for sustainable community-based dengue prevention and control were derived from literature reviews and include participation, leadership, community structure, needs assessment, information transfer, sense of community, resource mobilization, network partnerships, critical assessment, and program management [26, 27, 30, 32, 39, 40, 47, 81]. The guideline of in-depth-interviews and focus group discussions were based on these literature reviews.

### Fields Study

The objective was to define the domain of community capacity for sustaining the community-based dengue prevention and control. The qualitative method was used for collecting primary data consisted of secondary data assessment, in-depth interviews, and focus group discussions.

### Setting Areas and Sample Size

The setting areas were purposive sampling based on high incidence of dengue, having community-based activities concerning its prevention and available to participate in the study. The four sub-districts of four provinces were located in Nakhron Si Thammarat, Krabi, Songkhla and Trang provinces. These areas were as the same characteristics of setting areas in this study.

The study focused on people in sub-district communities where dengue intervention programmes are trying to bring about behaviour change. The first group was labeled the "capacity for delivery and building group." It consisted of representatives of local administrative organization officials, school teachers, formal community leaders, and religious leaders. Further criteria were that members of this group had to have resided in the community for more than one year, be eighteen years of age or older, have fluency in the Thai language, and be available to participate in the study. The representatives of this group were assigned by health care workers in community based on these criteria.

The second group, non-leaders, was the "sustain dengue prevention and control group." The participants in this group were representatives of households in the community, meaning they were involved with dengue prevention and control activities for their households. In community, health care workers and VHVs were assigning households in their responsibility area and covering community area. These participants were also used in the focus group discussions.The same inclusion criteria were used for this group as for the first group.

**Collecting Data**

1. Secondary Data Assessment

Dengue is a complex problem because it involves entomology, epidemiology, and socio-ecological components. Therefore, secondary data collection for communities involved rates of dengue incidence, entomological surveillance, and information about previous or current dengue intervention programs. Dengue statistics for the current and previous five years, details of dengue interventions, implementation in the communities, and the results of dengue programs were all collected from health centers and local administrative organization officers.

2. In-depth Interviews (IDIs)

This study elicited detailed information about people's perceptions of the dengue problem, possible solutions, components of community capacity, and domains for sustainable dengue prevention and control in communities. The IDI technique involved participants and researchers talking about dengue issues. The conversations generally lasted from forty-five to sixty minutes, depending on the content. The researcher prepared question guidelines and an audio recorder and set a time and places where participants felt comfortable and where transportation was available. The researcher in the study started each interview by introducing herself and obtaining permission from the participants to allow recording of the conversation.

3. Focus Group Discussions (FGDs)

Focus groups discussions were used to obtain information about people's feelings, opinions, perceptions, insights, beliefs, misconceptions, attitudes, as well as the receptivity of a group of people to an idea. The sampling technique included family members of households in the target communities who were available for discussion. Containing no more than 15 people usually included, FGDs were 6-8 non-leaders per group,. All participants in each group were interviewed by the researcher one week before the session. In each instance, the researcher introduced herself to the group and invited members to introduce themselves. Then the researcher provided the objectives of the study, obtained informed consent, discussed the focus group process, and obtained permission to audio record the session. To foster a flexible climate for discussion, the conversations were held in the local language, and lasted between ninety to 120 minutes.

In summary, the sample size of 60 leaders and 60 non-leaders were purposive technique in four sub-districts as showed in Table 5.

**Table** 5 Sample size in the first phase (In-Depth Interviews and Focus Group Discussion)

| Sample size in the first phase | | | |
|---|---|---|---|
| Method ⟋ Community group | In-depth Interviews (total 15 leaders) | Focus group (2 groups, 6-8 non-leaders per group) | Secondary data assessment |
| **Leaders group: Capacity for delivery and building group** (Representative who are responsibility role) | -2 LAO offices -2 to 3 Health workers -2 to 3 Community leaders -2 to 3 school health teachers -2 to 3 Religious leaders -2 to 3 community club members | | -Dengue strategy plan and budget plan, dengue intervention plan and dengue incidence data for five years (2002-2006) |
| **Non-leaders: Capacity to sustain dengue prevention and control group** | | -Representative of household (people in community) | |
| **Sample size per sub-district** | 15  leaders | 15  non-leaders | |
| **Sample size per 4 sub-districts** | 60 leaders | 60  non-leaders | |

**Content Analysis and Three Experts Reviews**

Content analysis was the technique used in this phase. After collecting data, the researcher considers a complete recording and file note. The process of content analysis consisted of three main steps; 1)reviewing the data set, 2)coding and categorizing the same meaning of words to categories and 3)setting theme whose meaning associated the context [97, 98]. The meaning and ten themes of dengue community capacity were found at the final of three experts reviews. The details of the first phase are shown in Appendix D.

**Trustworthiness**

The eight community members from the sub-districts added credibility to the study, as these stakeholders had the opportunity to examine categories, interpretations, and conclusions for real-life validity. This technique was the most important one for establishing this study's credibility [97]. Thus, all participants were asked to validate the common concepts and the general description of the two groups' experiences after the preliminary interpretation. Two members from each sub-district were asked to serve as peer debriefers to provide feedback on the credibility and appropriateness of the study's findings.

In summary, under qualitative method, the researcher and research assistant collect data and determine the validity of content [97]. Trustworthiness was necessary for the qualitative method in the step used triangulation resources such as three experts for content analysis. The three experts review panel to verify content validity of dengue community capacity themes included academics, practitioners, management and representatives from the community. The results of defining meaning and themes in the qualitative method were 10 initial themes i.e. stakeholders participation, community leadership, core activities group, problem solving needs assessment, dengue information transfer, resource mobilization, sense of community for dengue problem, dengue network partnership, critical dengue situation management, and continuing dengue prevention and control activities. The results of the first phase are shown in Appendix D.

## Phase II: Developing Items and Testing Tool

This phase was devised into developing items and testing tool. Results in this phase showed item pool, measurement format and reliability.

### 2.1 Developing Items

Developing items were generating item pool, determine the format for measurement, and items validation by seven experts, pilot-testing and item improvement.

**Generated Item Pool**

In our estimation from qualitative method, there were 10 themes as 10 initial domains of dengue community capacity for sustainability of community-based interventions. Generating item pool step, it would not be unusual to begin with a pool of items that should develop pool because the initial pool may be as small as 50% larger than the final scale [51]. Then there were several items of assessments were divided by community capacity items into two data sets: 10 domains (249 items) in the leaders group and 10 domains (243 items) non-leaders group.

### Determining the Format for Measurement

It was determined to use a 5-point rating scale: 1(the least ability), 2(less ability), 3(moderate ability), 4(more ability) and 5(the most ability) because this scale was easy for the general population to use.

### Items Validation by Seven Experts Review Panel

This step used seven experts to confirm items for initial content validity. The seven experts had different experience in the dengue field ranging from the academic to the practical to community based intervention programs. Content validity concerns items sampling adequacy that their extents reflect a content domain [51]. This step devised a content validity index (CVI) based on the areas of agreement among the seven experts. The CVI is defined as the proportion of items given a rating of quite relevant and or very relevant by the majority of experts involved [89]. Seven experts were determined from several disciplines such as experts from dengue prevention and control in the community and dengue local policy, community capacity in health promotion, and instrument development. The process of analysis used a 4-point rating scale: (1) not relevant (2) somewhat relevant (3) quite relevant and (4) very relevant. The CVI was computed from the categories with the total number of responses divided by the number of experts. A CVI of 0.80 or above was acceptable [91, 92]. Moreover, face validity were confirmed by two leaders and two non-leaders reviewing the contents, questions and formatting while responding to ensure that the questions and instructions were free of ambiguities; to obtain comments on how to improve questionnaires. After content validity and face validity, the community capacity item for pilot-testing were 10 domains (227 items) in the leaders group (CVI=0.90) and 10 domains (221 items) in the non-leaders group (CVI=0.91).

### Reliability and Improved Items of Pilot-testing

Pilot-testing was applied in order to identify reliability steps needed to improve items and to select the appropriate items. Adequate sample of each group of population were 60 leaders and 60 non-leaders with the same characteristics as the study population. The study area was a high dengue incidence sub-district in Nakhorn Si Thammarat province by purposive sampling sub-district as study setting areas.

Participants in the pilot-testing were asked to critically analyze each question for clarity, format and wording, as follows:

1) Researcher introduces herself and presents the objective of the study to the dengue community capacity representative.

2) The research was three research assistants, a health care worker and two village health volunteers, trained by the researcher for assistance in collecting data and explaining the objectives of this study.

3) Informed consent solicited at the time of the first meeting.

**The Results of Pilot-testing**

The characteristics of all 60 leaders and 60 non-leaders were more than half participants were female (65.0%, 81.7%). A large majority of leaders and non-leaders (68.3%, 58.3%) was Buddhist. 78.3% and 61.7% were married. 40% and 63.3% had an elementary level education. Business and unskilled laborer were almost occupation of leaders group (30.0%), whereas business was the main occupation of non-leaders (38.3%).

Almost position in community of leaders group was village health volunteer (51.6%). For non-leaders group, 100% were villagers that no position in the community involved dengue situation. The participants had received information concerning dengue prevention and control in the last 12 months in leaders (55%), and non-leaders (30%). Almost half, 65.0%, of the leaders had experience with the illness, mostly with an experience from neighbor (45%). In other hand half of non-leaders group had experience (50%) and almost via from neighbor.

The age of the leaders were average age of 45.93 years (SD=14.33) and non-leaders were average age 45.90 (SD=14.45). The average monthly family income of leaders was 12,670.49 baht (SD=29,128.19) and non-leaders was 12,765.00 Baht (29,364.56). The leaders had lived in the community an averaged of 36.84 years (SD=18.37) and non-leaders had lived in the community an averaged of 36.65 years (SD=18.46). Dengue education time of leaders in the past 12 months had average 0.57 time (SD=1.07) and non-leaders had average 0.58 time (SD=1.07). The detail of characteristics of leaders and non-leaders in pilot-testing showed in Appendix E.

The results of this step showed reliability of tool. Table 6, the total items of leaders were 249 items pool. Based on CVI>0.91, the seven experts reduced the number of items in the leaders' group to 227. Pilot-testing results showed Cronbach alpha coefficient of ten domains from 0.78 to 0.93 and of a total 0.98. The researcher then deleted 45 items and revised by integrating and referring to other domains 182 items in the leaders' group. The new Cronbach alpha coefficient reliability of 10 domains was from 0.79 to 0.93 and of total 0.98.

Table 7, the total items of non-leaders were 243 items pool. Based on a CVI>0.91, the seven experts reduced the number of items in the non-leaders' group to 221. Pilot-testing, the researcher then deleted 55 items and revised by integrating and referring to other domains 167 items in the leaders' group. The new reliability of the non-leaders' group was a Cronbach alpha coefficient of 0.87 to 0.94 with a total of 0.97.

**Table** 6 The items pool, CVI and reliability before and after deleted items of leaders

| Domain of leaders | Items Pool | CVI after review by seven experts | Reliability by pilot- testing | Number of deleted and revised items | Number of Items after Improvement | New Reliability |
|---|---|---|---|---|---|---|
| 1. Stakeholders participation | 30 | 25 | .91 | -deleted 2 items | 23 | .91 |
| 2.Community leadership | 33 | 28 | .93 | -deleted 9 items | 19 | .93 |
| 3.  Core activities group | 12 | 12 | .80 | - none deleted | 12 | .80 |
| 4. Problem solving needs assessment | 19 | 17 | .92 | -none deleted | 17 | .92 |
| 5. Dengue information transfer | 26 | 25 | .92 | -deleted 2 | 23 | .92 |
| 6. Resource mobilization | 15 | 15 | .84 | -none deleted | 15 | .84 |
| 7. Sense of community for dengue problem | 15 | 12 | .79 | -none deleted | 12 | .79 |
| 8. Dengue network partnership | 36 | 34 | .91 | -deleted 10 items | 24 | .90 |
| 9. Critical dengue situation management | 33 | 31 | .93 | -deleted 15 items | 21 | .91 |
| 10. Continuing dengue prevention and control activities | 30 | 28 | .93 | -deleted 12 items | 16 | .91 |
| **Total** | **249** | **227** | **.98** | **Total deleted 45 items** | **182** | **.98** |

**Table** 7 The items pool, CVI and reliability before and after deleted items of non-leaders

| Qualitative domain of non-leaders | Items Pool | CVI after review by seven experts | Reliability by pilot- testing | Number of deleted and revised items | Number of Items after Improvement | New Reliability |
|---|---|---|---|---|---|---|
| 1. Stakeholders participation | 30 | 26 | .87 | | 21 | .87 |
| | | | | - deleted  5 items | | |
| 2.Community leadership | 29 | 28 | .91 | | 18 | .92 |
| | | | | - deleted 10 items | | |
| 3.  Core activities group | 12 | 12 | .81 | -none deleted | 12 | .81 |
| 4. Problem solving needs assessment | 19 | 17 | .94 | -none deleted | 17 | .94 |
| 5. Dengue information transfer | | | | -none deleted | | |
| | 26 | 25 | .92 | | 25 | .92 |
| 6. Resource mobilization | | | | | | |
| | 15 | 13 | .90 | -none deleted | 13 | .90 |
| 7. Sense of community for dengue problem | 14 | 12 | .81 | -none deleted | 12 | .81 |
| 8. Dengue network partnership | 36 | 30 | .93 | | 12 | .90 |
| | | | | -deleted  18 items | | |
| 9. Critical dengue situation management | 38 | 36 | .92 | | 20 | .88 |
| | | | | -deleted 16 items | | |
| 10. Continuing dengue prevention and control activities | 24 | 22 | .92 | -deleted 5 items | 17 | .90 |
| **Total** | **243** | **221** | **.98** | **Total deleted 55 items** | **167** | **.97** |

**2.2 Testing Tool for Construct Validity**

The objective of testing tool was a verified construct validity computed by the factor analysis technique. This step consisted of applying questionnaires to 5-10 participants per item using 8 sub-districts of 8 provinces of dengue high risk in southern Thailand. The data analyzed by factors analysis technique for construct validity.

**Sample**

Sample of the testing tool was divided into leaders and non-leaders in each sub-district.

1. Leaders group. The leaders group refers to the capacity of building and delivering dengue community capacity groups. They are actively activities of dengue prevention and control and accepted as community leaders from almost people in community. They activities are presenting in community such as situation dengue assessment, leading other persons, communication of dengue information, participating dengue activities, supporting resources and networking. Leaders group consisted of representatives of formal and informal position i.e. local administrative organizations (LAO) members, health care workers, school health teachers, community leaders, religious leaders, village health volunteers, students, community club members. The group is required to have resided in the community for more than one year, to be 18 or older, to be fluent in Thai, and to be available for this study.

2. Non-leaders Group. The non-leaders group refers to the ability of sustainable dengue prevention and control activities group. The participants in this group were representatives of households in the community, meaning they were involved with dengue prevention and control activities for their householdsas and community. The group is required to have resided in the community for more than one year, to be 18 or older, to be fluent in Thai, and to be available for this study.

**Sample Size**

The researcher estimated the sample size from the total households in the community and, based on the number of items. A number of samples depend on number of items of tool. Moreover, Nunnally, 1978 [51] point out the easily rule of ten suggested that number of participants should be at least 10 participants per each item of tool. One suggestion proposes 5 to 10 participants per item up to 300 participants who associated with a study uses 200 participants per 40 items and the large participants is excellent, they suggest that a participant of 100 as poor, 200 as fair, 300 as good, 500 as very good and 1,000 as excellent [51].

According to the ratio of participants per item used at least 5 participants per item, the items of leaders were 182 items, the participants for testing tool were at least 910 leaders and 167 items of the participants for testing tool were at least 835 non-leaders. The study used 6-8 participants per item. Then the total of questionnaires was distributed 1,092 questionnaires to leaders group (6 leaders per item) and 1,350 questionnaires to non-leaders group (8 non-leaders per item). The ranges of questionnaires per sub-district were divided into leaders 100 to 140 sets and non-leaders 100 to 150 sets. These the sample size were associated with the criteria of

number participants in community at least 100 participants per community by the dengue surveillance of WHO [2].

**Data Collection**

The purposive sampling technique was covering 8 provinces in setting study areas. The target sub-districts were selected a sub-districts per province followed by criteria i.e. high risk dengue incidence in past 5 years, having dengue prevention and control activities and welling to participate in this study. Then, there were 8 sub-district's name from 8 the medical official of province. The researcher was conducting as followed:

-The researcher confirmed 8 sub-district's criteria by telephone with the local administrative organization and health care center of each sub-district.

-The covering letters were sent for available collecting data to the 8 medical officials of 8 provinces, 8 local administrative organization and the 13 health care centers of 8 sub-districts.

-The researcher visited 8 sub-districts in order to introduce and present the objectives to representatives of a sub-district to understand the study consisted of representative of local administrative organization officers, community leaders, health care centers, VHVs, and community committees' members.

-The researcher discussed with health care worker in order to estimate the number of leaders and non-leaders group in each sub-district based on context of community.

- The researcher met two research assistants in a sub-district (A health care worker per health center and head of village health volunteers) for assistance in collecting data and sent back data to researcher.

- The researcher met and trained about collecting data method to 6 to 8 village health volunteers per a health center.  In case of some a sub-district was two health centers the researcher was separated meeting group because it was available time.

- Informed consent was obtained at the first session before colleted data of leaders and non-leaders.

**Data Analysis of Constructs Validity**

Factor analysis was used for construct validity. Factor analysis is a tool that can help the researcher determine empirically how many constructs, latent variables, or other factors underline a set of items. It is an essential scale development. The concept consisted of extracting factors, rotation of factors and interpreting factors [51].

In this study, quantitative data were analyzed by the Statistical Package for Social Sciences version 11.5 (SPSS). The purpose of the analysis was to examine the differences in  responses of  the leaders and non-leaders groups The Kaiser Meyer Olkin (KMO) test and Bartlett's test of Shericity determined that the sample and correlation matrix were satisfactory for factor analysis [51, 91].   Factor analysis technique for construct validity, factor analysis is tool that can help the researcher determine empirically how many constructs, or latent variables, or factors underline a set of items. It is an essential tool or scale development. The concept consist of

extracting factors, rotation of factors and interpreting factors [51]. Using Exploratory Factor Analysis (EFA) is a method of extracting factors in order to examine relationships among related variables. For rotating factors, the researcher used Varimax rotating because the technique reduces the item pool, factor loadings 0.5 and Eigenvalue > 2 were minimum acceptable for both groups. Because the study was interested in items that represented only one factor, items with multiple factor loadings were removed during the process of Factor Analysis.

Cronbach alpha coefficient was used to assess the internal consistency of items within scale reliability. The ranges of reliability research as follows: unacceptable, below 0.60; undesirable, between 0.60-0.65; minimally acceptable, between 0.65-0.70; respectable, between 0.70-0.80; very good, between 0.80-0.90; and 0.90 and above, excellent the researcher should consider cutting the scale [51].

### Compile and Name the Domain

Compile and name the domain of dengue community capacity and new domains appropriated to the current dengue domains from factor analysis.

In conclusion, after applying the qualitative method and an expert review process, there will be an appropriate integration of dengue community capacity domains. Then, the domains the domains generated an item pool that was confirmed by seven experts who had varied experience in dengue prevention and control, instrument development, community intervention, and epidemiology. The final results of this phase presented the reliability of items of all domains in the leaders' and non-leaders' groups.

## Phase III: The Application of Using Tool

The application of the new assessment tool was an important. The study phase was to define the application of a Dengue Community Capacity-Assessment tool (DCCAT) of sustainable community-based practice guideline. The study design used a community participation approach in a village in Southern Thailand. This phase consisted of community preparation step and collecting data and data analysis step, and summary of using the guidelines step.

### Community Preparation Step

In the community preparation step, there were setting area, determining sample size, integrating tool with entomological survey, and collecting data team.

1. Setting Area.
The researcher initially discussed the dengue problem and possible solutions with community stakeholders such as health care…and the local administrative organization representative. A high dengue incidence village of the sub-district was indicated for study. The researcher was confirming morbidity and mortality rate of

dengue from the health care center statistics and the medical official of Nakhorn Si Thammarat province. The high dengue incidence village consisted of 473 households, a temple, a primary school, a mosque and two staff members of the local administrative organization. In the assessment step, the community leaders group appointed a team for gathering data.

2. Determining Sample Size

A village was selected using criteria including the identification of having a dengue problem in the village for five years, having dengue prevention and control activities and being willing to participate in this study. Sample size was estimated based on two groups of village community members: Group 1: The leaders' group; Group 2: The non-leaders group.

1.1 The leaders group consisted of representatives with delivery and building capacities and representatives of LAO and school, community, and religious leaders who had resided in the community for more than one year, were at least 20 years old, were fluent in Thai and were available for this study.

1.2 The non-leaders' group consisted of representatives who were the family health leader of each household in the community and who were able to sustain dengue prevention programs and who were also willing to serve as part of a control group [2]. The sample size of each group was determined by the size of the village. Only the non-leaders group served in a larval indices survey. If A village is a large community is > 300 households, using 10% and use simple random sampling or 100 households [2]. Then the study was selected at least 100 households in non-leaders group and 30 leaders group by purposive technique.

3. Integrating Tool with Entomological Surveys

According to the conceptual of sustainability community-based prevention and control necessitates the conducting of dengue interventions, *e.g.,* 1) community capacity, 2) positive dengue prevention and control behavior are observing from routine entomological surveys (larval indices) assessed by the Bretaeu Index (BI), the House Index (HI) and the Container Index (CI), 3) community environment survey and 4) an epidemiology index in regards to morbidity and mortality rates as long-term outcome, the dengue community capacity was as a part of process and outcome sustainable community-based dengue control. The assessment tool was necessary to use not only the community capacity assessment tool but also three other important survey tools to assess the capacity of the community: the larval indices survey form, the Household environment observation form and the reported morbidity and mortality rates. The DCCAT was composed of four parts as follows:

Part I: General characteristics. This part included questions about the responder's address, gender, age, education level, family income per month, occupation, time living in the community, dengue illness experience, dengue information acquired in the previous year, and time of staying in community's position.

Part II: The Dengue Community Capacity-Assessment Tool (DCCAT) provided questionnaires for the dengue community capacity of leader and the dengue community capacity of non-leaders.

Part III: Household environment observation Form with open ended questions and a guide for observers of dengue prevention controls such as the covering of water containers. Temephos (Abate) sand granules in large water containers, and the destruction of probably mosquito breeding sites.

Part IV: Larval indices survey form, the old form of entomological vector surveillance. A larval survey was undertaken to examine the vectors density levels. The House Index (HI) and Breteau Index (BI) and Container Index (CI) were calculated to indicate the dengue density.

Moreover, five years of supporting data on morbidity and mortality rates and dengue prevention and control projects and activities was collected. The secondary data form was sent to the health care center and the local administrative organization.

4. Collecting Data Team. The researcher established a data collection team which consisted of 15 village health volunteers, who were involved in dengue prevention and control activities, available participation in the study. In addition, they have been taken dengue activities and responsibility of health care in 15-20 households in community. The people were the partners of a village health volunteer for making dengue prevention and control activities. Then 15 village health volunteers were trained by researcher team for collecting data.

**Assessment of Data Collection Step**

The researcher collected data in a village in Nakhorn Si Thammarat Province. The steps were as follows:

1. Researcher introduced herself and presented the objective of the study to community council representatives.

2. Researcher met health care workers and key VHVs for assistance in collecting data and making the objective of this study understood.

3. The informed consent of the participants was obtained at the first session.

4. Collecting data of leaders and non-leaders group used purposive technique. The representatives of this leaders group were assigned by health care workers in community based on these criteria. Non-leaders group was assigned by VHVs based on criteria and cover village areas.

**Data analysis**

This step was followed by the measurements in order to evaluate sustainable community-base dengue prevention and control. The descriptive and inferential statistics were used in this study such as percentage, mean, median, range and standard deviation were used describe general characteristics of leaders and non-leaders group, and environment characteristics.

    1. The Dengue Community Capacity-Assessment Tool

The community capacity of leaders consisted of 115 items in 14-domains. The possible overall mean scores and cut of point were categorized into five levels as follows: ranged from 0- 575 scores and categorized into five levels were ranking with scores 0-115 scores as very low, 116-230 as low, 231-345 as moderate, 346-460 as high and 461-575 as very high as indicated in Table 8 .

**Table** 8 Possible score and cut-off point of community capacity level of leaders

| Domain | Domain label | Item | Mean Scores | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | | Very low | Low | Mod-erate | High | Very high |
| L1 | Critical situation management | 9 | 0-9 | 10-18 | 19-27 | 28-36 | 37-45 |
| L2 | Personal leadership | 12 | 0-12 | 13-24 | 25-36 | 37-48 | 49-60 |
| L3 | Health care provider capacity | 8 | 0-8 | 9-16 | 17-24 | 25-32 | 33-40 |
| L4 | Needs assessment | 8 | 0-8 | 9-16 | 17-24 | 25-32 | 33-40 |
| L5 | Sense of community | 11 | 0-11 | 12-22 | 23-33 | 34-44 | 45-55 |
| L6 | Leader group networking | 11 | 0-11 | 12-22 | 23-33 | 34-44 | 45-55 |
| L7 | Communication of dengue information | 10 | 0-10 | 11-20 | 21-30 | 31-40 | 41-50 |
| L8 | Community leadership | 8 | 0-8 | 9-16 | 17-24 | 25-32 | 33-40 |
| L9 | Religious leader capacity | 9 | 0-9 | 10-18 | 19-27 | 28-36 | 37-45 |
| L10 | Community and leader group networking | 7 | 0-7 | 8-14 | 15-21 | 22-28 | 29-35 |
| L11 | Resources mobilization | 4 | 0-4 | 5-8 | 9-12 | 13-16 | 17-20 |
| L12 | Dengue working group | 6 | 0-6 | 7-14 | 15-18 | 19-24 | 25-30 |
| L13 | Community participation | 6 | 0-6 | 7-14 | 15-18 | 19-24 | 25-30 |
| L14 | Continuing activities | 6 | 0-6 | 7-14 | 15-18 | 19-24 | 25-30 |
| | **Total** | **115** | **0-115** | **116-230** | **231-345** | **346-460** | **461-575** |

Community capacity was analyzed with descriptive statistics and divided by domain for both groups. The dengue community capacity-assessment tool of non-leaders consisted of 83 items divided among 11 domains. The possible mean score and cut off point overall scores were categorized into five levels with  scores 0-83 ranked as very low, 84-166 as low, 167-249 as moderate, 250-332 as high and 333-415 as very high dengue community capacity as in Table 9.

**Table** 9 Scores and cut-off points of community capacity levels of non- leaders

| Domain | Domain label | Item | Mean scores | | | | |
|--------|--------------|------|-------------|------|------|------|------|
| | | | Very low | Low | Mod-erate | High | Very high |
| NL1 | Critical situation management | 13 | 0-13 | 14-26 | 27-39 | 40-52 | 53-65 |
| NL2 | Personal leadership | 8 | 0-8 | 9-16 | 17-24 | 25-32 | 33-40 |
| NL3 | Religious leader capacity | 10 | 0-10 | 11-20 | 21-30 | 31-40 | 41-50 |
| NL4 | Community leadership | 8 | 0-8 | 9-16 | 17-24 | 25-32 | 33-40 |
| NL5 | Health care provider capacity | 6 | 0-6 | 7-14 | 15-18 | 19-24 | 25-30 |
| NL6 | Sense of community | 8 | 0-8 | 9-16 | 17-24 | 25-32 | 33-40 |
| NL7 | Communication of dengue information | 7 | 0-7 | 8-14 | 15-21 | 22-28 | 29-35 |
| NL8 | Continuing activities | 6 | 0-6 | 7-14 | 15-18 | 19-24 | 25-30 |
| NL9 | Dengue working group | 7 | 0-7 | 8-14 | 15-21 | 22-28 | 29-35 |
| NL10 | Resources mobilization | 5 | 0-5 | 6-10 | 11-15 | 16-20 | 21-25 |
| NL 11 | Needs assessment | 4 | 0-4 | 5-8 | 9-12 | 13-16 | 17-20 |
| | **Total** | **83** | **0-83** | **84-166** | **167-249** | **250-332** | **333-415** |

2. Larval Indices

Vector surveillance was important in determining the distribution, population density, major larval habitat, spatial and temporal risk factors related to dengue transmission, and levels of insecticide susceptibility or resistance[2]. Standard larval surveys [48] as epidemiologic indicators of dengue transmission should be viewed with caution. The larval indices involved three traditional indicators, the Breteau index, the House index, and the Container index. The indexes were calculated as follows: House index (HI): percentage of houses infested with larvae and/or pupae, Container index (CI): percentage of water-holding containers infested with larvae or pupae and Breteau index (BI): number of positive containers per 100 houses inspected. The guideline of larval indices to evaluate low risk is according to the

Breteau Index (BI) <5, the House Index (HI) <10 and the Container Index (CI) <1 (Ministry of Public Health, 2007).

<u>3. Morbidity rate and mortality rate</u>

Data analyzed from the number of dengue case in super 100,000 population as morbidity rate and the ratio of deaths to total dengue cases determined the mortality rate. The Ministry of public Health stated that the morbidity rate should not exceed 20 cases per 100,000 people and the mortality rate should not exceed 0.2% (The 9th Health Care Plan in the 9th National Social and Economic Development Plan 2002-2006).

Summary, the last step was summary and improvement assessment tool. The researcher summarized all four data sources, and obstacles and limitations to the application process. The information concerning the assessment tool findings and the associated indicators of sustainable community-based dengue prevention and control data was confirmed by three experts. Moreover, the final step provided guidelines for the implementing the assessment tool.

### Summary of Using the Guidelines Step

The step was meeting for discussion among collecting data team, supporting team and stakeholders. The results of collecting data can use in this step as data based for planning and setting strategies dengue prevention and control. Plan and implement of dengue prevention and control and reassessment were offered in this step.

### Protection of the Subjects' Human Rights

The research protocol was submitted to the Ethical Committee of Chulalongkorn University. Permission to carry it out was obtained from the Provincial Chief Medical Officer of 8 provinces in the Southern Region of Thailand. Written informed consent for in-depth interviews, focus group discussions and questionnaires were obtained from community representatives and participants. Collected data was used only for the purposes of this study. No permanent record of participants' names pr other identifying was made. All information obtained during the collection of data was, and will remain, confidential.

In summary, the objective of this study was to develop and test a tool to assess community capacity of sustainable community-based dengue prevention and control. There were three phases: domains, developing items and testing and using the assessment tool [51, 80].

The first phase was to define meaning and themes of dengue community capacity domains by qualitative method. This phase consisted of literature review, the field study of qualitative methods, content analysis by the researcher and the review of the phase results by three experts. Data was collected in four sub-districts. In each sub-district, there were two focus group discussions of 15 non-leaders (seven to eight participants per group) and In-depth interviews with 15 leaders. Results of the first phase were expected meaning and themes of dengue community capacity based-on local community in Southern Thailand.

The second phase consisted of developing items and testing the assessment tool by the quantitative method. There was a generated item pool evaluated on a five point rating scale which was validated by seven experts. Additionally, there was pilot-testing and item improvement. The participants included 60 leaders and 60 non-leaders who had the same characteristics as the overall population in this study.   The data was analyzed for construct validity by the Factor Analysis technique.

The third phase was the application of a new assessment tool by the participatory approach. The purpose of this phase was to define possible practiced guidelines in final study. It was conducted on a high dengue incidence village in a sub-district in Nakhon Si Thammarat province. The phase was compound three steps, community preparation, assessment and community hearing meeting.

The study was divided into three phases as shown in Figure 4 below:

**Figure** 4 The process of developing and testing a tool to assess community capacity of sustainable community-based dengue prevention and control



| Literature Reviews | Content Analysis |

Generate an item pool, Leaders 258 items, Non-leaders 246 items

Testing tool for construct validity
- 8 sub-districts of 8 provinces in Southern Thailand
- Participants were 964 leaders and 1,248 non- leaders

Application of using assessment tool in a village in Southern Thailand; (32 leaders and 174 non-leaders)

Field study in 4-sub-districs

Focus group Discussion (60 non-leaders)

In depth interviews (60 leaders)

Secondary data

3 experts review panel

Meaning and themes of dengue community capacity

Determine 5-Rating scale for measurement format

Item content validity (CVI) by seven experts; Leaders 227 items, Non-leaders 221items

Pilot-testing for reliability Collecting data from 60 leaders and 60 non-leaders

Analysis and Item improvement; Leaders 182 items, Non-leaders 167 items

Analyzed by Factor analysis and item improvement,

-Leaders tool consisted of 14 domains (115 items),

-Non-leaders tool consisted of 11 domains (83-item)

Compile and name domains of two tools

Data analysis; Level of community capacity of leader and non-leaders

Summary of possible application of using assessment tools guideline

| Phase I: Defining meaning and themes by qualitative method (6 months: November 2007 to April, 2008) | Phase II: Developing items and testing assessment tool by quantitative method (7 months: May- November 2008) | Phase III: Application of new assessment tool by participation approach (5 months: December 2008-April, 2009) |

# CHAPTER IV

# RESULTS

The main purposes of this study were to develop, test, and apply a new tool to assess community capacity for sustainable community-based dengue prevention and control in Southern Thailand. This chapter consists of the results of the study followed by the process of developing and testing the new assessment tool. The research activities were carried out for 18 months from November 2007 to April 2009. The findings of this study were organized into three parts listed below:

Part I:    Characteristics of participants for testing tool
Part II:   The dengue community capacity-assessment tool (DCCAT) of leaders and non-leaders
Part III:  A practical guideline of using dengue community capacity-assessment tool (DCCAT)

## Part I:  Characteristics of Participants for Testing Tool

The 1,092 questionnaires for leaders and 1,350 questionnaires for non-leaders were distributed in eight sub-districts by the researcher. The researcher met health workers, local administrative organization officers, and village health volunteers to describe the research's objectives. Six to eight village health volunteers and two health workers working as facilitators were enlisted to send back data to the researcher. Two months later, 973 questionnaires of the leaders (92.7%) and 1,252 questionnaires of the non-leaders (89.1%) were returned. The questionnaires of 973 leaders, 9 incomplete of outlier, were 964 (88.27%) of leaders. The 1,252 questionnaires of non-leaders were 4 incomplete of outlier were 1,248 non-leaders. Thus in the final, the 964 (88.27% of 1,092) leaders and 1,248 (92.33% of 1,350) non-leaders were completed surveys which comprised the study sample.

## Characteristics of Leaders

Table 10 describes the demographic characteristics of all 964 leaders. A plurality of participants was from a sub-district of Pang Nga Province (15.4 %). More than half participants were female (61.1%). A large majority (82.1 %) was Buddhist and 80% were married. 30% had an elementary (basic) level education. Farming was the main occupation of leaders (30.3%).

**Table** 10 Characteristics of leaders (*N*= 964)

| Characteristics of leaders | Frequency (n=964) | Percentage (%) |
|---|---|---|
| **Setting areas** | | |
| Nakhon Si Thammarat Province | 145 | 15.0 |
| Surat Thani  Province | 108 | 11.2 |
| Songkhla  Province | 107 | 11.1 |
| Trang  Province | 109 | 11.3 |
| Khabi  Province | 97 | 10.1 |
| Chumphon  Province | 115 | 11.9 |
| Ranong  Province | 135 | 14.0 |
| Pang Nga  Province | 148 | 15.4 |
| **Gender** | | |
| Male | 375 | 38.9 |
| Female | 589 | 61.1 |
| **Religion** | | |
| Buddhist | 791 | 82.1 |
| Muslim | 173 | 17.9 |
| **Marital status** | | |
| Single | 106 | 11.0 |
| Married | 771 | 80.0 |
| Widowed, Divorced, Separated | 87 | 9.0 |
| **Education level** | | |
| No education | 11 | 1.1 |
| Elementary (Basic) | 296 | 30.7 |
| Elementary (High) | 222 | 23.0 |
| Junior high school | 141 | 14.6 |
| Senior high school | 125 | 13.0 |
| Diploma (Basic) | 28 | 2.9 |
| Diploma (High) | 36 | 3.7 |
| Bachelor degree | 96 | 10.0 |
| Master degree | 9 | 0.9 |
| **Occupation** | | |
| Farming | 292 | 30.3 |
| Business | 162 | 16.8 |
| Government officer | 85 | 8.8 |
| Unemployed | 18 | 1.9 |
| Unskilled laborer | 216 | 22.4 |
| Housewife | 139 | 14.4 |
| Fisherman | 28 | 2.9 |
| Student | 13 | 1.3 |
| Other | 11 | 1.1 |

As illustrated in the table below, Almost position in community were village health volunteer and community club member (34.3% and 33.0%), 56.8% of the participants had received information concerning dengue prevention and control in the last 12 months. Almost half, 48.8%, of the participants had experience with the illness itself, mostly with an infected neighbor. However some leader may be more than one position in community and several channel of dengue illness experience.

**Table** 10 Characteristics of leaders (*N*= 964) *(Cont.)*

| Characteristics of Leaders | Frequency (n=964) | Percentage (%) |
|---|---|---|
| **Position in community** *(more than a position)* | | |
| Community committee | 193 | 20.0 |
| Local Administrative Organization member | 83 | 8.6 |
| Community leader | 104 | 10.8 |
| Religious leader | 27 | 2.8 |
| Community club member | 318 | 33.0 |
| Village Health Volunteer | 331 | 34.3 |
| Teacher | 44 | 4.6 |
| Health worker | 8 | 0.8 |
| Other | 4 | 0.4 |
| **Receiving dengue knowledge in past 12 months** | | |
| Have | 548 | 56.8 |
| **Having dengue illness experience** | | |
| Have | 470 | 48.8 |
| **Having dengue illness experience** *(more than a answer)* | | |
| Themselves | 25 | 2.6 |
| Family member | 121 | 12.6 |
| Neighbor | 338 | 35.1 |
| Other | 13 | 1.3 |

As shown in Table 11, the age of the leaders ranged from 18 to 80 years old, with an average age of 44.2 years (SD=10.7). The average monthly family income was 10,493.4 baht (SD=11,071.7). They had lived in the community an averaged of 34.51 years (SD=16.26) in the community. Dengue education time in the past 12 months had average 1.66 time (SD=2.8).

**Table** 11 Mean, Standard Deviations (SD), Minimum (Min) and Maximum (Max) scores of leaders

| Characteristics of Leaders | Mean | SD | Min | Max |
|---|---|---|---|---|
| Age (yrs.) | 44.2 | 10.7 | 18 | 80 |
| Family monthly income (Baht) | 10,493.4 | 11,071.7 | 0 | 100,000 |
| Length of time residing in the community (yrs.) | 34.5 | 16.3 | 1 | 80 |
| Dengue education time in past 12 months (time) | 1.7 | 2.8 | 0 | 12 |

**Characteristics of Non-Leaders**

Table 12 describes the demographic characteristics of all 1,248 non-leaders. A plurality of the participants was from a sub-district of Nakhon Si Thammarat Province (15.6%). Very slightly under two thirds of the participants were female (66.5%), and a large majority (82.5%) were Buddhist.

Most participants (34.4%) had an elementary (Basic) level education. 28.8% were unskilled laborers. The participant's receiving knowledge of dengue prevention and control in last 12 months were (28%) and dengue experience illness (36.2%). The large group of participants' dengue experience was neighborhood (24.1%).

**Table** 12 Characteristics of non-leaders (*N*=1,248) *(Cont.)*

| Characteristics of Non-leaders | Frequency (n=1,248) | Percentage (%) |
|---|---|---|
| **Setting areas** | | |
| Nakhon Si Thammarat Province | 195 | 15.6 |
| Surat Thani  Province | 182 | 14.6 |
| Songkhla  Province | 191 | 15.3 |
| Trang  Province | 129 | 10.3 |
| Khabi  Province | 148 | 11.9 |
| Chumphon  Province | 127 | 10.2 |
| Ranong  Province | 129 | 10.3 |
| Pang Nga  Province | 147 | 11.8 |
| **Gender** | | |
| Male | 418 | 33.5 |
| Female | 830 | 66.5 |
| **Religion** | | |
| Buddhist | 1029 | 82.5 |
| Muslim | 219 | 17.5 |
| **Marital status** | | |
| Single | 177 | 14.2 |
| Married | 954 | 76.4 |
| Windowed, Divorced, Separated | 117 | 9.4 |
| **Education level** | | |
| Non | 28 | 2.2 |
| Elementary (Basic) | 429 | 34.4 |
| Elementary (High) | 258 | 20.7 |
| Junior high school | 199 | 15.9 |
| Senior high school | 118 | 9.5 |
| Diploma (Basic) | 45 | 3.6 |
| Diploma (High) | 59 | 4.7 |
| Bachelor degree | 110 | 8.8 |
| Master degree | 2 | 0.2 |

**Table** 12 Characteristics of non-leaders (*N*=1,248) *(Cont.)*

| Characteristics of Non-leaders | Frequency (n=1,248) | Percentage (%) |
|---|---|---|
| **Occupation** | | |
| Farming | 318 | 25.5 |
| Business | 183 | 14.7 |
| Gov. officer | 57 | 4.6 |
| Unemployed | 47 | 3.8 |
| Unskilled laborer | 360 | 28.8 |
| Housewife | 189 | 15.1 |
| Fisherman | 41 | 3.3 |
| Student | 47 | 3.8 |
| Other | 6 | 0.5 |
| **Receiving knowledge of dengue in part 12 months** | | |
| Have | 349 | 28 |
| **Dengue experience illness** | | |
| Have | 452 | 36.2 |
| **Having dengue experience illness** *(more than a answer)* | | |
| Themselves | 43 | 3.4 |
| Family member | 113 | 9.1 |
| Neighbor | 301 | 24.1 |
| Other | 9 | 0.7 |

As shown in Table 13, the age of the participants ranged from 18 to 80 years old, with an average age of 43.3 years (SD = 13.5). They had lived an average of 32.5 years (SD=17.9) in community. Dengue education time in the past 12 months had averaged .3 time (SD=0.4).

**Table** 13 Mean, Standard Deviations (SD), Minimum (Min) and Maximum (Max) scores of non-leaders *(N= 1,248)*

| Characteristics of Non-leaders | Mean | SD | Min | Max |
|---|---|---|---|---|
| Age (yrs.) | 43.3 | 13.5 | 18 | 80 |
| Family monthly income (Baht) | 9,285.3 | 9,359.3 | 0 | 95,000 |
| Length of time residing in the community (yrs.) | 32.5 | 17.9 | 0 | 80 |
| Dengue education time in past 12 months (time) | 0.3 | 0.4 | 0 | 1 |

**Part II: The Dengue Community Capacity-Assessment Tool (DCCAT) of Leaders and Non-leaders**

The dengue community capacity-assessment tool (DCCAT) was the results of developing and testing tool. A new assessment tool of community capacity of sustainable community-based dengue prevention and control was divided into two sets: leaders and non-leaders

**Dengue Community Capacity-Assessment Tool (DCCAT) of Leaders**

The correlation matrix of the leader's group assessment tool (182-item) was examined in order to gather rough information as to whether it was appropriate to use factor analysis with the data set. Kerlinger (1986) has suggested that a suitable data set for factor analysis is one in which the correlation matrix contains several sizes of correlations and many of the correlations exceed 0.30-0.70 (Fleury, 1998).

Before factor analysis was carried out, three assumptions of data are *Kaisor-Meyer-Olkin (KMO) and* Bartlett's test of Sphericity and communality.

A KMO value > 0.90 is considered an excellent indication for using factor analysis. According the criteria, Kaisor-Meyer-Olkin (KMO) and Bartlett's test of Sphericity test were used to measure the sampling adequacy. The results showed the KMO value was 0.964 and the significance of Bartlett's test of Sphericity test was 0.000 ($x^2$ = 146087.61, df =16471, p=0.000). 115 items within 14 domains produced the best fit. All 14 domains together explained 57.58% of the variance. For communality, a measure of how the variability in a given variable is explained by all the factors in the analysis ranged from 0.498 to 0.828. Thus, the items had very acceptable communalities with a value greater than 0.20.

When the principle components analysis was initially performed on the leaders, 14 domains (factors) with Eigenvalues of 2 or greater emerged and were acceptable. The Scree test was also based on Eigenvalues that point out 14 domains met the elbow of the Scree plot as shown in Figure 5.

**Figure** 5   Scree plot of dengue community capacity of leaders
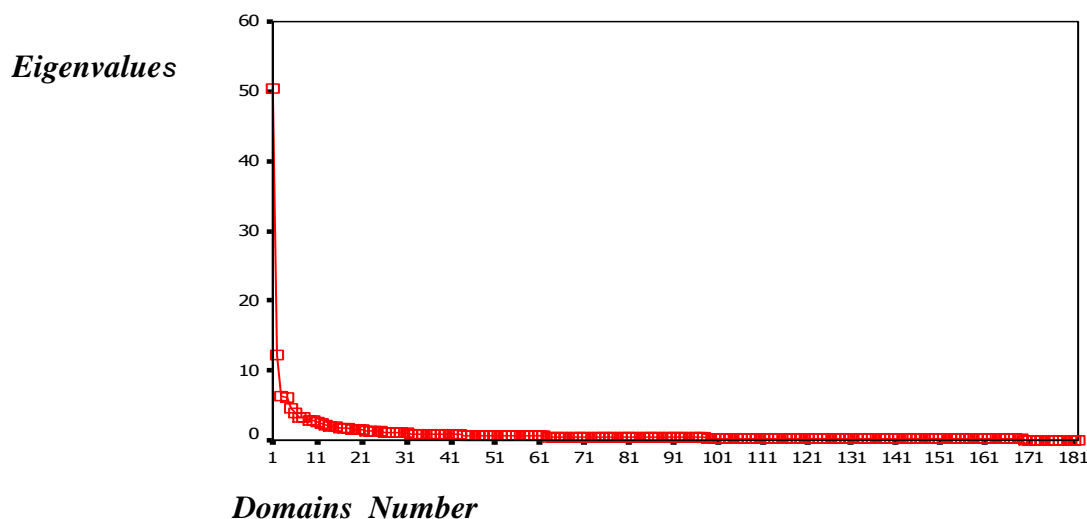
The final domain solution is presented in Table 13.  Factor analysis yielded 115 items within 14 domains producing the best fit. Initial Eigenvalue for the domains ranged from 2.06 to 50.39, % of the variance was 27.68 and communality % indicated 14 domains together explaining 57.58% of the variance and a Conbrach's alpha coefficient of .97. The 14 domains (L) of the dengue community capacity-assessment tool of leaders were:

### 1. Critical situation management domain (L1)

This domain consisted of nine items with factor loadings ranging from 0.579-0.788, and accounted for 27.68 % of variance with an Eigenvalue of 50.39 as showed in Table 14. An examination of the item content, as shown in Table 19 (P: 94), related that these items focused on a pattern of dengue prevention and control that quickly activities of leaders. The domain was compiled and named "Critical situation management". When analyzed individually, it revealed that all items can be included in one domain with a total variance of 27.68%.

### 2. Personal leadership domain (L2)

This domain included 12 items with factor loadings ranging from 0.503-0.747, and accounting for 6.66 % of variance with an Eigenvalue of 12.12 as showed in Table 14. An examination of the item content, as shown in Table 20 (P: 96), shows that these items focused on the individual's perception of their activities to prevent and control dengue. The domain was compiled and labeled as "Personal leadership". When analyzed individually, it revealed that all 12 items can be included in one domain, with a total variance of 34.35 %.

### 3. Health care provider capacity domain (L3)

This domain consisted of eight items with factor loadings ranging from 0.528-0.662, and accounting for 3.43 % of variance with an Eigenvalue of 6.25 as showed in Table 14. An examination of the item content, as shown in Table 23 (P::102), reveals that these items focused on dengue prevention and control activities of health care workers and village health volunteers.   The domain was compiled and labeled as "Health care provider capacity" When analyzed individually, it revealed that all eight items can be included in one domain, with a total variance of 37.78 %.

### 4. Needs assessment domain (L4)

This domain consisted of eight items with factor loadings ranging from 0.532-0.755, and accounting for 3.30 % of variance with an Eigenvalue of 6.01 as showed in Table 14. An examination of the item content, as shown in Table 29 (P: 115), shows that these items focused on representatives of the local administrative organization as a center for receiving dengue problem and solution needs. The domain was compiled and labeled as "Needs assessment". When analyzed individually, it revealed that all eight items can be included in one domain with a total variance of 41.09 %.

### 5. Senses of community domain (L5)

This domain included 11 items with factor loadings ranging from 0.615-0.732, and accounting for 2.48 % of variance with an Eigenvalue of 4.52 as showed in Table 14. An examination of the item content, as shown in Table 24 (P: 104),

reveals that these items focused on the perception of dengue as a problem for the leaders in the community. The domain was compiled and labeled as "Senses of community". When analyzed individually, it revealed that all 11 items can be included in one domain with a total variance of 43.57 %.

### 6. Leader group networking domain (L6)

This domain included 11 items with factor loadings ranging from 0.507-0.696, and accounting for 2.18% of variance with an Eigenvalue of 3.97 as showed in Table 14. An examination of the item content, as shown in Table 30 (P: 117), shows that these items focused on dengue prevention and control networking among community leaders. The domain was compiled and labeled as "Leader group networking". When analyzed individually, it revealed that all 11 items can be included in one domain with a total variance of 45.75%.

### 7. Communication of dengue information domain (L7)

This domain contained 10 items with factor loadings ranging from 0.504-0.707, and accounting for 1.82% of variance with an Eigenvalue of 3.32 as showed in Table 14. An examination of the item content, as shown in Table 25 (P: 106), reveals that these items focused on channels of and resources for receiving dengue information. The domain was compiled and labeled as "Communication of dengue information". When analyzed individually, it revealed that all 10 items can be included in one domain with a total variance of 47.58%.

### 8. Community leadership domain (L8)

This domain contained eight items with factor loadings ranging from 0.545-0.730, and accounting for 1.77% of variance with an Eigenvalue of 3.23 as showed in Table 14. An examination of the item content, as shown in Table 22 (P: 100), shows that these items focused on how community members perceive dengue prevention and control as their responsibilities. The domain was compiled and labeled as "Community leadership". When analyzed individually, it revealed that all eight items can be included in one domain with a total variance of 49.36%.

### 9. Religious leader capacity domain (L9)

This variance contained nine items with factor loadings ranging from 0.508-0.676, and accounting for 1.59% of variance with an Eigenvalue of 2.89 as showed in Table 14. An examination of the item content, as shown in Table 21 (P: 98), reveals that these items focused on capacity of imams and monks to take action concerning of dengue prevention and control. The domain was compiled and label as "Religious leader capacity". When analyzed individually, it revealed that all nine items can be included in one domain with a total variance of 50.95%.

### 10. Leader group and community networking domain (L10)

This variance contained seven items with factor loadings ranging from 0.572-0.699, and accounting for 1.54% of variance with an Eigenvalue of 2.81 as showed in Table 14. An examination of the item content, as shown in Table 31 (P: 118), shows that these items focused on dengue prevention and control networking between community members and leaders. The domain was compiled and labeled as "Leader

group and community networking*"*. When analyzed individually, it revealed that all seven items can be included in one domain with a total variance of 52.49%.

### 11. Resources mobilization domain (L11)

This variance contained four items with factor loadings ranging from 0.572-0.794, and accounting for 1.40% of variance with an Eigenvalue of 2.55 as showed in Table 14. An examination of the item content, as shown in Table 28 (P: 113), reveals that these items focused on the ability of community members to mobilize resources for dengue prevention and control. The domain was compiled and labeled as "Resources mobilization". When analyzed individually, it revealed that all four items can be included in one domain with a total variance of 53.90%.

### 12. Dengue working group domain (L12)

This domain contained six items with factor loadings ranging from 0.559-0.743, and accounting for 1.31 % of variance with an Eigenvalue of 2.38 as showed in Table 14. An examination of the item content, as shown in Table 27 (P: 111), shows that these items focused on community member group and representatives of organization in community are leaders group to prevent and control dengue disease. The domain was compiled and labeled as "Dengue working group". When analyzed individually, it revealed that all six items can be included in one domain with a total variance of 55.21%.

### 13. Community participation domain (L13)

This domain consisted of six items with factor loadings ranging from 0.506-0.745, and accounting for 1.23% of variance with an Eigenvalue of 2.24 as showed in Table 14. An examination of the item content, as showed in Table 32 (P: 119), reveals that these items focused on community leaders' participation in dengue prevention and control. The domain was compiled and labeled as "Community participation". When analyzed individually, it revealed that all six items can be included in one domain with a total variance of 56.44 %.

### 14. Continuing activities domain (L14)

This domain contained six items with factor loadings ranging from 0.508-0.553, and accounting for 1.13 % of variance with an Eigenvalue of 2.06 as showed in Table 14. An examination of the item content, as shown in Table 26 (P: 108), shows that these items focused on community labeled as "Continuing activities". When analyzed individually, it revealed that all six items can be included in one domain with a total variance of 57.58 %.

**Table** 14 Domains of dengue community capacity-assessment tool (DCCAT) of leaders

| Domain of DCCAT of leaders | Item | Factor loading | Eigenvalue | % of variance | Cum % |
|---|---|---|---|---|---|
| L1: Critical situation management | 9 | 0.579-0.788 | 50.39 | 27.68 | 27.68 |
| L2: Personal leadership | 12 | 0.503-0.747 | 12.12 | 6.66 | 34.35 |
| L3: Health care provider capacity | 8 | 0.528-0.662 | 6.25 | 3.43 | 37.78 |
| L4: Needs assessment | 8 | 0.532-0.755 | 6.01 | 3.30 | 41.09 |
| L5: Senses of community | 11 | 0.615-0.732 | 4.52 | 2.48 | 43.57 |
| L6: Leader group networking | 11 | 0.507-0.696 | 3.97 | 2.18 | 45.75 |
| L7: Communication of dengue information | 10 | 0.504-0.707 | 3.32 | 1.82 | 47.58 |
| L8: Community leadership | 8 | 0.545-0.730 | 3.23 | 1.77 | 49.36 |
| L9: Religious leader capacity | 9 | 0.508-0.676 | 2.89 | 1.59 | 50.95 |
| L10: Leader group and community networking | 7 | 0.572-0.699 | 2.81 | 1.54 | 52.49 |
| L11: Resources mobilization | 4 | 0.572-0.794 | 2.55 | 1.40 | 53.90 |
| L12: Dengue working group | 6 | 0.559-0.743 | 2.38 | 1.31 | 55.21 |
| L13. Community participation | 6 | 0.506-0.745 | 2.24 | 1.23 | 56.44 |
| L14: Continuing activities | 6 | 0.508-0.553 | 2.06 | 1.13 | 57.58 |
| **Total 14 domains** | **115** | **0.503-0.798** | **2.06-50.39** | **1.13-27.68** | **57.58** |

In summary, the factor analysis yielded 115 items in 14 domains. Initial Eigenvalue for the leaders domains ranged from 2.06 to 50.39, % of the variance was 27.68 and communality % indicated 14 domains together explained 57.58% of the variance. The 14 domains of the leaders were: critical situation management (9 items), personal leadership (12 items), health care provider capacity (8 items), needs assessment (8 items), senses of community (11 items), leader group networking (11 items), communication of dengue information (10 items), community leadership (8 items), religious leader capacity (9 items), leader group and community networking (7 items), resources mobilization (4 items), dengue working group (6 items), community participation (6 items), and continuing activities (6 items).

**Dengue Community Capacity-Assessment Tool (DCCAT) of Non-leaders**

The correlation matrix of non-leaders (167 items) was examined in order to gather rough information as to whether it was appropriate to use factor analysis with the data set. Kerlinger (1986) has suggested that a suitable data set for factor analysis is one in which the correlation matrix contains several sizes of correlations and many of the correlations exceed 0.30-0.70 (Fleury, 1998). The five item-total statistics less than 0.3 were deleted in the step. Then, the fit of these criteria of item-total statistics of non-leader (162-item) were 30-0.67. Before factor analysis was carried out, three assumption e Kaisor-Meyer-Olkin (KMO) and Bartlett's test of Sphericity and communality. A KMO value > 0.90 is considerd an excellent indication for using factor analysis. According the criteria, Kaisor-Meyer-Olkin (KMO) and Bartlett's test of Sphericity test were used to measure the sampling adequacy. The results of factor

analysis showed the KMO value was 0.976 and the significance of Bartlett's test of Sphericity test was 0.000 ($x^2$ =168271.8, df=13041, p=0.000). For communality, a measure of how the variability in a given variable is explained by all the factors in the analysis ranged from 0.627 to 0.804. Thus items of non-leaders tool had very acceptable communalities with a value greater than 0.20.

Accordingly, the Eigenvalue rule asserts that factors with Eigenvalues less than 1.0 should not be retained [51]. When the principle components analysis was initially performed on non-leaders, 11 domains (Factors) with Eigenvalues of two or greater emerged. Thus Eigenvalue >2 or greater are acceptable. The Scree test is also based on Eigenvalues as shown in Figure 6, and indicates that 11 domains met the elbow of the Scree plot.

**Figure** 6 Scree plot of dengue community capacity of non-leaders
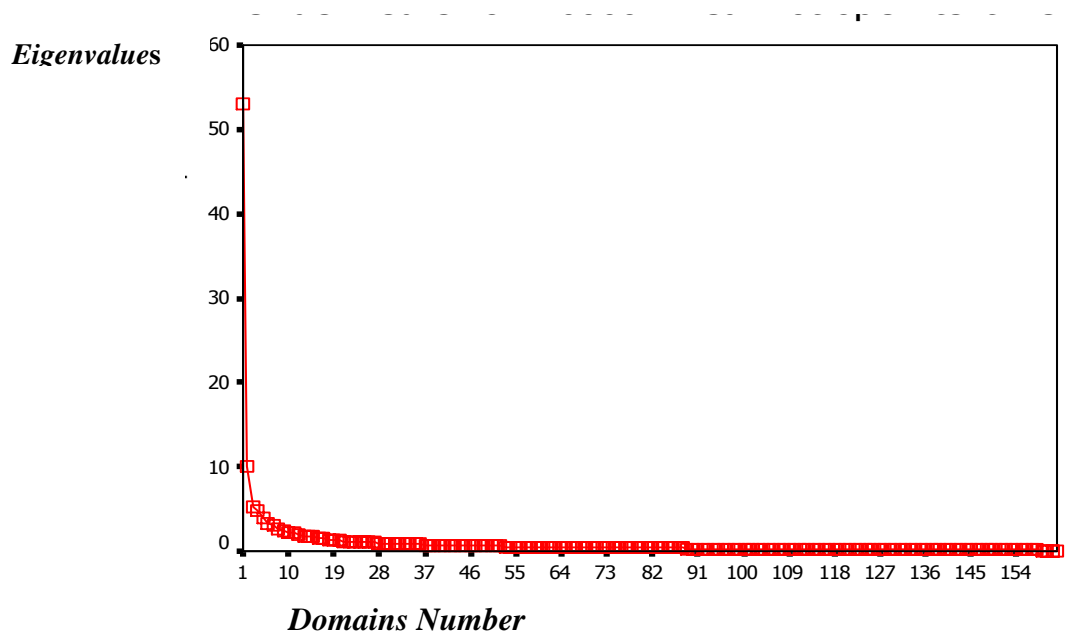


The final domain solution is presented in Table 15. Factor analysis yielded 83 items, 11 domains which produced the best fit. Initial Eigenvalue for the domain ranged from 2.07 to 52.96, % with a variance of 32.69 and communality % indicated 11 domains together explained 57.11% of the variance. The 11 domains (NL) of dengue community capacity-assessment tool of non-leaders were:

1. Critical situation management domain (NL1)

This domain consisted of thirteen items with factor loadings ranging from 0.590-0.733, and accounting for 32.69 % of variance with an Eigenvalue of 52.96 as showed in Table 15. An examination of the item content, as shown in Table 19 (P: 94), reveals that these items focused on patterns of dengue prevention and control that quickly activities as soon as possible. The domain was compiled and labeled as

"Critical situation management". When analyzed individually, it revealed that all 13 items can be included in one domain with a total variance of 32.69%.

### 2. Personal leadership domain (NL2)

This domain consisted of eight items with factor loadings ranging from 0.599-0.722, and accounting for 6.15 % of variance with an Eigenvalue of 5.26 as showed in Table 15. An examination of the item content, as shown in Table 20 (P: 96), shows that these items focused the individual's perception of their activities to prevent and control dengue disease. The domain was compiled and labeled as "Personal leadership". When analyzed individually, it revealed that all eight items can be included in one domain with a total variance of 38.84 %.

### 3. Religious leader capacity domain (NL3)

This domain consisted of ten items with factor loadings ranging from 0.549-0.691, and accounting for 5.26 % of variance with an Eigenvalue of 9.96 as showed in Table 15. An examination of the item content, as shown in Table 21 (P: 98), reveals that these items focused on the capacity of imams and monks to take initiate action of dengue prevention and control. The domain was compiled and labeled as "Religion capacity". When analyzed individually, it revealed that all ten items can be included in one domain with a total variance of 42.09 %.

### 4. Community leadership domain (NL4)

This domain consisted of eight items with factor loadings ranging from 0.569-0.708, and accounting for 2.96 % of variance with an Eigenvalue of 4.80 as showed in Table 15. An examination of the item content, as shown in Table 22 (P: 100), shows that these items focused on how community members perceive dengue prevention and control as their responsibilities. The domain was compiled and labeled as "Community leadership". When analyzed individually, it revealed that all eight items can be included in one domain with a total variance of 45.06 %.

### 5. Health care provider capacity domain (NL5)

This domain included six items with factor loadings ranging from 0.549-0.641, and accounting for 2.43 % of variance with an Eigenvalue of 3.93 as showed in Table 15. An examination of the item content, as shown in Table 23 (P: 102), revealed that these items focused on dengue prevention and control activities of health care workers and village health volunteers. The domain was compiled and labeled as "Health care provider capacity" When analyzed individually, it revealed that all six items can be included in one domain with a total variance of 47.49 %.

### 6. Senses of community domain (NL6)

This domain included eight items with factor loadings ranging from 0.681-0.778, and accounting for 2.03 % of variance with an Eigenvalue of 3.28 as showed in Table 15. An examination of the item content, as shown in Table 24 (P: 104), shows that these items focused on the perception of dengue disease as a community problem. The domain was compiled and labeled as "Senses of community" When analyzed individually, it revealed that all eight items can be included in one domain with a total variance of 49.52 %.

### 7. Communication of dengue information domain (NL7)

This domain contained eight items with factor loadings ranging from 0.512-0.692, and accounting for 1.89 % of variance with an Eigenvalue of 3.07 as showed in Table 15. An examination of the item content, as shown in Table 25 (P: 106), reveals that these items focused on channels of and resources for receiving dengue information. The domain was compiled and labeled as "Communication of dengue information". When analyzed individually, it revealed that all eight items can be included in one domain with a total variance of 51.41%.

### 8. Continuing activities domain (NL8)

This domain contained six items with factor loadings ranging from 0.537-0.603, and accounting for 1.66 % of variance with an Eigenvalue of 2.70 as showed in Table 15. An examination of the item content, as shown in Table 26 (P: 108), shows that these items focused on community guideline and policies of dengue prevention and control. The domain was compiled and labeled as "Continuing activities". When analyzed individually, it revealed that all six items can be included in one domain with a total variance of 53.08 %.

### 9. Dengue working group domain (NL9)

This domain contained seven items with factor loadings ranging from 0.587-0.672, and accounting for 2.31 % of variance with an Eigenvalue of 2.31 as showed in Table 15. An examination of the item content, as shown in Table 27 (P: 111), reveals that these items focused on community member groups and representatives of organizations in community such as "dengue leader group" to prevent and control dengue disease. The domain was compiled and labeled as "Dengue working group". When analyzed individually, it revealed that all seven items can be included in one domain with a total variance of 54.51 %.

### 10. Resources mobilization domain (NL10)

This domain included five items with factor loadings ranging from 0.526-0.767, and accounting for 1.31 % of variance with an Eigenvalue of 2.13 as showed in Table 15. An examination of the item content, as shown in Table 28 (P: 113), shows that these items focused on the ability of community members to mobilize resources for dengue prevention and control. The domain was compiled and labeled as "Resources mobilization". When analyzed individually, it revealed that all five items can be included in one domain with a total variance of 55.83 %.

### 11. Needs assessment domain (NL11)

This domain contained five items with factor loadings ranging from 0.590-0.705, and accounting for 1.28 % of variance with an Eigenvalue of 2.07 as showed in Table 15. An examination of the item content, as shown in Table 29 (P: 115), reveals that these items focused on the community members needs concerning dengue problems and solutions. The domain was compiled and labeled as "Needs assessment". When analyzed individually, it revealed that all five items can be included in one domain with a total variance of 57.11 %.

**Table** 15 Domains of dengue community capacity-assessment tool (DCCAT) of
          non-leaders

| Domain of DCCAT of non-leaders | Item | Factor loading | Eigenvalue | % of variance | Cum % |
|---|---|---|---|---|---|
| NL1: Critical situation management | 13 | 0.590-0.733 | 52.96 | 32.69 | 32.69 |
| NL2: Personal leadership | 8 | 0.599-0.722 | 9.96 | 6.15 | 38.84 |
| NL3: Religious leader capacity | 10 | 0.549-0.691 | 5.26 | 3.25 | 42.09 |
| NL4: Community leadership | 8 | 0.569-0.708 | 4.80 | 2.96 | 45.06 |
| NL5: Health care provider capacity | 6 | 0.549-0.641 | 3.93 | 2.43 | 47.49 |
| NL6: Senses of community | 8 | 0.681-0.778 | 3.28 | 2.03 | 49.52 |
| NL7: Communication of dengue information | 7 | 0.512-0.692 | 3.07 | 1.89 | 51.41 |
| NL8: Continuing activities | 6 | 0.537-0.603 | 2.70 | 1.66 | 53.08 |
| NL9: Dengue working group | 7 | 0.587-0.672 | 2.31 | 1.42 | 54.51 |
| NL10: Resources mobilization | 5 | 0.526-0.767 | 2.13 | 1.31 | 55.83 |
| NL11: Needs assessment | 5 | 0.590-0.705 | 2.07 | 1.28 | 57.11 |
| **Total 11 Domains** | **83** | **0.512-0.778** | **2.07-52.96** | **1.28-32.69** | **57.11** |

In conclusion, the final non-leaders domains presented in factor analysis yielded 83 items within 11 domains producing the best fit. Initial Eigenvalue for the domains ranged from 2.07 to 52.96, % with a variance of 32.69 and a communality % indicated 11 domains together explained 57.11% of the variance. The 11 domains of non-leaders tool were: critical situation management (13 items), personal leadership (8 items), religion capacity (10 items), community leadership (8 items), health care provider capacity (6 items), senses of community (8 items), communication of dengue information (7 items), continuing activities (6 items), dengue working group(7 items), resources mobilization (5 items), and needs assessment (5 items).

**Part III: A Practical Guideline of Using Dengue Community Capacity-Assessment Tool (DCCAT)**

The objective of the application of using the DCCAT was to apply the new tool for confirming a possible practical guideline of using assessment tool in the community. The participatory approach was conducted in a high dengue incidence village in Nakhorn Si Thammarat province Southern Thailand. This phase was carried out for 5 months from December 2008 to April 2009.

The results of application of the DCCAT focused on only a practical guideline of using DCCAT and level of dengue community capacity of leaders and non-leaders.

**A Practical Guideline of Using the Dengue Community Capacity-Assessment Tool (DCCAT)**

The practical guideline of using DCCAT was based on community participatory approach. It consisted of five steps i.e. community preparation step, assessment step, community hearing meeting step, plan and implement and reassessment.

1. Community Preparation Step
The community preparation step was consisted of consulting and discussing, establishing, organizing Dengue Leaders Group (DLG) and dengue supporting team.
1.1 Consulting and discussing with the formal leaders of sub-district i.e. health care workers, local administrative organization officers, and formal community leaders. Collecting data of dengue morbidity and mortality of community from health care center's document in past 5 years were discussion issues for consensus of solving problem.
1.2 Establishing "Dengue Leader Group (DLG)" as the key group for conducting on dengue prevention and control, they were volunteers and available time for dengue activities. The DLG included leaders and non-leaders.
1.3 Organizing dengue supporting team consisted of health workers, local administrative organization officers, and religion leaders.

2. Assessment Step
The step was collecting data, estimating sample size, assessing data and data analysis.
2.1 Collecting data team. The village health volunteers were trained about gathering data skills and described the objective of the study and utilities of results for plan and implement dengue prevention and control.
2.2 Estimating sample size of leaders and non-leaders. The number of participants based on context of community. Determining sample size of at least 100 households per community and collecting data by DLG.
2.3 Assessing data with DCCAT, the format consisted of 4 parts: (1) general characteristics, (2) the dengue community capacity-assessment questionnaires

consisted of leaders (14 domains and 115 items) and non-leaders (11 domains and 83 items), (3) household environment observation and (4) larval indices survey form.

        2.4 Data analysis was followed the assessment format. The level of dengue community capacity of leaders and non-leaders were clearly cut-off point off mean score of each domain and total score.

### 3. Community Consensus Step

        The step was meeting for discussion among DLG, supporting team and other stakeholders. The results of collecting data can use in this step as data based for planning and setting strategies dengue prevention and control. Plan and implement of dengue prevention and control and reassessment were offered in this step. The study was showed only three steps but two steps, "4. Stretegies plan and implement step" and "5. Reassessment step" were offered from community hearing meeting that required for building community capacity for sustainable dengue prevention and control. All steps were showed in Figure 7.

**Figure** 7 A practical guideline of using the DCCAT to assess community capacity of sustainable community-based dengue prevention and control
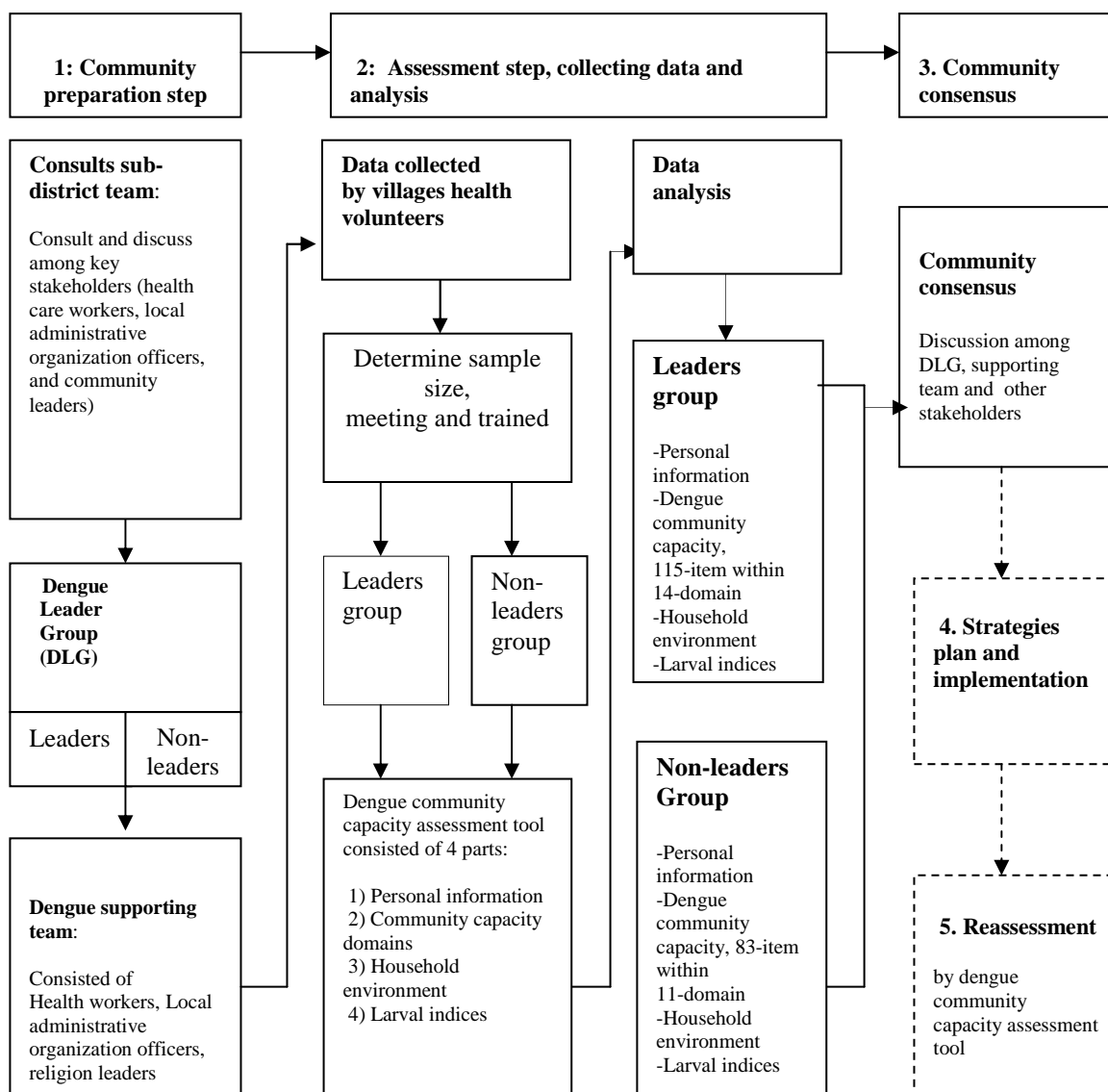
**The Level of Dengue Community Capacity**

The village consists of 473 households. The sample sizes of two groups, 206 households of leaders (32) and non-leaders (174), were representative of all households for the larval indices survey.

**The Level of Dengue Community Capacity of DCCAT of Leader**

Gathering data of 32 leaders used purposive sampling technique with representatives of community leaders, religious leaders, teachers, and local administrative organization officers. The results of leaders showed the total community capacity level was high level ($\overline{X}$ =360.47, SD= 58.82). One of 14 domains of DCCL, the "sense of community domain, was very high ($\overline{X}$ =44.31, SD=6.45). Half (7 domains) were "high level" and nearly half (6 domains) were "moderate level" as shown in Table 16:

**Table** 16 Level of dengue community capacity of leaders

| Domains of Leaders | Dengue Community Capacity of leader  (*N*= 32) | | |
|---|---|---|---|
| | $\overline{X}$ | SD | Level |
| L1:  Critical situation Management | 30.34 | 4.61 | High |
| L2:  Personal leadership | 40.09 | 7.15 | High |
| L3:  Health care provider capacity | 27.91 | 5.70 | High |
| L4:  Needs assessment | 25.84 | 4.96 | High |
| L5:  Senses of community | 44.31 | 6.45 | Very high |
| L6:  Leader group networking | 34.13 | 7.63 | High |
| L7:  Communication of dengue information | 27.56 | 10.46 | Moderate |
| L8:  Community leadership | 22.00 | 7.31 | Moderate |
| L9:  Religious leader capacity | 21.13 | 9.74 | Moderate |
| L10: Leader group and community  networking | 23.31 | 5.13 | High |
| L11: Resources mobilization | 9.88 | 4.01 | Moderate |
| L12: Dengue working group | 16.53 | 6.26 | Moderate |
| L13: Community  leader participation | 17.88 | 3.85 | Moderate |
| L14: Continuing  activities | 19.56 | 4.34 | High |
| **Total** | **360.47** | **58.82** | **High** |

**The Level of Dengue Community Capacity of Non-leaders**

The 174 non-leaders showed a total community capacity level at the "moderate level". Almost all, nine, non-leaders domains were at the "moderate level" ($\overline{X}$ =205.66, SD= 60.09). Two domains were at "low level": the religious leader capacity domain ($\overline{X}$ =16.51, SD=11.04) and the communication of dengue information domain ($\overline{X}$ =12.97, SD=8.90). They were shown in Table 17:

**Table** 17 Level of dengue community capacity of non-leaders

| Domain of DCCAT of non-leaders | Dengue Community Capacity of Non leader (N=174) | | |
|---|---|---|---|
| | $\overline{X}$ | SD | Level |
| NL1: Critical situation management | 33.51 | 12.10 | Moderate |
| NL2: Personal leadership | 20.48 | 8.41 | Moderate |
| NL3: Religious leader capacity | 16.51 | 11.04 | Low |
| NL4: Community leadership | 18.48 | 9.07 | Moderate |
| NL5: Health care provider capacity | 17.59 | 5.23 | Moderate |
| NL6: Senses of community | 29.91 | 6.42 | Moderate |
| NL7: Communication of dengue information | 12.97 | 8.90 | Low |
| NL8: Continuing activities | 15.13 | 5.76 | Moderate |
| NL9: Dengue working group | 17.18 | 7.89 | Moderate |
| NL10: Resources mobilization | 10.57 | 4.97 | Moderate |
| NL11: Needs assessment | 13.34 | 5.28 | Moderate |
| **Total** | **205.66** | **60.09** | **Moderate** |

In conclusion, results of the application of the new assessment tool phase showed the levels of community capacity of sustainable community-based dengue prevention and control of leaders and non-leaders and a practical guideline of using the assessment tool and the results of the assessment. The practical guideline consisted of five steps 1) community preparation step 2) assessment step, collecting data and analysis, 3) community hearing meeting, 4) plan and implement, and 5) reassessment. In particular, the community preparation was defined dengue problem solution needs. The Dengue Leader Group (DLG) consisted of 15 leaders and 15 non-leaders, and integrated the dengue community capacity assessment tool with entomological larval indices surveys. The detail of results in application of the assessment tool phase as shown in Appendix G. In addition, the format of integrated assessment tool both leader and non-leaders shown in Appendix G.01 and G.02

# CHAPTER V

# DISCUSSIONS CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of this research study and is divided into three sections. The first section focuses on discussions based on research methodology and research results. The second section shows the conclusion of the results, and the last section describes recommendations from this study, limitations and implications, and recommendations in conducting further research**.**

## Section I: Discussions

The discussion is presented in two parts: the first part is a discussion of research methodology and the second discusses the major findings.

### Part I: Discussion on Research Methodology

The research design utilized a mixed method (both qualitative and quantitative methods) for developing and testing a dengue community capacity-assessment tool. This study was divided into three phases: defining domains, developing and testing tool and then the application of a tool [32, 51, 87].

#### Research Design

The mix of qualitative and quantitative methods of data gathering provided the study with a strong research design that allowed for a more valid measure of capacity and a understanding of capacity building[99] as well as to examine different aspects of capacity measurement based on concepts of community capacity building and the development of a measurement scale.

The concept of community capacity building of sustainable community-based dengue prevention and control was constructed from several concepts such as dengue prevention and control, community capacity building, tool development and community-based intervention [32, 51, 80, 87]. Bush et al. [49] pointed out five stages of developing community capacity: 1) review the literature to identify common indicators of capacity, 2) carry out field studies to collect information following a district trial of a health promotion program of the community, 3) synthesize case study research literature and field study findings, 4) conduct an expert review of the Capacity Index and 5) improve the Capacity Index and conduct further field trials.

The development of a measurement scale was integrated with 10 steps of measurement scale by Burns and Grove and the eighth steps of scaling development by Devellis [51]. These steps are defining the concept, designing the scale, seeking item review, conducting preliminary item tryout, performing a field test, conducting item analysis, selecting items to retain, conducting validity studies, evaluating the

reliability of the scale and compiling norms on the scale. Then, those step were divided into three phase in this study in order to develop, test and apply the new tool.

According to the concept that mention, the research design employed a mixed method for developing the community capacity assessment tool [49, 51, 80, 95] with the study divided into three phases: defining domains, developing items, and testing and applying the tool. In the first phase, the researcher focused on finding domains of community capacity building by using a qualitative method in the field study. The quantitative method was used in the second phase. In the third phase, a participatory approach focused on the stakeholders' participation in applying the tool. The design of the research covered the objective of study and relevant concepts. That the supported by some wording as below [91].

"…We develop scales when we want to measure phenomenon which we believe exist because of our theoretical understanding of the world, but that we can not assess directly. Over the years, a variety of techniques have been developed, which can elicit these viewpoints in a rigorous and systematic manner; these procedures are used primarily by 'qualitative' researchers, and are only now finding their way into more 'quantitative' types of studies…"

**Study Sample**

The numbers of samples were based on trustworthiness concept. The inclusion criteria for the leaders group or those with capacity for delivery and building sustainability group was representatives of local administrative officers, teachers, students, community leaders and religious leaders located in the community, having resided in the community for more than one year, aged 18 or over, fluent in the Thai language, and available for this study. For the non-leader group or the sustained dengue prevention and control group, these were representatives of households in the community. Using criteria based on dengue actors' responsibilities in the community [2, 33], the researcher determined the responsibilities for dengue prevention and control intervention and divided these individuals into two groups.

The first phase used a qualitative method. In the first phase, the 120 participants in this study were divided into two groups, 1) 60 leaders that underwent In-depth Interviews (IDIs) and 2) 60 non-leaders for eight Focus Group Discussions (FGDs). Purposive sampling technique was used to select 15 participants for in-depth interviews and seven to eight participants were chosen per a FDG [72, 97]. These samples were selected as homogenous of the two groups.

All participants ranged between 18 to 80 years old with the average age of 43.2 years (SD= 10.9) and average time of having stayed in these communities for 37.2 years (SD= 15.7). The profile of characteristics of the group of participants were female 65.8%, Buddhist 63.3%, married 91.7%, elementary education 36.7%, the main occupation being agriculturist 39.2%. On the other hand, leaders group were represented of village health volunteer 17.5%. The study samples were selected from 4 sub-districts from amongst the 8 provinces of highest dengue incidence.

The second phase focused on items development and tool testing. The purpose of the pilot-testing was to determine internal consistency and reliability. The sample size in the pilot-testing had the same characteristics as that of the population covered by this study. The 60 leaders and 60 non-leaders were an adequate sample of each population group [51]. The testing tool was applied in purposive settings which were eight sub-districts of eight provinces which were high risk dengue areas in southern Thailand. The total target sub-districts were selected by following purposive criteria showing problems with dengue in the past five years, having dengue prevention and control activities, and were welling to participate in this study. The researcher distributed 1,092 questionnaires to leaders and 1,350 questionnaires to non-leaders in the eight sub-districts. Two months later, 973 questionnaires of the leaders (92.7%) and 1,252 questionnaires of the non-leaders (89.1%) were returned. The questionnaires of 973 leaders, 9 incomplete of outlier, were 964 (88.27%) of leaders. The 1,252 questionnaires of non-leaders were 4 incomplete of outlier were 1,248 non-leaders. Thus in the final, the 964 (88.27% of 1,092) leaders and 1,248 (92.33% of 1,350) non-leaders were completed surveys which comprised the study sample.

As mentioned above, almost all (88.27%, 92.33%) of the questionnaires were completed because of the methods of administering this research study. Because of the researcher met health workers, local administrative organization officers, and village health volunteers to describe the research objectives. In order to set a group for collecting data, six to eight village health volunteers and two health workers were selected as facilitators to send back data to the researcher. However, the sample sizes exceeded the researcher's estimated ratio by at least 5 participants per item. For example, the tool used for leaders with 182 items was completed by at least 910 participants and for the 167 items on the non-leaders tool were administered to 835 non-leaders. Then, the sample size in testing tool were adequate as following the sample size of testing tool criteria that stated "5 to 10 participants per item up to 300 participants associated with a study and that there be a minimum of 200 participants per 40 items but having a large number of participants is excellent, it is suggested having 100 participants is poor, 200 is fair, 300 is good, 500 is very good and 1,000 is excellent" [51].

The third phase was the application of new tool for a possible practical guideline of using tool. For the sample size in dengue larval surveys, WHO[2] suggested that the number of houses to be inspected in each locality depends on the level of precision required, level of infestation, and available resources, with the increase in the number of houses inspected leads to greater precision. A village is a large community of > 300 households, so it is reasonable to use 10% and to use simple random sampling or at least 100 households[2]. This study used sample size based on the context of community and entomological or vector surveillance. The phase then the total selected 206 households, 32 leaders and 174 non-leaders who were representatived by purposive sampling technique from amongst the community leaders, religious leaders, teachers, and local administrative organization officers.

**Trustworthiness in Qualitative Method**

It was necessary to ensure trustworthiness in the domain of community capacity of sustainable community-based dengue prevention and control. In this study, trustworthiness has been enhancing through triangulation, methodology triangulation and researcher triangulation.

First, methodological triangulation had been used with multiple methods to collect data including in-depth interviews, focus group discussions, document review, and observation. Using qualitative methods, the researcher as the tool of study to collect data and to determine validity of content [97]. The researcher had trained the program of qualitative study.

Second, triangulation were three experts including academics, practitioners, management and representatives from the community acting as a review panel to verify content validity of community capacity domains. Having member checks and peer debriefing among multiple research methods add to the credibility of research findings [100]. Eight community members (two members from each sub-district) as member checks provided credibility by allowing members of the stake holding groups to serve as peer debriefers to provide feedback on the credibility and appropriateness of the study's findings. All member checks were asked to validate the common concepts and the general description experiences of two groups.

**Content Validity**

Content validity of community capacity was examined by applying the Content Validity Index (CVI) which is the proportion of items which are given a rating of being quite relevant to the objectives of the tools by seven experts. The CVI for each item is determined by the proportion of experts who rate the item the content as valid (agreement quite/very relevant; a rating of 3 or 4), and the CVI for the entire instrument is the proportion of total items judged content valid. A CVI above 0.80 is acceptable and the item is excluded rated by experts less than 5 experts as valid[91, 92]. The total CVI for the 10 domains, 227 items of leader's tool collected data had a CVI of 0.90 for their instrument, and 10 domains, 221-item of non-leaders tool collected data had a CVI of 0.91 and. The total CVI of these tools reflected a high agreement among experts that the items were relevant to the objectives of the instrument.

**Construct Validity**

Construct validity is directly concerned with the theoretical relationship of a variable (e.g., a score on some scale) to other variables [51]. Factor analysis technique is used to determine construct validity and is a tool that can help the researcher determine empirically how many constructs, or latent variables, or factors underline a set of items. The Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of Sphericity determined those sample and correlation matrixes are satisfactory for factor analysis. Exploratory Factor Analysis (EFA) extracts factors in order to examine relationships among variables that go together. The EFA concept consists of extracting factors, rotation of factors and interpreting factors [51]. Whereas extracting

factors is the name given to this method to determine the appropriate number of factors to examine, rotating factors achieves clarification by checking factors that result in each item substantially loading only one factor. The researcher used Varimax rotating because this technique can reduce the item pool and allow independent factors, factor loadings of 0.5 and Eigenvalue > 2 of minimum acceptability for both groups. Because the study was interested in items that represented only one factor, items with multiple factor loadings were removed during the process of factor analysis [51, 91].

### Reliability

Various research studies have made different recommendations regarding the minimum accepted level of reliability. This study presents the last reliability after deleting items in which the item totals a coefficient <0.2.  Cronbach alpha coefficient of 10 domains in dengue community capacity assessment tool ranged from 0.81 to 0.92 for the non-leader's tool and from 0.79 to 0.93 in leader's tool. These high scores indicate good internal consistency because the reliability exceeds 0.7.  Following the standard of acceptable reliability, the range of reliability research is as follows: unacceptable is below 0.60; undesirable between 0.60-0.65; minimally acceptable is between 0.65-0.70; respectable is between 0.70-0.80; very good is between 0.80-0.90; and for much above 0.90, the researcher should consider cut-off on the  scale [51]. In this study, the cut off on the scale used Cronbach alpha coefficient above 0.80.

## Part II: Discussions of the Study Results

There were only a few tools to assess community capacity of sustainable community-based dengue prevention and control. This study focused on the development of a dengue community capacity assessment tool to assess community capacity of sustainable community-based dengue prevention and control in southern Thailand. The factor loading cutoff point was set at 0.5. A proposed factor loading greater than 0.3 can be regarded as significant, Eigenvalue of 2 or greater was acceptable[51, 91].  The results of study are the dengue community capacity-assessment tool (DCCAT) of leaders and non-leaders and a practical guideline of using tool.

The discussion of results are presented three parts: 1) the number of domains and items of the DCCAT of leaders and non-leaders, 2) characteristics of domains and items of DCCAT of leaders and non-leaders  and 3) a practical guideline of using the DCCAT.

**Discussion of the Number of Domains and Items of DCCAT of Leaders and Non-leaders**

This discussion focused on the number of domains, items and item overlap of dengue community capacity-assessment tools of the leaders and non-leaders. The details of domains and items are shown in Table 18.

**The Domains and Items of DCCAT of Leaders**

Factor analysis yielded 115 items within 14 domains in a model that produced the best fit. Initial Eigenvalue for the domains ranged from 2.06 to 50.39 % with a variance of 27.68 and communality % indicated 14 domains together explained 57.58% of the variance and Cronbrach's alpha coefficient of 0.97. The 14 domains of leader capacity were critical situation management (9 items), personal leadership (12 items), health care provider capacity (8 items), needs assessment capability (8 items), senses of community (11 items), leader group networking (11 items), communication of dengue information (10 items), community leadership (8 items), religious leader capacity (9 items), leader group and community networking (7 items), resources mobilization (4 items), dengue working group (6 items), community participation (6 items), and continuing activities (6 items).

**The Domains and Items of DCCAT of Non-leaders**

The final domains of the non-leader's tool utilizing factor analysis yielded 83 items within 11 domains that produced the best fit. Initial Eigenvalue for the domain ranged from 2.07 to 52.96, % of a variance of 32.69 and the communality % indicated 11 domains together explained 57.11% of the variance. The 11 domains of the non-leader's capacities were critical situation management (13 items), personal leadership (8 items), religious leader capacity (10 items), community leadership (8 items), health care provider capacity (6 items), senses of community (8 items), communication of dengue information (7 items), continuing activities (6 items), dengue working group (7 items), resources mobilization (5 items), and needs assessment (5 items).

**Item Overlap of DCCAT of Leaders and Non-leaders**

As key actors in community, these two groups were the key players in conducting dengue prevention and control in community. There was an overlap of 58 items between dengue community capacity domains of the leaders (14 domains and 115 items) and those of the non-leaders (11 domains and 83 items) and. They were as follows: critical situation management, (5 items), personal leadership (4 items), religious leader capacity (9 items), community leadership (7 items), health care provider capacity (5 items), senses of community, (7 items), communication of dengue information (4 items), continuing activities (4 items), dengue working group (5 items), resources mobilization (4 items), and needs assessment (4 items) as showed in Table 18.

**Table** 18 Comparison the items overlapping of dengue community capacity–assessment tools for leaders and non-leaders.

| Domains of Leaders | Item | Domains of Non-leaders | Item | Overlap item |
|---|---|---|---|---|
| L1: Critical situation Management | 9 | NL1: Critical situation management | 13 | 5 |
| L2: Personal leadership | 12 | NL2: Personal leadership | 8 | 4 |
| L9: Religious leader capacity | 9 | NL3: Religious leader capacity | 10 | 9 |
| L8: Community leadership | 8 | NL4: Community leadership | 8 | 7 |
| L3: Health care provider capacity | 8 | NL5: Health care provider capacity | 6 | 5 |
| L5: Senses of community | 11 | NL6: Senses of community | 8 | 7 |
| L7: Communication of dengue information | 10 | NL7: Communication of dengue information | 7 | 4 |
| L14: Continuing activities | 6 | NL8: Continuing activities | 6 | 4 |
| L12: Dengue working group | 6 | NL9: Dengue working group | 7 | 5 |
| L11: Resources mobilization | 4 | NL10: Resources mobilization | 5 | 4 |
| L4: Needs assessment | 8 | NL11: Needs assessment | 5 | 4 |
| L6: Leader group networking | 11 | | | |
| L10: Leader group and community networking | 7 | | | |
| L13: Community leader participation | 6 | | | |
| **Total 14 Domains of leaders** | **115** | **Total 11 Domains of non-leaders** | **83** | **58** |

As there were 14 domains in the leaders, and 11 domains of the non-leaders tool with an overlap of items in both tools, still the leader's assessment tool had more domains than the non-leader's assessment. The dengue community capacity domains that emerged in the present study in these two tools reflect many of the domains of community capacity found in previous studies. Laverack and Labonte & Laverack [33, 52, 86] focused on nine main domains: participation, leadership, organizational structures, problem assessment, resource mobilization, asking why, links with others, role of outside agents, and program management. For the community capacity, a measurement scale pointed out nine domains of the development of measuring community capacity for community-based funding programs in Canada [101]. The later study confirmed the nine factors of community capacity in health. In addition, the measurement scale measures the degree of community-based intervention. "Development of scales measuring the capacity of community-based initiatives" shows six factors of two scales, for both the leaders and non-leaders group. These factors were leadership, resources, external networking, visibility/recognition, ability and commitment to organizational action, and personal sustainability. Moreover other factors, Smith et al. [32] and Bopp and Bopp address the senses of community in their perspective of the community capacity domain.

However a few qualitative studies in dengue prevention and control that follow the community capacity concepts of Gibbon et al.[33] entitled "Achieving sustainability of community-based dengue control in Santiago de Cuba" [24] presented eight factors: participation, organizational structure, leadership, needs assessment, resources mobilization, implementation, linkage, and management (monitoring and evaluation).

Viewing the list above and considering the results of the qualitative method of this study, there was congruity of several factors with the results of two tools. Those were participation (community participation of leaders), organizational structure (dengue working group), leadership (personal leadership, community leadership, religious capacity, health care provider capacity), needs assessment, problem assessment (needs assessment), resource mobilization (resource mobilization), asking "why" (critical situation management), linkage (leader group networking, leader group and community networking in leaders), management, implementation, monitoring and evaluation (continuing activities), senses of community (sense of community) and knowledge and skills (communication of dengue information).

It can be concluded that the leader group needs more dengue community capacity as seen in such domains as "leader group networking", "leader group and community networking" and "community participation". Chaskin[39] pointed out that leaders group was a core component of community capacity, that they facilitated and gave direction to the work of community organization.

In summary, community capacity was consonant with previous studies of community capacity with synonymous themes of community capacity building, but detail of variables (items) are based on dengue prevention and control activities.


**Characteristics of Domains and Items of DCCAT of Leaders and Non-leaders**

Domains common to both tools, both for leaders and non-leaders, were critical situation management, personal leadership, religious leader capacity, community leadership, health care provider capacity, sense of community, communication of dengue information, continuing activities, dengue working group, resource mobilization, needs assessment, leader group networking, leader group and community networking and community participation. This part will discuss each domain which is consonant with previous studies and with qualitative findings from this research. In addition, the items in each domain of leaders and non-leaders will be discussed what is same and different items.

### Critical Situation Management Domain

Both the assessment tools of leaders and non-leaders contain domains related to critical situation management activities. Critical situation management is a distinctive domain because it is the first domain of both tools even though the assessment tool of leaders includes nine items and the assessment tool of non-leaders consists of 13 items. There are five items which overlap in both tools. All items are related to a pattern of dengue prevention and control of quick and immediate response activities as, for example, "Health center quickly assesses critical situation and epidemiology of dengue", "Your community quickly destroys mosquito breeding water containers", and "Village health volunteers quickly find and destroy mosquito breeding places and containers". This domain is associated with the common domain of community capacity building and asking 'why' which means the ability of the community to critically assess a crucial stage towards developing appropriate personal and social change strategies[27, 33, 38]. Moreover all stakeholders are involved in the activities: "Community members are participating in dengue prevention and control", and "All stakeholders in your community participate in dengue prevention and control activities". Laverack [52] pointed out the process has been termed as 'critical awareness', 'critical thinking' and 'critical consciousness' which is an important domain for enhancing ability to act. Similarly, Maclellan-Wright et al. [101] found that "asking why" as a domain of community capacity for community-based funding programs in Canada. The "asking why" domain is refer as the critical thinking for solving problem. In Thailand, a qualitative study found community thinking toward DHF prevention and control [102]. However, in a few dengue studies, such as Toledo[24] who did not present this domain in achieving sustainability of community-based dengue prevention and control because that study did not use this term to evaluate community. Might be the study was only qualitative method.

In summary, relevant items of the critical management domain focused on the key dengue stakeholders and their activities which were to provide quick prevention and control of the dengue problem. This domain is associated with the concept definition in the initial study that is defined as "the ability of the community to evaluate critical stages in developing appropriate personal and community changes in dengue intervention strategies". Moreover, this domain is related to the definition of critical dengue situation domain that was identified in the first phase. The relevant items of the critical situation management domain are shown in Table 19.

**Table** 19 The items in critical situation management domain of leaders and non-leaders tool

| Item Number | L 1:  Critical situation management | Factor loading | Comm unality | Item number | NL 1: Critical situation management | Factor loading | Commu nality |
|---|---|---|---|---|---|---|---|
| 1 | Health center assesses quickly critical situation and epidemiology of dengue | 0.788 | 0.793 | 1 | Community members participate in dengue prevention and control | 0.733 | 0.719 |
| 2 | Health center quickly surveys and destroys mosquito breeding places/containers | 0.783 | 0.805 | 2<1>* | Your community is quick in destroying mosquito breeding water containers | 0.731 | 0.751 |
| 3<5>* | Village health volunteers are quick in conducting dengue prevention and control | 0.778 | 0.794 | 3 | The community is quick to investigate to control dengue | 0.727 | 0.708 |
| 4<4>* | Health care center is quick in conducting on dengue prevention and control | 0.765 | 0.764 | 4<2>* | Your community is quick in communicating dengue information throughout coverage area | 0.717 | 0.686 |
| 5 | Village health volunteers are quick to find and destroy mosquito breeding places and container | 0.762 | 0.795 | 5 | Your community  is quick in chemical fogging for dengue control | 0.713 | 0.724 |
| 6<1>* | Your community is quick in destroying mosquito breeding water containers | 0.714 | 0.757 | 6 | Your community quickly supplies Temephos (Abate) sand granules  for dengue control | 0.698 | 0.741 |
| 7<2>* | Your community is quick in communicating dengue information throughout coverage area | 0.695 | 0.729 | 7<3>* | Outside organizations help your community to prevent and control dengue disease | 0.667 | 0.658 |
| 8 | All stake holders in your community participate in dengue prevention and control activities | 0.682 | 0.723 | 8<4>* | Health care center is quick in conducting on dengue prevention and control | 0.663 | 0.705 |
| 9<3>* | Outside organizations help your community to prevent and control dengue disease | 0.579 | 0.666 | 9 | Local administration organization is quick in conducting dengue prevention and control | 0.658 | 0.731 |
| | | | | 10<5>* | Village health volunteers are quick in conducting dengue prevention and control | 0.652 | 0.738 |
| | | | | 11 | Head of villages are quick in conducting dengue prevention and control | 0.623 | 0.715 |
| | | | | 12 | You are quick in conducting  dengue prevention and control | 0.605 | 0.715 |
| | | | | 13 | Head of sub-district is quick in conducting dengue prevention and control | 0.59 | 0.709 |

* Number of overlapped item

**Personal Leadership Domain**

The personal leadership domain was the second domain of both tools; in the leader's instrument there were 12 items and the non-leader's consisted of eight items. An examination of the item content related that these items focused on individual perception of activities to prevent and control dengue disease. Four overlapping items focused on individual capacity for leading: "You are able to give counseling on dengue prevention and control to the community", "You are able to give your time to prevent and control dengue", "You can take the dengue prevention and control role model to your neighborhood", and "you can strengthen your neighborhood to prevent and control". In these items, effective personal leadership ranged from supporting, dealing with conflict, acknowledging and encouraging other community members to voice their thoughts, creating strategies, sharing, trusting, modeling, to bringing people with diverse skill sets together and facilitating allocation of community resources.

For the leaders tool, there were five items focusing on capacities to enhance others dengue stakeholders in dengue prevention and control: "You can support dengue prevention and control in your community", "You have convincing methods to conduct dengue prevention and control", "You can present the ideas about dengue prevention and control to community members", "You can present methods of dengue prevention and control to community members", and "You are able to make community member trust in dengue prevention and control".

In other hand, non-leaders tool focusing on personal capacity to do dengue prevention and control in the community: "You are able to share the knowledge of dengue prevention and control", "You are able to be a role model of dengue prevention and control in your family", "You accept the function and responsibility of dengue prevention and control", and "You are able to facilitate dengue prevention and control with your neighbours".

Personal leadership as the part of leadership are understood as the characteristics of individual person in the community demonstrating skill in leading others member in community. It is an important domain in the dengue community capacity associated with previous study of community capacity building [45, 87] and achieving sustainability of dengue prevention and control [24, 103, 104]. Hawe et al.[88] discussed leadership as one of five strategies to building capacity. NSW[31] defines leadership as the characteristic of a leader to think systematically, to be future orientated, to search out opportunities to change and grow, to enable other to act by empowering others, and by setting an example by behaving in a way that is consistent with shared values.

This included personal characteristics of formal and informal local leaders having necessary insider knowledge of neighborhood practices to participate in the dengue program, invest time and to identify mosquito breeding sites [14]. Relevant items of the personal leadership domain are shown in Table 20.

**Table** 20 The items in personal leadership domain of leaders and non-leaders tool

| Item number | L 2: Personal leadership | Factor loading | Comm unality | Item number | NL 2: Personal leadership | Factor loading | Comm unality |
|---|---|---|---|---|---|---|---|
| 1<8>* | You can have dengue prevention and control activities adopted as role model for your neighborhood | 0.747 | 0.724 | 1<6>* | You are able to give dengue prevention and control counseling to the community | 0.722 | 0.751 |
| 2 | You can support dengue prevention and control in your community | 0.743 | 0.702 | 2 | You are able to share knowledge of dengue prevention and control | 0.712 | 0.71 |
| 3 | You have convincing methods to conduct dengue prevention and control | 0.735 | 0.651 | 3<7>* | You are able to give your time to prevent and control dengue | 0.67 | 0.637 |
| 4 | You can present ideas about dengue prevention and control to community members | 0.73 | 0.702 | 4<8>* | You can have dengue prevention and control activities adopted as role model for your neighborhood | 0.627 | 0.681 |
| 5<9>* | You can strengthen your neighborhood to prevent and control | 0.726 | 0.713 | 5 | You are able to have role model of dengue prevention and control implemented in your family | 0.618 | 0.674 |
| 6 | You can present methods of dengue prevention and control to community members | 0.725 | 0.668 | 6<9>* | You can strengthen your neighborhood to prevent and control | 0.615 | 0.707 |
| 7<6>* | You are able to give dengue prevention and control counseling to community | 0.707 | 0.676 | 7 | You carry out a function and responsibility of dengue prevention and control | 0.707 | 0.627 |
| 8 | You are able to make community members trust in dengue prevention and control | 0.702 | 0.704 | 8 | You are able to facilitate dengue prevention and control in your neighborhood | 0.599 | 0.694 |
| 9 | You are able to listen to ideas about dengue prevention and control from community members | 0.694 | 0.678 | | | | |
| 10 | You receive ideas of community members in dengue prevention and control | 0.684 | 0.669 | | | | |
| 11<7>* | You are able to give your time to prevent and control dengue | 0.677 | 0.596 | | | | |
| 12 | You are a core leader of dengue prevention and control | 0.503 | 0.562 | | | | |

* Number of overlapped item

**Religious Leader Capacity Domain**

This domain was the ninth domain of leaders tool (9 items) and the third domain of non-leaders tool (10 items). There were nine items which overlapped in both tools. An examination of the item content reveals that these items focused on the capacity of imams and monks to initiate activities of dengue prevention and control. These items are "Monks or imams are clearly able to implement activities for dengue prevention and control", "Dengue information is disseminated by monks and imams", "You are involved or participate in dengue prevention and control with monks and imams", "Monks or imams engage in routine activities for dengue prevention and control", "People in community present dengue needs and problems though monks or imams", "You are able to present dengue needs and problems through monks or imams", "Monks or imams carry out dengue prevention and control as quickly as possible", "Monks or imams are group leaders for dengue prevention and control", "Monks and imams coordinate dengue prevention and control with people in the community"

One item of non-leaders tool was "You obtain information of dengue prevention and control from temples or mosques". The item reflected the local culture of the sub-districts in Southern Thailand that there are two religions in the community. This confirms religious leaders, whether in rural, semi-urban or urban communities, play a central role in the community. For example, a participant said:

"…The mosques are important places for distribute dengue information… Islamic clerics will help coordinate. This confirms religious leaders, whether in rural, semi-urban or urban communities, play a central role in the community villagers by using community radio broadcasts about dengue. They participate fully in activities to manage the environment surrounding the houses e.g. by announcing strategies for destroying mosquito breeding containers once a month and by devoting more time if there are cases of dengue infection occurring in community…" *(A health worker)*

Relevant items of religious leader capacity domains are shown in Table 21.

**Table** 21 The items in religious leader capacity domain of leaders and non-leaders tool

| Items number | L 9 : Religious leader capacity | Factor loading | Commu nality | Item number | NL 3 : Religious leader capacity | Factor loading | Commu nality |
|---|---|---|---|---|---|---|---|
| 1<10>* | Monks or imams are clearly able to implement activities for dengue prevention and control | 0.676 | 0.732 | 1<12>* | Dengue information is disseminated by monks and imams | 0.691 | 0.721 |
| 2<12>* | Dengue information is disseminated by monks and imams | 0.662 | 0.692 | 2<11>* | Monks or imams engage in routine activities for dengue prevention and control | 0.665 | 0.749 |
| 3<16>* | You are involved or participate in dengue prevention and control with monks and imams | 0.656 | 0.725 | 3<10>* | Monks or imams are clearly able to implement activities for dengue prevention and control | 0.662 | 0.734 |
| 4<11>* | Monks or imams engage in routine activities for dengue prevention and control | 0.649 | 0.751 | 4<13>* | People in community present dengue needs and problems through monks or imams | 0.648 | 0.692 |
| 5<13>* | People in community present dengue needs and problems through monks or imams | 0.625 | 0.732 | 5<14>* | You are able to present dengue needs and problems through monks or imams | 0.639 | 0.708 |
| 6<14>* | You are able to present dengue needs and problems through monks or imams | 0.622 | 0.713 | 6<15>* | Monks or Imams are a group leaders for dengue prevention and control | 0.591 | 0.723 |
| 7<18>* | Monks or imams carry out dengue prevention and control as quickly as possible | 0.622 | 0.793 | 7<16>* | You are involved or participate in dengue prevention and control with monks and imams | 0.59 | 0.686 |
| 8<15>* | Monks or imams are a group leaders for dengue prevention and control | 0.557 | 0.726 | 8 | You obtain information of dengue prevention and control from temples or mosques | 0.573 | 0.669 |
| 9<17>* | Monks and imams coordinate dengue prevention and control with people in the community | 0.508 | 0.697 | 9<17>* | Monks and imams coordinate dengue prevention and control with people in the community | 0.561 | 0.713 |
| | | | | 10<18>* | Monks or imams carry out dengue prevention and control as quickly as possible | 0.549 | 0.685 |

**Community Leadership Domain**

This domain is the eighth domain of the instrument of leaders tool (8 items) and the fourth domain of non-leaders tool (8 items). Almost all items (7 items of 8 items) in the non-leaders and leaders overlapped in both tools. An examination of the item content indicates that these items focus on community member perception of dengue prevention and control as their own responsibility i.e. "Community members manage to give time for dengue prevention and control", "Community members use creative thinking about dengue prevention and control activities", "Community members consult about dengue prevention and control:, "Community members have the strength to act about dengue prevention and control", "Community members demonstrate  clear responsibility for dengue prevention and control", "Community members listen to other ideas about   dengue prevention and control", "Community members are positive role models for others in the community about dengue prevention and control "

The characteristics of community as perceived by community members were showing strength, consulting, managing, taking clear responsibility, listening, and stimulating thinking about dengue prevention and control.  Hawe et al.[88] discussed leadership as one of five strategies to building capacity. NSW[31] defines leadership as the characteristic of a leader to think systematically, to be future orientated, to search out opportunities to change and grow, to enable other to act by empowering others, and by setting an example by behaving in a way that is consistent with shared values.

Whereas in the non-leaders tool an item states "The community members accept to perform dengue prevention and control methods", in the leaders tool it states, "Community members adopt new methods for dengue prevention and control". From these items, different methods of dengue prevention and control between the non-leaders group and the leaders group can be seen.  The non-leaders group perceived that their dengue prevention and control's ideas did not accept of community as well as the ideas of leaders group. In dengue prevention programs, the local group led the process of social mobilization and human resources development [24]. These items are shown in Table 22.

**Table** 22 The items in community leadership domain of leaders and non-leaders tool

| Item number | L 8 : Community leadership | Factor loading | Commu nality | Item number | NL 4: Community leadership | Factor loading | Commu nality |
|---|---|---|---|---|---|---|---|
| 1<19>* | Community members manage to give time for dengue prevention and control | 0.73 | 0.743 | 1<22>* | Community members have the strength to act about dengue prevention and control | 0.708 | 0.734 |
| 2<20>* | Community members use creative thinking about dengue prevention and control activities | 0.71 | 0.733 | 2<21>* | Community members consult about dengue prevention and control | 0.622 | 0.712 |
| 3<21>* | Community members consult about dengue prevention and control | 0.692 | 0.71 | 3<19>* | Community members manage to give time for dengue prevention and control | 0.613 | 0.663 |
| 4<22>* | Community members have the strength to act about dengue prevention and control | 0.689 | 0.742 | 4<25>* | Community members are positive role models for others in the community about dengue prevention and control | 0.612 | 0.667 |
| 5<23>* | Community members demonstrate clear responsibility for dengue prevention and control | 0.671 | 0.66 | 5<23>* | Community members demonstrate clear responsibility for dengue prevention and control | 0.601 | 0.681 |
| 6<24>* | Community members listen others ideas about dengue prevention and control | 0.665 | 0.686 | 6<24>* | Community members listen to other' ideas about dengue prevention and control | 0.589 | 0.662 |
| 7<25>* | Community member are positive role models for others in the community about dengue prevention and control | 0.639 | 0.678 | 7 | Community members accept dengue prevention and control | 0.58 | 0.632 |
| 8 | Community members create new methods for dengue prevention and control | 0.545 | 0.498 | 8<20>* | Community members use creative thinking about dengue prevention and control activities | 0.569 | 0.681 |

* Number of overlapped item

### Health Care Provider Capacity Domain

This domain was the third domain of the leaders tool (8 items) and the fifth domain of non-leaders tool (6 items). An examination of the contents of the items indicates that these items focus on the dengue prevention and control activities of health care workers and village health volunteers. There were five items which overlapped in both tools: "You are able to show the needs for dengue prevention and control through village health volunteers", "Community members are able to show the needs for dengue prevention and control through village health volunteers", "Village health volunteers are the core group for dengue prevention and control in community", "Community members share dengue information between health center and village health volunteers", and "Village health volunteers provide sufficient support for dengue prevention and control".

For the leaders tool, the capacity of health care providers had three items that did not overlap because these items referred to the capacity of health care centers. These items were "Community members are able to show the needs of dengue prevention and control through health care centers", "Health center is a key element of dengue prevention and control in community", and "The health center and community members share information about dengue prevention and control". The items identified that local health center had an important role of dengue prevention and control in the local community. In this case, for local community health worker, local health worker was a priority [9, 105].

Five of six items on the non-leaders tool overlapped but the last item did not overlap: "Village health volunteers facilitate dengue prevention and control among community members". The item indicates the important capacity of village health volunteers (VHVs) for dengue prevention and control because VHVs are key stakeholders in providing health care service in communities in Thailand.

In Thailand, the key person with leadership standing in each community is also an important driving force for the development and maintenance of an effective and sustainable dengue program. For example, education programs in schools, village health volunteers and women have played a key role for the past several years. The lead of health district workers is of primary importance in successfully initiating dengue hemorrhagic fever prevention and control [66]. Knowledge and skills gained from one health worker's initiative should contribute to the community's capacity to take on new and different initiatives in the future. These items are shown in Table 23.

**Table** 23 The items in health care provider capacity domain of leaders and non-leaders tool

| Item number | L 3: Health care provider capacity | Factor loading | Communality | Item number | NL 5: Health care provider capacity | Factor loading | Communality |
|---|---|---|---|---|---|---|---|
| 1 | Community members are able to demonstrate the needs of dengue prevention and control through health care centers | 0.662 | 0.668 | 1<26>* | You are able to demonstrate the needs of dengue prevention and control through village health volunteers | 0.641 | 0.68 |
| 2<27>* | Community members are able to demonstrate the needs of dengue prevention and control through village health volunteers | 0.621 | 0.635 | 2<27>* | Community members are able to demonstrate the needs of dengue prevention and control through village health volunteers | 0.639 | 0.71 |
| 3<26>* | You are able to demonstrate the needs of dengue prevention and control through village health volunteers | 0.61 | 0.69 | 3<28>* | Village health volunteers are in the core group of dengue prevention and control in the community | 0.594 | 0.722 |
| 4<29>* | Community members share dengue information between health center and village health volunteers | 0.603 | 0.653 | 4<29>* | Community members share dengue information between health center and village health volunteers | 0.558 | 0.706 |
| 5 | Health center is a key element of dengue prevention and control in community | 0.599 | 0.735 | 5<30>* | Village health volunteers provide sufficient support for dengue prevention and control | 0.552 | 0.724 |
| 6 | The health center and community members share information about dengue prevention and control | 0.563 | 0.69 | 6 | Village health volunteers facilitate dengue prevention and control with community members | 0.549 | 0.69 |
| 7<28>* | Village health volunteers are in the core group of dengue prevention and control in the community | 0.542 | 0.708 | | | | |
| 8<30>* | Village health volunteers provide sufficient support for dengue prevention and control | 0.528 | 0.612 | | | | |

* Number of overlapped item

### Senses of Community Domain

This domain was the fifth domain in the leaders tool (11 items) and the sixth domain of the non-leaders tool (8 items). There are seven items which overlapped both tools. An examination of the item contents indicate that these items focused on perception of the dengue problem and solution in community: "Community members perceive that dengue disease is one of the important problems of the community", "Community members perceive that dengue disease is one of the horrible problems in the community", "You appreciate people who carry out dengue prevention and control activities", "You perceive that dengue disease is one of the important community problems", "Community members appreciate people who carry out dengue prevention and control activities", "Community members perceive that the dengue disease is a preventable disease", and "You perceive that the dengue disease can be prevented and controlled". These items are reflecting community members become genuinely committed to a community problem when they see that situation has a vital impact on their lives and the values [85].

One item only on the non-leaders tool focused on individual dengue perception: "You perceive that dengue disease is one of the horrible problems in the community".

On the other hand, the leaders tool showed four items: "Community members perceive that dengue prevention and control need vigorous activities of all sectors in community", "Community members perceive that dengue prevention and control need the unity of all members", "You perceive that dengue prevention and control activities are the responsibility of all members", and "Community members perceive that dengue prevention and control activities are the responsibility of all members". These items focused on overall perception of community's member and of the leader group.

From these items, both the leaders and non-leaders group presented the feeling that all community members have a sense of belonging, that dengue problem matters to each other as a problem of their community. They share a common faith that community member needs will be met through their commitment to act together. In addition, the sense of community cultivates the feelings of belonging and emotional safety leading to self-investment in the community, which has the consequence of giving a member the sense of having earned his or her membership[106]. These items are shown in Table 24.

**Table** 24 The items in senses of community domain of leaders and non-leaders tool

| Item number | L 5 : Senses of community | Factor loading | Commu nality | Item number | NL 6: Senses of community | Factor loading | Commu nality |
|---|---|---|---|---|---|---|---|
| 1<31>* | Community members perceive that the dengue disease is a one of the important problems of the community | 0.732 | 0.667 | 1 | You perceive that dengue disease is a horrible problem in your community | 0.778 | 0.686 |
| 2<32>* | Community members perceive that the dengue disease is a horrible problem in their community | 0.728 | 0.645 | 2<31>* | Community members perceive that the dengue disease is one of the important problems of the community | 0.769 | 0.681 |
| 3 | Community members perceive that dengue prevention and control needs vigorous activities of all sectors in the community | 0.716 | 0.839 | 3<32>* | Community members perceive that the dengue disease is a horrible problem in their community | 0.768 | 0.68 |
| 4 | Community members perceive that dengue prevention and control need the unity of all members | 0.708 | 0.828 | 4<34>* | You appreciate people who undertake dengue prevention and control activities | 0.746 | 0.659 |
| 5<33>* | Community members perceive that dengue is one of the important preventable diseases | 0.695 | 0.605 | 5<35>* | You perceive that dengue disease one of the important problems of the community | 0.746 | 0.643 |
| 6 | You perceive that dengue prevention and control activities are the responsibility of all members | 0.69 | 0.665 | 6<36>* | Community members appreciate people who undertake dengue prevention and control activities | 0.737 | 0.683 |
| 7 | Community members perceive that dengue prevention and control activities are the responsibility of all members | 0.672 | 0.776 | 7<33>* | Community members perceive that dengue is one of the important preventable diseases | 0.708 | 0.603 |
| 8<34>* | You appreciate people who undertake dengue prevention and control activities | 0.631 | 0.573 | 8<37>* | You perceive that the dengue disease can be prevented and controlled | 0.681 | 0.587 |
| 9<35>* | You perceive that dengue disease is one of the important problems of the community | 0.623 | 0.631 | | | | |
| 10<36>* | Community members appreciate people who undertake dengue prevention and control activities | 0.62 | 0.618 | | | | |
| 11<37>* | You perceive that dengue disease can be prevented and controlled | 0.615 | 0.615 | | | | |

*Number of overlapped item

### Communication of Dengue Information Domain

This domain was the seventh domain of the leaders tool (10 items) and the seventh domain of non-leaders tool (7 items). An examination of the item content revealed that these items focused on channels and resources of receiving information about dengue. There were four items which overlapped both tools and focused on familiar channels in these sub-districts in Southern Thailand: "You receive dengue information from community broadcasts", "You receive dengue information from radio of community", "You receive dengue information from mobile trucks with loudspeakers", and "You receive information about dengue from posters or notice boards". Health educational campaigns need to involve all stakeholders locally and should be adapted seasonally to potentially changing ecologies of both humans and mosquitoes [14].

The community needs to understand that routine activities may not prove effective because vector indices and dengue epidemics have not always correlated. For instance, house index is more indicative of a dengue risk area than the container index and the papal index may more closely correlation to dengue transmission than the more familiar larval indices [2, 4, 84]. The leaders group needs knowledge of dengue from several meetings in the community because dengue information is distributed directly in the community by face to face. The leaders group, especially, needs to receive information about dengue from more than the usual and common channels: "You receive information about dengue from LAO meetings", "You receive information about dengue from temples or mosques", "You receive information about dengue from pamphlets", "You receive information about dengue from meetings in villages", and "You receive information about dengue from discussion with your neighbor". Moreover, some items presented the types of dengue information: "You receive information about chemical fogging plan". This indicates that knowledge of vector control is important. Thus, knowledge transfer of dengue is developmental based upon the exchange and use of information within and between groups and organizations within the community [80].

There were three items which related only to the non-leaders group, "You receive dengue information from community radio stations", "You receive dengue information from local administrative organizations publications", and "You receive dengue information from newsletters". These information channels provided accurate information quickly and comprehensively. Information were also provided by an authorized media spokesperson from health care centers in the sub-districts [2]. These items are showed in Table 25.

**Table** 25  The items in communication of dengue information domain of leaders and non-leaders tool

| Item Number | L7: Communication of dengue information | Factor loading | Comm unality | Item Number | NL 7: Communication of dengue information | Factor loading | Commu nality |
|---|---|---|---|---|---|---|---|
| 1<38>* | You receive dengue information from community broadcasts | 0.707 | 0.729 | 1<38>* | You receive dengue information from community broadcasts | 0.692 | 0.737 |
| 2<39>* | You receive dengue information from radio dome of community | 0.703 | 0.688 | 2<39>* | You receive dengue information from radio dome of community | 0.675 | 0.703 |
| 3 | You receive dengue information from LAO meetings | 0.643 | 0.729 | 3 | You receive dengue information from community radio stations | 0.672 | 0.71 |
| 4<40>* | You receive dengue information from mobile trucks with loudspeakers | 0.625 | 0.657 | 4<40>* | You receive dengue information from mobile trucks | 0.582 | 0.639 |
| 5<41>* | You receive dengue information from dengue posters or notice boards | 0.602 | 0.665 | 5 | You receive dengue information from local administrative organization publications | 0.558 | 0.665 |
| 6 | You receive dengue information from temples or mosques | 0.555 | 0.68 | 6 | You receive dengue information from newsletters from community | 0.528 | 0.656 |
| 7 | You receive dengue information from pamphlets | 0.544 | 0.685 | 7<41>* | You receive dengue information from posters or notice boards | 0.512 | 0.678 |
| 8 | You receive information of chemical fogging plans | 0.538 | 0.622 | | | | |
| 9 | You receive dengue information from the meetings of villages | 0.528 | 0.625 | | | | |
| 10 | You receive dengue information from discussions with your neighbors | 0.504 | 0.600 | | | | |

*Number of overlapped item

### Continuing Activities Domain

This domain was the fourteenth domain of the leaders tool (6 items) and the eighth domain of the non-leaders tool (6 items). An examination of the item content suggested that these items focused on community guidelines and policies of dengue prevention and control. There were four items which overlapped on both tools: "Community members destroy mosquito larva as a routine activity", "The community clearly uses Temephos (Abate) sand granules guidelines", "The community has clear chemical fogging guidelines", "Local administrative organizations have policies or guidelines for dengue prevention and control" Gubler and Clark [9] mention that the community organization at the local level must provide guidance, leadership, and enforcement of community standards for effective and sustainable community-based *Ae. aegypti* control.

For other items, the non-leaders group has pointed out the need for clear guidelines: "The community has clear larval survey guidelines", and "You participate in determining dengue prevention and control in the community". Continuing dengue activities need program management that empowers the community including the primary stakeholders over decisions on planning, implementation, evaluation, finance, administration, and reporting and conflict resolution. Clarity of role and responsibility to be in line with all stakeholders are important of program management [27, 33, 38].

Similarly, the leaders tool presented two items: Community members participate regularly in chemical fogging as routine activity". This routine work includes time spent monitoring outcomes. Regarding continuing time for monitoring, a study which used social mobilization strategies, and education and communication for dengue prevention in Columbia suggested that developing a behavioral change project requires at least three years of continuous work before any significant changes are observed [60].

Moreover, an item from the leaders group instrument stating, "Village health volunteers have clear dengue prevention and control activities" indicates that leaders need clear activities for the village health volunteers because they are the key group providing public health services in the community. In clarifying the roles and responsibilities of the leaders for dengue prevention and control, a village health volunteer stated: "…Larval survey is a routine activity in solving the problem of dengue. Village health volunteers carry out a survey once a month. In a larval survey, a surveyor counts water containers, probable mosquito breeding sites and investigates mosquito larval formation. Then, we collect data in a survey format for the health worker. We divide the households of the community into 15 houses per a village health volunteer…" *(A village health volunteer)*

Similar and different items of continuing activities of leaders and non-leaders are shown in Table 26.

Table 26 The items in continuing activities domain of leaders and non-leaders tool

| Item number | L 14: Continuing activities | Factor loading | Commu nality | Item number | NL 8: Continuing activities | Factor loading | Commu nality |
|---|---|---|---|---|---|---|---|
| 1<42>* | Community members destroy mosquito larva as a routine activity. | 0.553 | 0.709 | 1 | Community has clear larval survey guidelines | 0.603 | 0.755 |
| 2<43>* | The community clearly uses Temephos (Abate) sand granules guidelines | 0.55 | 0.718 | 2<45>* | Local administrative organizations have policies or guidelines of dengue prevention and control | 0.582 | 0.729 |
| 3<44>* | The community has clear chemical fogging guidelines | 0.549 | 0.729 | 3<44>* | The community has clear chemical fogging guidelines | 0.567 | 0.771 |
| 4<45>* | Local administrative organizations have policies or guidelines for dengue prevention and control | 0.522 | 0.734 | 4<42>* | Community members destroy mosquito larva as a routine activity. | 0.564 | 0.707 |
| 5 | Community members routinely participate in chemical fogging activities. | 0.516 | 0.687 | 5<43>* | The community clearly uses Temephos (Abate) sand granules guidelines | 0.562 | 0.77 |
| 6 | Village health volunteers carry out clear dengue prevention and control activities | 0.508 | 0.769 | 6 | You participate in determining dengue prevention and control in the community | 0.537 | 0.689 |

*Number of overlapped item

**Dengue Working Group Domain**

This domain was the twelfth domain of the leaders tool (6 items) and the ninth domain of the non-leaders tool (7 items) with five items overlapping both tools. An examination of the item content indicated that these items focusing on the community member group and representatives of community organizations are leaders in preventing and controlling dengue disease. The dengue working group was community structure group which leads in capacity building for dengue prevention and control. Dengue programs will not succeed in dengue transmission prevention if that program has ignored the community structure [14]. Toledo et al., demonstrated that community working group (CWG), formed by formal and informal community leaders, primary health care workers and campaign workers, were achieving sustainability of community-based dengue prevention and control[24].

Both the leaders and non-leaders groups perceived all stakeholders as the key leaders of sustainable community-based dengue prevention and control: "Outside organizations are core leaders for conducting dengue prevention and control", "The head of the sub-district is a core leader for conducting dengue prevention and control" and "Members of our community are core leaders for conducting dengue prevention and control". They need specific teams to deal with the dengue program i.e. "Specific teams are core leaders for conducting dengue prevention and control". The team refers to formal groups and committees that foster the sense of belonging and gives the community a chance to express views and exchange information.

In terms of community health, Thailand has village health volunteers (VHVs), the backbone of the health care delivery system, which supports the concept of community involvement as the heart and soul of primary health care (PHC) activities [67]. The reality is that most communities where vector-borne diseases are endemic there is a lack of institutional systems and structures to encourage people to participate in control strategies, and, if they do exist, they do not function adequately [46]. Therefore, almost all stakeholders in sub-district Thailand have VHVs as core leaders for dengue prevention and control activities.

"…Village health volunteers are a key stakeholders in the community. They are actively involved in larval surveys and in destroying mosquito breeding places or waste containers. We, as community leaders, can help them only by coordinating and supporting…" *(A formal community leader)*

An item in the tool of the leaders group focuses on law or community regulations for dengue prevention and control: "There are community laws for dengue prevention and control". That item is related to the recommendation of WHO[2] that point out legislative support as sustainable prevention and control measure, but it is based on limitation and context of the area. Ooi E-E, Goh K-T, and Gubler DJ advance law is a component of the successful vector control program in Singapore that has two elements in addition to source reduction: public education and law enforcement[75]. It is consonant a recommendation of a community leader as bellows:

"…The practice of dengue prevention and control in community needs legal or a community practice guidelines for people in the community similar to Singapore…" *(A community leader)*

Finally, a set of items in the dengue working group domain can also be found in the literature review and qualitative method of field study. Several previous comments were point out community structures need the leaders group composed of community representatives dengue health promoters (who run the dengue program) and local authority/organization and non-leaders group represents capable people to sustain dengue prevention and control as individuals or households [2, 25, 27, 30, 33, 38, 46]. These items can be seen in Table 27.

**Table** 27 The items in dengue working group domain of leaders and non-leaders tool

| number | L 12: Dengue working group | Factor loading | Commu nality | Item Number | NL 9:  Dengue working group | Factor loading | Commu nality |
|---|---|---|---|---|---|---|---|
| 1<46>* | Outside organizations play a key role in conducting dengue prevention and control | 0.743 | 0.742 | 1<46>* | Outside organizations play a key role in conducting dengue prevention and control | 0.672 | 0.714 |
| 2<47>* | Private organizations play a key role in conducting dengue prevention and control | 0.722 | 0.705 | 2<50>* | The head of the village is a core leader in conducting dengue prevention and control | 0.659 | 0.712 |
| 3<48>* | Members of the community are core leaders in conducting dengue prevention and control | 0.621 | 0.63 | 3<47>* | Private organizations play a key role in conducting dengue prevention and control | 0.645 | 0.719 |
| 4<49>* | A specific team are core leaders in conducting dengue prevention and control | 0.619 | 0.599 | 4 | Teachers and students are core leaders in conducting dengue prevention and control | 0.636 | 0.707 |
| 5<50>* | The head of the village is a core leader in conducting dengue prevention and control | 0.572 | 0.685 | 5 | The local administrative organization  plays a key role in conducting dengue prevention and control | 0.62 | 0.755 |
| 6 | There are community laws for dengue prevention and control | 0.559 | 0.634 | 6<48>* | Members of the community are core leaders in conducting dengue prevention and control | 0.61 | 0.644 |
| | | | | 7<49>* | A specific teams are core leaders in conducting dengue prevention and control | 0.587 | 0.613 |

*Number of overlapped item

### Resources Mobilization Domain

This domain was the eleventh domain of leaders (4 items) and the tenth domain of non-leaders (5 items) in their respective tools with four items overlapping. An examination of the item content indicates that these items focused on the ability of community member to mobilize resources for dengue prevention and control: "There is enough equipment to support chemical fogging in dengue prevention and control", There is enough chemical for fogging for dengue prevention and control', There are enough human workers for fogging for dengue prevention and control', and "There are enough health workers for dengue prevention and control".

In a previous study, Raymond et al. discuss three characteristics of resources: human, physical, and financial. First, human resource management is needed to maintain a harmonious working environment. Second, physical resources, such as access to basic equipment and appropriate facilities, contribute to staff moral and willingness to actively serve the program. Last, financial resources including financial skills such as preparing financial reports; managing budgets and payrolls, invoicing and payments, and applying for funding, are all necessary requirements. [50].

For the non-leaders tool, an item states: "There are enough village health volunteers for dengue prevention and control". In other words, there is an adequate number of competent of village health volunteers who sustain efforts of dengue prevention and control, and who work closely with the people in the community. The ability of the community to mobilize resources both from within and the ability to negotiate resources from beyond itself is an indication of a high degree of skill and organization [79].

The conclusion of many studies have identified the ability of community groups to mobilize or gain access to resources as an important domain toward community capacity building [50, 86, 87]. Also, this dengue study reaffirmed that resource mobilization is one of the important domains in sustainable dengue prevention and control [9, 14, 24]. Items of the domain are shown in Table 28.

**Table** 28 The items in resources mobilization domain of leaders and non-leaders tool

| Item number | L 11: Resources mobilization | Factor loading | Commu nality | Item number | NL 10: Resources mobilization | Factor loading | Commu nality |
|---|---|---|---|---|---|---|---|
| 1<51>* | There is enough equipment to support chemical fogging in dengue prevention and control | 0.794 | 0.759 | 1<53>* | There are enough human workers for fogging for dengue prevention and control | 0.767 | 0.804 |
| 2<52>* | There is enough chemical for fogging for dengue prevention and control | 0.791 | 0.77 | 2<52>* | There is enough chemical for fogging for dengue prevention and control | 0.764 | 0.796 |
| 3<53>* | There are enough human workers for fogging for dengue prevention and control | 0.726 | 0.701 | 3<51>* | There is enough equipment to support chemical fogging in dengue prevention and control | 0.752 | 0.789 |
| 4<54>* | There are enough health care workers in dengue prevention and control | 0.572 | 0.651 | 4<54>* | There are enough health care workers in dengue prevention and control | 0.603 | 0.694 |
| | | | | 5 | There are enough village health volunteers in dengue prevention and control | 0.526 | 0.682 |

* Number of overlapped item

**Needs Assessment Domain**

This domain was the fourth domain of leaders tool (8 items) and the eleventh domain of non-leaders (5 items) with four items overlapping. An examination of the item content denotes that these items focus on the community members need related to the problem and solution of dengue in their locality. The four overlapping items stated: "Community members are able to demonstrate the needs of dengue prevention and control through LAO members", "Community members are able to demonstrate the needs of dengue prevention and control through meeting with the LAO", "Community members are able to demonstrate the needs of dengue prevention and control through the chairman of the LAO", and "Community member are able to demonstrate the needs of dengue prevention and control through meetings of village members". These items are focussing on community members' needs presented through several channels. The items highlighted the importance of local administrative organization (LAO) as the central provider of solutions to dengue. The local government are committing and implementing policies and providing facilities for community involvement in *Ae. aegypti* control, then sustainability can be achieved [9].

For the tool of the non-leaders group, only a single item indicated community needs in this domain: "Community members are able to learn of the needs of dengue prevention and control through public hearings".

In the leader group, needs assessment focused on individual perception of dengue prevention and control and needs expressed through the local administrative organization officers: "You are able to articulate the needs of dengue prevention and control through the chairman of LAO", "You are able to demonstrate the needs of dengue prevention and control through members of the LAO", "You are able to demonstrate the needs of dengue prevention and control through public hearings", "You are able to demonstrate the needs of dengue prevention and control through meetings of the local administrative organization".

Those items associated with the term 'needs assessment' refers to capacity building and presumes that capability to identify problems, provide solutions to problems and act to resolve problems of the community [27, 33, 38]. In addition, several ways of solving problems of dengue is for groups and organizations within the community and for the community itself to use well recognized methods to identify and solve problems that arise in the development and implementation of an activity or program . These items are shown in Table 29.

**Table** 29 The items in needs assessment domain of leaders and non-leaders tool

| Item number | L 4: Needs assessment | Factor loading | Commu nality | Item Number | NL 11: Needs assessment | Factor loading | Commu nality |
|---|---|---|---|---|---|---|---|
| 1<55>* | Community members are able to demonstrate the needs of dengue prevention and control through LAO members | 0.755 | 0.708 | 1 | Community members are able to demonstrate the needs of dengue prevention and control through public hearings | 0.705 | 0.744 |
| 2<56>* | Community members are able to demonstrate the needs of dengue prevention and control through meeting with the LAO | 0.744 | 0.757 | 2<58>* | Community members are able to demonstrate the needs of dengue prevention and control through meetings of village members | 0.693 | 0.718 |
| 3<57>* | Community members are able to demonstrate the needs of dengue prevention and control through the chairman of the LAO | 0.718 | 0.754 | 3<55>* | Community members are able to demonstrate the needs of dengue prevention and control through local administrative organization members | 0.679 | 0.73 |
| 4 | You are able to demonstrate the needs of dengue prevention and control through the chairman of the LAO | 0.716 | 0.736 | 4<56>* | Community members are able to demonstrate the needs of dengue prevention and control through meetings with the local administrative organization | 0.649 | 0.751 |
| 5 | You are able to demonstrate the needs of dengue prevention and control through members of the LAO | 0.678 | 0.681 | 5<57>* | Community members are able to demonstrate the needs of dengue prevention and control through the chairman of the LAO | 0.59 | 0.694 |
| 6 | You are able to demonstrate the needs of dengue prevention and control through public hearings | 0.594 | 0.697 | | | | |
| 7<58>* | Community member are able to demonstrate the needs of dengue prevention and control through meetings of village members | 0.543 | 0.733 | | | | |
| 8 | You are able to demonstrate the needs of dengue prevention and control through meetings of the local administrative organization | 0.532 | 0.532 | | | | |

*Number of overlapped item

### Networking Domain of Leaders tool

Two domains of the leaders tool for which there is no item overlap with the non-leader's tool focuses on networking. This is divided into leader group networking (L6), and community and leaders group networking (L10). From the qualitative phase of this study, the dengue network partnership domain was defined as the relationship between groups and organizations within a community or network for building capacity of community-based dengue prevention and control. The community exhibited network partnerships created by relationships between groups such as local politicians, public health units, schools, and groups of parents. Finally, item analysis and factor analysis divided networking domain of leaders tool into leader group network, and the leader group and community network.

### Leader Group Networking Domain

This domain was the sixth domain pertaining to the leader instrument that included 11 items with factor loading ranging from 0.507-0.696, and accounted for 2.18% variance with an Eigenvalue of 3.97. All 11 items can be included in one domain and the total variance explained at 45.75%. An examination of the item content indicated that these items focused on individual dengue networking of the leader group members with representatives of other stakeholders. These items are as follows: "You and the head of the sub-district participate in dengue prevention and control activities", "You and the LAO (local administrative organization) participate in dengue prevention and control activities", "You and the members of LAO participate in dengue prevention and control activities", "You and the chairman of LAO participate in dengue prevention and control activities", "You and the deputy of LAO participate in dengue prevention and control activities", "You and your neighbors participate in dengue prevention and control activities", "You and the educational institution participate in dengue prevention and control activities", "You and the community participate in dengue prevention and control activities", "You and teachers/students participate in dengue prevention and control activities", "You and the public health organization in your community participate in dengue prevention and control activities". These items are confirmed by Bush and Dower who describe network partnerships as the relationship between groups and organizations within a community and increasing the sustainability of the capacity to achieve health development . These items of this domain are shown in Table 30.

**Table** 30 The items in leader group networking domain of leaders tool

| Item number | L 6 : Leader group networking | Factor loading | Communality |
|---|---|---|---|
| 1 | You and the head of sub-district participate in dengue prevention and control activities | 0.696 | 0.756 |
| 2 | You and the local administrative organization participate in dengue prevention and control activities | 0.687 | 0.773 |
| 3 | You and the members of the LAO participate in dengue prevention and control activities | 0.657 | 0.775 |
| 4 | You and the chairman of LAO participate in dengue prevention and control activities | 0.618 | 0.788 |
| 5 | You and the deputy of LAO participate in dengue prevention and control activities | 0.59 | 0.747 |
| 6 | You and your neighbor participate in dengue prevention and control activities | 0.583 | 0.647 |
| 7 | You and the local educational institution participate in dengue prevention and control activities | 0.568 | 0.757 |
| 8 | You and the community participate in dengue prevention and control activities | 0.561 | 0.688 |
| 9 | You and teachers/students participate in dengue prevention and control activities | 0.558 | 0.711 |
| 10 | You and other organizations participate in dengue prevention and control activities | 0.545 | 0.726 |
| 11 | You and the public health organization in the community participate in dengue prevention and control activities | 0.507 | 0.675 |

*Number of overlapped item

## Leader Group Community and Networking Domain

The tenth domain of the tool for leaders contains seven items with factor loading ranging from 0.572-0.699, and accounting for 1.54% variance with an Eigenvalue of 2.81. All five items can be included in one domain and the total variance explained at 52.49%. An examination of the item content indicates that these items focus on dengue prevention and control networking between community members and the leader. The items for both the leaders and non-leaders group as: "Community and members participate in dengue prevention and control activities", "Community and members of local administrative organization participate in dengue prevention and control activities", "Community and teachers/students participate in dengue prevention and control activities", "Community and village health volunteers participate in dengue prevention and control activities". Leader and non leader groups participate in dengue prevention and control activities. Toledo [24] pointed out that the participation of actors in the different steps of the program by formal and informal leaders promotes sustainability of dengue prevention program.

In addition, community members and other organizations or representatives of organization networking were shown as: "Community and government organizations participate in dengue prevention and control activities", "Community and the chairman of LAO participate in dengue prevention and control activities", and "Community and my educational institution participate in dengue prevention and control activities" These items confirm the meaning of the networking of partnerships that linking community, dengue control program and governmental structure function [24] and linking people and organizations, including partnerships, coalitions and voluntary alliances between the community and others [25, 27, 33]. These items are shown in Table 31.

**Table** 31 The items in leader group and community networking domain of leaders tool

| Item Number | L 10: Leader group and community networking | Factor loading | Commu nality |
|---|---|---|---|
| 1 | Community and members participate in dengue prevention and control activities | 0.699 | 0.765 |
| 2 | Community and members of local administrative organization participate in dengue prevention and control activities | 0.685 | 0.815 |
| 3 | Community and government organizations participate in dengue prevention and control activities | 0.685 | 0.738 |
| 4 | Community and the chairman of LAO participate in dengue prevention and control activities | 0.678 | 0.831 |
| 5 | Community and educational institutions participate in dengue prevention and control activities | 0.657 | 0.729 |
| 6 | Community and teachers/students participate in dengue prevention and control activities | 0.611 | 0.711 |
| 7 | Community and village health volunteers participate in dengue prevention and control activities | 0.547 | 0.72 |

*Number of overlapped item

**Community Participation Domain**

The thirteenth domain of capacity of leaders tool is community participation. This domain consists of 6 items with factor loading ranging from 0.506-0.745, and accounts for 1.23% variance with an Eigenvalue of 2.24. All six items can be included in one domain and the total variance explained at 56.44 %. An examination of the item content of these items focus on the community leader's participation in dengue prevention and control: "Your neighbors support dengue prevention and control activities", "Your neighbors plan dengue prevention and control", "Your neighbors manage the budget in dengue prevention and control", "Your neighbors and outside organizations coordinate in dengue prevention and control", "Your neighbors encourage people to participate in dengue prevention and control", and "Your neighbors participate in the campaign of dengue prevention and control".

These items relate community participation (CP) with the most important strategies of dengue management. It is defined as a process "whereby individual families and communities are involved in the planning and conduct of local vector control activities so as to ensure that the program meets the local needs and priorities of the people who live in the community, and promote the community' s self- reliance in respect to development"[2, 46]. Community participation remains a guiding principle in efforts to combat tropical diseases. It involves a spectrum of processes, organization, planning, evaluation, cooperation. and contribution of time and resources by community [46].

Participation is basic to community capacity. Only by participating in small groups or larger organizations can individual community members better define, analyze and act on issues of general concern to the broader community [27, 33, 38]. The items of this domain are shown as Table 32.

**Table** 32 The items in community participation domain of leaders tool

| Item number | L 13: Community participation | Factor loading | Commu nality |
|---|---|---|---|
| 1 | Your neighbors support dengue prevention and control activities | 0.745 | 0.741 |
| 2 | Your neighbors plan dengue prevention and control | 0.707 | 0.726 |
| 3 | Your neighbors manage the budget in dengue prevention and control | 0.706 | 0.71 |
| 4 | Your neighbor and outside organizations coordinate in dengue prevention and control | 0.654 | 0.648 |
| 5 | Your neighbor encourage people to participate in dengue prevention and control | 0.579 | 0.648 |
| 6 | Your neighbor participates in the ade of dengue prevention and control | 0.506 | 0.591 |

*Number of overlapped item

**A Practical Guideline of Using Assessment Tool**

In applying the assessment tool for developing possible practical guidelines, a significant issue of the results of the study showed how community used the new tool to assess community capacity of dengue prevention and control. This study implied that the leaders and non-leaders tool could assess a community's participatory approach because involved approaches of the potential for capacity building as a top-down, bottom up, a partnership and a community organizing approach [107]. The participatory approach is a distinguishable form of research largely by its research and action component, which is carried out by the community rather than by outsiders [82]. Moreover the study focuses on integrating the epidemiology of dengue prevention and control. Gruber [108] suggested that vertical vector control programs may be ineffective because communities are not active partners in the control actions but rather are passive participants or recipients of the control efforts. Practical guidelines in using the tool consist of 3 steps: 1) community preparation, 2) assessment, collecting data and analysis and 3) community hearings meeting. These steps of using the tool in order to ensure good planning and appropriate implementation based on understanding: Who is in need, what intervention, when, and where? This would result in both bottom-up and top-down leadership, inter-organizational congruence, and readiness, all integral to building guidelines.

The Dengue Leader Group (DLG) is a working group to coordinate and manage dengue prevention and control activities in a community. It consists of both leaders and non-leaders who are available to join in applying the program. The leader group can continue building community capacity [24].

The results of applying the tool indicates the community's capacity of dengue prevention and control for leaders and non-leaders alike in the community and for obtaining larval indices and qualitative data for the DLG meeting. This guideline is consonant the process of the concept of community capacity building [30]. However, the application tool was a means of developing practical guidelines to answer how to use the tool itself and did not reach the final stage of sustainability as a means of dealing with the problem of dengue, but rather was directed at the process of community capacity building which integrated all dengue community capacity domains.

In case of partnering with government, community-based programs have often viewed as an economic problem subject to government intervention. The role of government needs to coordinate both a "bottom-up" and "top-down" approach in which successful implementation of the program of dengue control is more likely to be achieved and sustained. In addition, government needs to coordinate clinical-epidemiology and to manage dengue information in the context of timely feedback of dengue incidence [14].

**Section II: Conclusions**

This research study was conducted in 8 sub-districts in Southern Thailand with a high incidence of dengue. A mixed methodology approach was used to explore meaning and themes of dengue community capacity by using a qualitative method, to develop items and to test this tool by employing a quantitative research method and to apply this new tool with a possible practical guideline by utilizing a participatory approach. The conclusions of the study point out the results of this study: 1) meaning and themes of the capacity of sustainable community-based dengue prevention and control, 2) the dengue community capacity-assessment tool (DCCAT) consisted of two sub-tools, leaders and non-leaders, and 3) a practical guideline of using DCCAT.

### Meaning and Themes of Community Capacity of Sustainable Community-Based Dengue Prevention and Control

To explore meaning and themes of community of sustainable community-based dengue prevention and control, this phase used qualitative method consisting of a literature review, the application of qualitative methods (in-depth interviews, focus group discussions), utilization of the content analysis technique, and a three experts panel review. The initial domains of community capacity for dengue control were formulated through the accumulative process of literature review, in-depth interviews of 60 leaders, and eight focus group discussions of 60 non-leaders in four sub-districts in southern Thailand. The trustworthiness of the results was then revised by three experts and eight community members as a counter check. The ten initial domains of community capacity of a sustainable community-based dengue prevention and control program were based on literature reviews and employing a qualitative research method in four sub-districts in Southern Thailand. These themes were 1) community participation, 2) community leadership, 3) core dengue activities group, 4) problem solving needs assessment, 5) dengue information transfer, 6) sense of community for dengue problem awareness, 7) partnership network, 8) critical situation management and 10) continuing dengue prevention and control activities.

### The DCCAT of Leaders and Non-leaders

This phase was conducted in order to generate an item pool dividing items into community capacity of leaders (249 items) and non-leaders (243 items) for dengue control. After that, the format was determined using a five point rating scale for measurement, and content validity was verified by a seven member expert review panel, and the Content Validity Index (CVI) was deleted and revised resulting in 227 items for the leaders (CVI=0.90) and 221 items for the non-leaders (CVI=0.91). Moreover, face validity were confirmed by two leaders and two non-leaders reviewing the contents, questions and formatting while ensuring that the questions and instructions were free of ambiguities and providing comments on how to improve the questionnaires. Pilot-testing and items improvement were conducted on 60 leaders and 60 non-leaders having the same characteristics as the overall population in this study. The researcher used purposive sampling at a sub-district to test and improve the

items. The total Cronbach alpha reliability coefficient of the pilot-testing results for total items of leaders was 0.98 and a total item of non-leaders was 0.97. After item deletion and revision, 182 items of the leaders tool and 167 items of the non-leaders tool remained.

The testing tools were then subjected to test construct validity. These testing tools consisted of collected data, analyzed by the factor analysis technique, and then the final domains of two sub-tools were compiled and named. It was determined that the sample size should include at least five participants per items. The testing tool for leaders was administered to 964 leaders and non-leaders tool to 1,248 non-leaders in 8 sub-districts of 8 provinces in Southern Thailand. Construct validity was analyzed by Exploratory Factor Analysis (EFA) yielding factor loading of 0.5, and Eigenvalue >2.

In summary, the new tool, dengue community capacity-assessment tool (DCCAT) to assess community capacity of sustainable community-based dengue prevention and control consists of two sub-tools of 115 items within 14 domains resulting in the DCCAT of leaders and 83 items within 11 domains for the DCCAT of non-leaders. Fifty eight items overlapped between these two sub-tools in combined items.

### A Practical Guideline of Using DCCAT

A practical guideline of using community capacity-assessment tool consisted of 5 steps: 1) community preparation which included meeting all stakeholders to evaluate the problem of dengue and how to fulfill the needs, setting up a leader group, and also a support team. 2) assessment in order to determine the sample size with at least 100 households per community ,collecting data by Dengue Leader Group (DLG) and data analysis using descriptive statistics, environmental characteristics and larval indices, and 3) community hearings for brainstorming involving the researcher, the leader group and the support team.

The format of both assessment tools were integrated with the dengue index surveys. The leaders and non-leaders assessment tools each covered four parts 1) general characteristics, 2) the community capacity assessment tool questionnaires consisting of 115 items within 14 domains for leaders and 83 items within 11 domains for non-leaders, 3) household environmental observation form, and 4) larval indices survey form.

**Section III: Recommendations**

The recommendations of this study address the limitations, implications of the findings and future research recommendations.

**Limitations**

The limitations of this study were a cross-sectional survey for the testing tool and the study setting areas were high risk sub-districts of 8 provinces in Southern Thailand. The application of the new tool was conducting on a community. In addition, as a community is dynamic situation, this study does not allow for changes over time. Moreover, the new dengue community capacity-assessment tools of leaders and non-leaders contain many domains and items, the tool may place more of a burden on respondents. Hence, the user: researcher, health care worker, local administrative organization officers, dengue leader group, and data collectors should understand the concept of dengue community capacity that covering all domains.

**Implications of the Findings**

The results of this study have important implications for understanding community capacity of sustainable community-based dengue prevention and control for both leaders and non-leaders group. In addition, the community capacity assessment tool for dengue control developed in the study will be useful for measuring community capacity in dengue high-risk sub-districts in Southern Thailand. The development process of this tool may be used for the development of assessment tools for dengue control of others area that have high incidence of dengue such as Northern Thailand and Bangkok.

An important issue in using tool is the availability and utility of all data, both primary and secondary. The greatest challenge facing communities interested in tool is in obtaining useful data. Primary data collection though tool survey includes four areas: personal characteristics, dengue community capacity, household environment characteristics, and larval indices survey. Secondary data is mortality and morbidity rates of dengue incidence in order for the key stakeholders to use data to make decisions for build community capacity. Community members and consultants who can help the community should be encouraged to use both a qualitative and quantitative method for both leaders and non-leaders groups in the community.

In addition, sub-district as a community-base is a suitable unit for defining a high incidence of dengue and collecting data and the availability to assess because all sub-districts are village health volunteers for participating action.

The frequency and timing of measurement influences the utility of the tool. Single assessments may be the most useful for determining the decision to build community capacity of community-based dengue prevention and control. If communities need to develop community capacity for dengue control, then pre-post intervention assessments or serial assessments should be designed that incorporate feedback toward the goal of improving community capacity. Multiple measures across time are essential for sustainable community-based dengue prevention and control.

The results of measurements raise important issues for estimated the value of community that high and low level of only dengue community capacity. It is clear that none relating with others capacity of community. Thus, a community should be using the new tools based on the understanding of measurement objectives, outcome, resources and characteristics of community. A practical guideline of using assessment tool use assessing and reassessing for dengue community capacity building.

The Dengue Leader Group (DLG) or the dengue working group in the community is the important team who conducts dengue prevention and control, assessment, analysis and reflection, planning and implement, and then reassessment. In addition, this group must take role of leadership in the community, monitoring and evaluating outcome.

### Future Research Recommendations

This new tool was developed as a dengue community capacity-assessment tool of leaders and non-leaders in order to measure the level of community capacity of sustainable community-based dengue prevention and control. However the tool needs to integrate the dengue index survey form and define the practical guidelines of using tool, the outcome response of community capacity over time should be studied further.

The dengue community capacity-assessment tool for dengue control may prove to be a useful measure for the success of a community where there is a significant incidence dengue. Continued research to develop measures of community capacity for dengue prevention and control will expand understanding of how to the best measure various domains to assist community-based dengue prevention and control. Participatory action research may confirm the potential for community capacity building in sub-districts based on assessment, development, implement and reassessment to sustain community-based dengue prevention and control.

In addition, the study used Exploratory Factor Analysis (EFA) to define components. Therefore, it is recommended for future research that a large sample of leaders and non-leaders be studied to allow for additional the Confirmatory Factor Analysis (CFA). If such research confirms the results of this study in others area or by using other methodology to test these results, the concept of community capacity for dengue control can be further developed.

Furthermore, local administrative organization officers and health workers as policy-makers in local areas (sub-districts) who are involved in the problem of dengue in community can use this new tool as a practical guide for dengue prevention and control based on community backgrounds.

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**Appendix A:** High risk provinces of dengue in Southern Thailand

| Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | Median | Recurrent score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Southern** | 84.17 | 361.04 | 20.68 | 26.94 | 321.35 | 407.36 | 93.59 | 80.81 | 117.06 | 53.28 | *88.88* | - |
| **Chumporn** | 72.98 | **447** | 11.23 | 32.11 | **192** | **216** | **104** | **149** | 65.83 | 75.2 | **89.62** | 5 |
| **Ranong** | **205** | **437** | 24.48 | 87.2 | 62.04 | **131** | **99** | 83.82 | **129** | 70.4 | **93.24** | 5 |
| **Surat Thani** | 55.85 | **320** | 35.71 | 59.53 | **261** | **551** | 91.6 | 77.5 | **197** | **93** | **92.49** | 5 |
| **Pang nga** | 47.02 | **447** | 16.4 | 42.27 | **155** | **416** | **98.58** | 44.86 | **107** | **105** | **101.67** | 5 |
| **Phuket** | **128** | **416** | 73 | 15.85 | 66.41 | **196** | 76 | 41.3 | 59.15 | 44.18 | **69.75** | 4 |
| **Kabee** | 76.9 | **429** | 40.68 | 42 | **328** | **503** | **100** | 67.64 | **218** | 44.3 | **88.45** | 5 |
| **Nakhon Si Thammarat** | 46.43 | **635** | 10.12 | 7.8 | **290** | **472** | 73.6 | **128** | **314** | 43.72 | **101.02** | 5 |
| **Pattalung** | 87 | **395** | 9.15 | 9.54 | **358** | **489** | 57.29 | 16.2 | **121** | 32.08 | **72.15** | 4 |
| **Trang** | **150** | **428** | 15.24 | 14.93 | **302** | **322** | 43.94 | **103** | **123** | 14.72 | **113.23** | 6 |
| **Songkhla** | 87.05 | **296** | 20.4 | 21.17 | **610** | **374** | **139** | **220** | 87.39 | 67.64 | **113.04** | 5 |
| **Satunl** | 13.82 | **77** | 1.56 | 0.38 | **174** | **239** | **26** | 17.07 | **91** | 8.94 | **21.64** | 3 |

**Appendix A** High risk provinces of dengue in Southern Thailand (cont.)

| Provinces | Risk Area Score Recurrent score (10) | 8 provinces that high risk areas (≥ 5 scores) | 3 provinces that high risk areas (≤ 4 scores) |
|---|---|---|---|
| Chumporn | 5 | Chumporn | |
| Ranong | 5 | Ranong | |
| Surat Thani | 5 | Surat Thani | |
| Pang-nga | 5 | Pang-nga | |
| Phuket | 4 | | Phuket |
| Krabi | 5 | Krabi | |
| Nakhon Si Thammarat | 5 | Nakhon Si Thammarat | |
| Pattalung | 4 | | Pattalung |
| Trang | 6 | Trang | |
| Songkhla | 5 | Songkhla | |
| Satunl | 3 | | Satunl |

**Recurrent Score** (Total =10 scores) means score of recurrent disease. This score refers to all factors in each province which influenced with dengue outbreak of each province. Then, the criteria uses median morbidity rate in each year was compared with median morbidity rate in 10 years of the 11 provinces. The score was taken 1 if morbidity rate of each province in each year>median morbidity rate of same province in 10 years.

**Total score** = 10 scores, divided into two group; if ≥ 5 scores it is high risk area or if ≤ 4 scores it is low risk area.

**Appendix C**

**Qualitative Questions Guide**

**Qualitative question guidelines for focus group discussions and in-depth interviews**

**Opening:**

     -Researcher and research assistant introduce themselves, names and surnames, propose the objective of focus group, the steps to be followed, and obtain the agreement of focus group, and individual informed consent.

     -Members of focus group: introduce themselves, their names, surnames and position in community**.**

**Introduction:** You have been chosen because you have significance in your community for dengue prevention and control. Each of you has particular and valuable experience. Please let us know briefly what you have done.

**Key questions**

1.  What do you think about the dengue problem in your community?
2.  How does the present is dengue situation compare with what has gone on in the past; what do you hope to see in the future?
3.  What is your idea about how to decrease dengue problem?
4.  Who has the main responsibility for building the community's capacity for sustainable dengue prevention and control?
5.  What are barriers and hurdles that effect sustainability in community-based dengue prevention and control?
6.  What is the domain of community capacity for dengue prevention and control in community?
7.  What do you think about the following ten domains of community capacity for sustaining community-based dengue prevention and control?
    1)  Participation
    2)  Leadership
    3)  Community structure
    4)  Needs assessment
    5)  Information transfer
    6)  Resource mobilization

7) Sense of community

8) Network partnership

9) Critical assessment

10) Program management

**Sub questions for ten domains of community capacity**

- What is the meaning of each domain?

- How is the domain important for your community?

- How do you build community capacity domain in your community?

**Ending**: List the dengue community capacity domains on a flip chart and ask members of group if any domains should be added or if they have suggestions they would like to add.

**Appendix D**

**Domains of Community Capacity for Sustainable
Community-Based Dengue Prevention and Control
: Focus on Qualitative Method**

# Domains of Community Capacity for Sustainable Community-Based Dengue Prevention and Control
## : Focus on Qualitative Method

### Abstract

Aim: The objectives of this phenomenological study were to explore the meanings and domains for giving communities the capacity to be successful in dengue prevention and control. Methods: One hundred and twenty participants were purposely selected from four sub-districts of four provinces in Southern Thailand with a high dengue incidence. Sixty community leaders and sixty non-community leaders participated in this study. In-depth interviews, as well as focus group discussions with tape-recorders and note-taking, were used to collect data. All records were transcribed verbatim and analyzed by using the Colaizzi method for content analysis. Results: The findings showed that people view the creation of a sustainable dengue community program as possible only with the support of each community in its entirety: *"everyone, every sector, all participating, and with continuing activities."* Community capacity for dengue prevention and control is dependent on ten domains: i) stakeholder participation, ii) community leadership, iii) a core-activities group, iv) a problem-solving needs assessment, v) dengue information transfer, vi) resource mobilization, vii) a sense of community for the dengue problem, viii) a dengue network partnership, ix) critical dengue situation–management, and x) continuing dengue prevention and control activities. Conclusion: These community capacity domains can be developed into an assessment tool for use in the community capacity-building process. Community capacity domains require community leaders and non-community leaders to clarify dengue prevention and control assistance required.

## Introduction

Dengue is public health and community problem. Sustainability has become one of the most critical issues regarding dengue prevention and control. Meanwhile, the new paradigm for understanding dengue's epidemiology requires a community-based program [1, 2]. However, community-based dengue prevention and control has generally been shown to be weak[3]. Community capacity building can increase a community's ability to assess, define, and analyze its dengue problem, and to implement and evaluate its solution. It is a 'means and end concept,' and as a dynamic process, it must be a part of the strategy for sustainability from the beginning to the end [4].

The National Dengue Control and Prevention Program in Thailand has endorsed community-based control programs by encouraging residents to take responsibility for control activities in their households. However, dengue prevention

and control activities have not had much impact in reducing dengue transmission at the national level, as has been seen in Southern Thailand. It is at high risk for dengue incidence because of several regional factors, such as more rainy days, greater total rainfall, higher average relative humidity, and warmer temperatures than in other parts of the country[5]. Therefore, people need a better understanding of prevention and control of the disease, and continuing community participation is an important issue [6-8]. Few studies have explored the concept of a sustainable, community-based, dengue prevention and control program for Southern Thailand.

A community, and its involved personnel, needs to assess its capacity; what is appropriate and what domains for sustainable dengue prevention and control need to be created or improved? With the goal of conducting an appropriate community capacity-building program for sustainable community-based dengue prevention and control, this study seeks to explore the meanings and domains of community capacity for dengue prevention and control.

**Review of Literature**

Literature reviews involved five issues: the dengue problem, community-based dengue prevention and control, sustainable dengue prevention and control, community capacity building, and domains of community capacity, which are discussed in the following paragraphs [9-14].

Dengue is actually several diseases, of varying severity: uncomplicated dengue fever (DF), dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS)[15, 16]. There is no specific treatment for infection, and preventive vaccines, while under development, are not yet available. Chemical insecticide application has been ineffective as a method of elimination for adult vectors. The lack of efficacy of the chemical insecticide approach led to a policy aimed at the prevention and control of epidemic dengue [17, 18]. Environmental changes, particularly those related to climate, directly affect the incidence and prevalence of most vector-borne diseases. Moreover, social factors, such as lifestyles and population density, particularly in the case of dengue, are also important [2, 19]. Consequently, dengue is viewed as a community problem and it thus requires a community solution, which may consist of such domains as creating an understanding its epidemiology, taking flexible approaches, maintaining the process of prevention and control, and combining health-promotion approaches in order to change human behavior. The prevention and control of dengue infections in the community, or community-based intervention, is the only currently available option [15, 20].

Community-based dengue prevention and control involves many factors, such as setting, targets, agents, and resources for intervention [21]. It is, in this context, defined as a strategy consisting of two groups for dengue prevention and control. The first group is community leaders as the "capacity-building group," which consists of representatives of dengue health promoters, local authority/organization networks, schools, temples, and village health volunteers. The second group is non-community leaders as the "sustainable prevention and control group," which consists of community members who serve as family health leaders [15, 22]. Both groups have differences in their demographics. In communities that suffer from the dengue problem, community-based activities are necessary for sustainable dengue prevention and control.

Sustainability has become one of the most critical concepts for dengue prevention and control. It means the existence of an adaptive prevention system, with continuous innovation, that can be integrated into ongoing operations to benefit diverse stakeholders [23]. Sustainability is a continuing challenge and a major issue, and must be defined according to the characteristics of each specific setting [19, 24]. One of the bridges to effective prevention and control is a basic adaptability, both of control programs to the mosquito's changing behavior, and of education programs to public, regional and local particularities. Other bridges include transdisciplinary, community-based, intervention; the ability to apply the lessons of local situations at a higher level; and the capacity to learn from experience to achieve sustainability [2-4, 17, 19, 25]. Most importantly, the ability of the community (people, groups, and organizations) will be the driving force for the development and maintenance of an effective and sustainable program [19].

Community capacity building is not only concerned with the large-scale prevention and control of communicable diseases, but is also focused on individual protection within communities[14]. It is addressed in terms of community participation, community intervention, and community-based approaches, all of which should be multidisciplinary[26]. Consequently, community capacity building is an intervention process which increases a community's capacity. This process involves four sub-dimensions: 1) preparation by defining domains and developing the assessment tool, 2) assessment of domains, recording, and analyzing, 3) developing a strategic plan and implementation and 4) follow-up and re-assessment with the same assessment tool [27, 28]. Concerning the domains of community capacity, this study proposes ten domains that have emerged from an extensive literature review, and which include participation, leadership, community structure, needs assessment, information transfer, resource mobilization, sense of community, network partnerships, critical assessment, and program management [12, 13, 22, 28, 29].

Consequently, community capacity for sustainable community-based dengue prevention and control is defined as a set of characteristics of community activities aimed at the prevention and control of dengue. Relating to the dengue problem and solutions, these activities must define, analyze, implement, and evaluate, using the community as setting, and community participants as targets, agents, and resources of intervention. These domains of community capacity are based on situations or areas [10, 12, 13, 21, 27, 29-32].

## Methods

### Study Design

This qualitative study employed dynamic processes, including literature reviews, a field study involving individual interviews (IDIs), focus group discussions (FGDs), assessments of secondary data, and content analysis using the Colaizzi method [33].

### Study Sites

The researchers decided to limit the study to only the southern part of Thailand, where the dengue disease burden is greatest. In this area, the median morbidity rate over the past ten years (1997-2006) was 88.88 per 100,000 people, and the mortality rate was 0.19 %[34]. In Thailand, sub-districts consist of villages or

small communities. The sub-districts are grouped into districts, and the districts into provinces. Sub-districts are communities where contributing needed resources, providing community safety, insuring a dependable water supply, maintaining adequate sanitation, and having effective solid waste management must all occur. The purposive selection criteria numbered three. The first was a sub-district widely recognized as a high-risk area for dengue infection over the past five years (2003-2008) [35, 36]. The second selection criterion was a sub-district where community members had engaged in previous dengue prevention and control activities. The final criterion was a community where members were available to help conduct research. The four sub-districts in this study were located in Nakhron Si Thammarat Province, Krabi Province, Songkhla Province and Trang Province.

### Participants and Selection Criteria

The study focused on people in sub-district communities where dengue intervention programmes are trying to bring about behaviour change. The first group was labeled the "capacity for delivery and building group." It consisted of representatives of local administrative organization officials, school teachers, formal community leaders, and religious leaders. Further criteria were that members of this group had to have resided in the community for more than one year, be eighteen years of age or older, have fluency in the Thai language, and be available to participate in the study. The second group, with non-community leaders, was the "sustain dengue prevention and control group." The participants in this group were representatives of households in the community, meaning they were involved with dengue prevention and control activities for their households, and were also used in the focus group discussions. The same inclusion criteria were used for this group as for the first group.

### Questionnaires Guideline

The question guidelines were based on the literature review of dengue as a public health problem, the sustainability of community-based dengue prevention and control, and domains of community capacity for this sustainability. The question guidelines for the focus group discussions and in-depth interviews were examined by three experts who reviewed them for content validity. The first section consisted of open-ended, semi-structured interviews, and was employed to explore the participants' concepts and understanding of sustainable dengue prevention and control. Another section was concerned with expanding community capacity domains, and was designed to reflect opinions and assumptions about the domains: participation, leadership, community structure, needs assessment, information transfer, resource mobilization, senses of community, network partnership, critical assessment, and program management. The data-collection approach was informal, facilitating the open expression of views and ideas among participants.

### Data Collection

The study was approved by "The ethical review committee for research involving human research subjects, health science group, Chulalongkhorn University." The primary phase of the research was conducted, reviewed, and analyzed from December 2007 to May 2008. The specific mixture of methods was

selected in order to better understand the diversity of community dynamics within the overall qualitative approach, as well as to promote rigor through triangulation [33]. The data collection methods used included in-depth interviews (IDIs), focus group discussions (FGDs), and secondary data analysis, as explained in the following paragraphs.

### 1) In-depth Interviews (IDIs)

This study elicited detailed information about people's perceptions of the dengue problem, possible solutions, components of community capacity, and domains for sustainable dengue prevention and control in communities. The IDI technique involved participants and researchers talking about dengue issues. The conversations generally lasted from forty-five to sixty minutes, depending on the content. The researchers prepared question guidelines and an audio recorder, and set a time and place where participants felt comfortable and where transportation was available. The researcher in the study started each interview by introducing herself and obtaining permission from the participants to allow recording of the conversation.

### 2) Focus Group Discussions (FGDs)

Focus groups discussions are used to obtain information about people's feelings, opinions, perceptions, insights, beliefs, misconceptions, attitudes, as well as the receptivity of a group of people to an idea. The sampling technique included family members of households in the target communities who were available for discussion. Groups were rather small and usually included fifteen people. All participants in each group were invited by the researcher one week before the session. In each instance, the researcher introduced herself to the group and invited members to introduce themselves. Then the researcher provided the objectives of the study, obtained informed consent, discussed the focus group process, and obtained permission to audio record the session. To foster a flexible climate for discussion, the conversations were held in the local language, and lasted between ninety to 120 minutes.

### 3) Secondary Data Assessment

Dengue is a complex problem because it involves entomology, epidemiology, and socio-ecological components. Therefore, secondary data collection for communities involved rates of dengue incidence, entomological surveillance, and information about previous or current dengue intervention programs. Dengue statistics for the current and previous five years, details of dengue interventions, implementation in the communities, and the results of dengue programs were all collected from health centers and local administrative organization officers.

### Data Analysis

The technique of content analysis was used in the study [37]. It was a continuous, dynamic process that had to be integrated into the collection and coding of data, as well as the literature review. After data collection, the researcher made a complete recording, with a file note. All data from the IDIs and FGDs were tape-recorded, DVD recorded, and given a field note. The process of content analysis consisted of three main steps: reviewing the data set, coding and categorizing words

into categories based on meaning, and setting contextual themes for the meanings [33, 38]. The result was that the key concepts were organized into domains of community capacity for dengue prevention and control. At the end of the study, the researcher presented the results of the content analysis to eight community members from four sub-districts so they could review the interpretation of the results, as part of the member's review process.

### Trustworthiness

The eight community members from the sub-districts added credibility to the study, as these stakeholders had the opportunity to examine categories, interpretations, and conclusions for real-life validity. This technique is the most important one for establishing such a study's credibility [33]. Thus, all participants were asked to validate the common concepts and the general description of the two groups' experiences after the preliminary interpretation. Two members from each sub-district were asked to serve as peer debriefers to provide feedback on the credibility and appropriateness of the study's findings.

## Results

The 120 participants in this study were divided into two groups of four sub-districts. The community leaders group included sixty participants who were questioned with IDIs. The sixty non-leaders group was questioned using eight FGDs. Participants ranged from eighteen to eighty years of age, with an average age of 43.2 years (SD= 10.9). The average time participants had lived in their communities was 37.2 years (SD= 15.7). Concerning the demographics of the participants, 65.8% were female, 63.3% Buddhist, 91.7% married, 36.7% had at least an elementary education level, and 39.2% worked primarily in agriculture. Half of all participants were villagers without leadership roles, while the community leaders group constituted the other 50%. The results defined meanings and identified the domains of community capacity for sustainable community-based dengue prevention and control.

### Meaning of Community Capacity for Sustainable Dengue Prevention and Control

Different participants may naturally have differences of opinion. The study allowed individuals to participate, discuss views, and interact with others. According to the data analysis, all participants were in agreement that *"everyone, every sector, all participating, and with continuing activities"* should be the vision for the community capacity program. Everyone and every sector mean that all stakeholders in all places must contribute to facilitating and supporting sustainable dengue prevention and control. Continuing activities means that activities or strategies for dengue prevention and control must be ongoing and routine. The following quotes offer additional insights:

"…We are participating in the management of the dengue problem, and are involving health service staff from the province, district, and sub-district levels. All people must continue to serve their roles and functions in the community. Moreover, we have been following a continuing dengue management process…" *(A local administrative official in the forth sub-district).*

"…Sustainability means the strong participation of all sectors in the community, such as community leaders, health workers, and village health volunteers…they all serve to keep the home environment dengue-free, as long as community leaders model the necessary activities…" *(A villager in the third sub-district)*

**Domains for Community Capacity for Sustainable Community-Based Dengue Prevention and Control**

A series of ten core opened-ended, semi-structured, questions was asked to the participants. The results confirmed that the concepts gleaned from the literature review were related with the themes (or domains) of this study. The ten domains to achieve sustainable community dengue prevention and control were identified as follows: community participation, community leadership, a core dengue activities group, a problem-solving needs assessment, dengue information transfer, a sense of community awareness of the dengue problem, a partnership network, critical dengue situation management, and continuing dengue prevention and control activities.

**1. Stakeholders Participation**

Participation of all stakeholders was considered a vital characteristic of dengue prevention and control in the community. It was divided into two distinct groups. The "capacity for delivery and building group" consisted of dengue health promoters (implementing the dengue program), local authorities, and local organizations. The "capacity to sustain dengue prevention and control group" was the other group, as described earlier. All participants of dengue prevention and control in the communities, in both groups, were involved in defining, planning, implementing and evaluating activities. For example, some participants said:

"…Dengue is one of the major areas of health promotion efforts in primary school…students have done larval surveys…they are responsible for surveying water containers in their homes and getting rid of any larva found. Such containers could include drinking water jars, flower vases, flower pot plates, ant traps, cemented containers in toilets, coconut shells, discarded bottles and cans, and other discarded containers. The students send survey reports to their health teachers, who then send all this data to the health center every month, four times per semester... " *(A teacher in the forth sub-district)*

**2. Community Leadership**

Leadership by community members was defined as a skill of certain people in communities which allows them to lead other members of the communities. In this study, the traits of an effective community leader were supporting others, dealing with conflict, acknowledging and encouraging community members to voice their opinions, creating strategies, sharing leadership, trusting, modeling, bringing people with diverse skill sets together, and facilitating usage of community resources. The following statements from some participants expressed further information:

"…The most important factor is leadership…the villagers' trust in the formal community leader, local administration officials, and others…the villagers elected the leaders because they were trusted and inclusive to begin with…" *(A local administration official in the second sub-district)*

### 3) Core Dengue Activities Group

Core dengue community groups were defined as groups of at least two people, and were divided into the "capacity for delivery and building group" and the "ability to sustain dengue prevention and control group." These two core groups consisted of formal community leaders, school teachers and students, health workers, village health volunteers, local administrative officials, and villagers. Health workers and local administrative officials were already involved in planning, coordinating, and facilitating functions in the effort to eliminate the dengue problem. However, communities need more robust policies and guidelines, and community laws, for managing dengue outbreak. Village health volunteers were the most important core group for the launching of the anti-dengue campaign, serving in its main roles and functions.

"…Village health volunteers are strong core stakeholders in their communities. They are responsible for larval surveys and destruction of mosquito breeding places and waste containers. We as community leaders can help them only by coordinating things and supporting them…" *(A formal community leader in the fourth sub-district)*

### 4. Dengue Problem-solving Needs Assessment

Community needs assessment was defined as the capability of a community's members to identify the causes of the dengue problem, potential solutions to the dengue problem, and needed actions by the community to resolve the problem. The needs assessment was determined by making requests, asking questions, discussing ideas, and holding a community meeting. Participants expressed many ideas, such as the following:

"…I am always joining in our community meetings. If I cannot join a meeting for any reason, my husband goes for me. My village has set its meeting time in the afternoons because at that time of day, villagers have time available for discussions. I estimate that 80% of the villagers attend the meetings... " *(A villager in the third sub-district)*

### 5. Dengue Information Transfer

Dengue information transfer was defined as the process of thoroughly communicating dengue-related information to communities to create, develop, exchange, and use such information. Recipients would be both people and groups inside and outside of the communities. The important attributes of dengue-related media were types of channels, sources of information, frequency of announcements, types of content, and groups of recipients. Dengue information channels should include posters, brochures, telephone calls, community meetings, postcards, broadcasts from community dorms, and radio station broadcasts. The contents should concern important situation needs, dengue surveillance, dengue infection cases, dengue death cases, methods for dengue solutions, and disease monitoring. Announcement frequencies should be weekly, monthly, or yearly. Dengue information transfer should involve information about entomology, epidemiology, ecology, and sociology. Participants expressed many ideas, such as the following:

"…The mosques are important places for distribution of dengue information… our Islamic priest coordinates with villagers about dengue by using broadcasts. He is well placed to manage information distribution in our environment. For example, he announces strategies for destroying mosquito breeding containers one time per month, and takes time to give details about cases of dengue infection which occur in the community…" *(A health worker in the fourth sub-district)*

### 6) Resource Mobilization

Resource mobilization was defined as the ability of a community to mobilize a variety of resources, such as local policy resources, human resources, financial resources, and health resources. Resource mobilization aids participants in sharing materials and finances for fogging and for using Temephos (Abate) sand granules. Moreover, villagers can mobilize their labor resources to better survey and destroy mosquito breeding containers, launch dengue campaigns, and find personal protection for family members. Better mobilization can improve both the quantity and quality of resources for dengue prevention and control.

"…We manage the budget every year. I divide the dengue budget carefully because my local administrative organization is of small size, with not much public revenue…" *(A local administrative official in the second sub-district)*

### 7) A sense of Community for the Dengue Problem

A sense of community was defined as sharing community values and building and achieving trust among others. Participants explained sense of community as the degree of positive response to ameliorating the dengue problem, community creation, reinforcement of local ownership, and the changing of household-level behaviors, such as the elimination of mosquito breeding sites and the reduction of potential breeding water-containers.

"…Villagers perceive that the dengue disease is a community problem. When there is an instance of a dengue case occurring in the community, villagers will be on the alert to find the cause and obtain treatment resources. The majority of the people are available to join in dengue solution activities…" *(A village health volunteer in the third sub-district)*

### 8) Dengue Network Partnerships

The dengue network partnerships were defined as the necessary relationships between groups and organizations within a community or network for building the capacity of community-based dengue prevention and control. Community network partnerships included relationships between such groups as local politicians, public health units, schools, and parents. In addition, the network partnerships were also involved with receiving support from outside of the community group, e.g. from district public health centers, province public health centers, and the Ministry Public Health Center itself.

"…Starting with coordination among health workers, village health volunteers, local administrative officials, and formal community leaders, we can implement effective activities against dengue infection. These activities would be associated with

government policy and community culture…" *(A local administrative official in the third sub-district)*

### 9) Critical Dengue Situation Management

Critical dengue situation management was defined as the ability of a community to evaluate critical stages when there is a dengue fever case in the community. Communities must develop the appropriate personnel and social structures for dengue intervention strategies. The capacity of critical management was judged as the ability of a community to identify and solve problem activities for both persons and groups in the sub-district as soon as possible. Techniques included surveillance of the disease, defining and destroying breeding places and containers, and quickly fogging and using Temephos sand granules. Moreover, non-community leaders were trained to alert health centers or doctors when they or their family members showed any trace of the disease, including mere fever symptoms. The villagers were thus trained to solve the dengue problem in their sub-district by themselves.

"…When there is a dengue case in the community, the hospital calls the health center about it. A health worker goes to the site for rapid disease investigation. We put Temephos sand granules in water containers, use chemicals to eliminate mosquitoes, and work to control the environments surrounding houses. Village health volunteers who have accountability for the dengue infection area will be stationed in a local facility and will monitor the dengue outbreak…" *(A health worker in the first sub-district )*

### 10) Continuing Dengue Prevention and Control Activities

Continuing program management was defined as the ability of communities to manage dengue prevention and control activities in the sub-district areas. It was reviewed for effectiveness of planning, implementation, evaluation, finances, administration, reporting, and conflict resolution. Participants must continually conduct certain activities, which should be integrated into routines for the dengue program management to oversee. Participants also clarified the roles and responsibilities necessary for dengue prevention and control.

"…a conducting larval survey is one of the routine jobs necessary for a dengue solution. Village health volunteers conduct surveys once per month. In the surveys, a volunteer counts water containers to estimate probable mosquito breeding and mosquito larva. Then, we give our collected data from the survey to a health worker. We divide our community's households into fifteen houses per village health volunteer…" *(A village health volunteer in the fourth sub-district)*

### Discussion

This research paper will first discuss the strengths of the method of investigation, then the lessons that can be drawn from the findings, and finally make a projection of what the data suggests in terms of defining dengue prevention and control capacity domains.

The main strength of the research approach was that it allowed the researchers to build the domains from the participants' perspectives. Many participants involved in the study group were long-time community members. The mean time among participants for living in these communities was 37.2 years. The methodological approach, question guideline development, triangulation of data collection, and content analysis were all conducted with joint review, until data saturation had been achieved. The semi-structured format of the interviews and discussions was examined by content analysis using the Colaizzi method [37], which allowed for probing and clarification of response, and was designed to minimize interpretation.

The data gathering methods not only ensured trust between researchers and participants, but also served to continuously enrich the analyses of the three researchers, who were specialists in entomology, epidemiology, and community-based study. Moreover, the trustworthiness of the study was assured by having certain community members recheck the conclusions for credibility. This is an important step in qualitative research [33]. The study participants included sixty community leaders and sixty representatives from regular households, in an effort to reach a core group of people in the communities [15, 22].

From the study's data, some important lessons can be summarized which can lead to future anti-dengue program development. First, it was discovered that many participants shared the opinion that the motto should be ***"everyone, every sector, all participating, and with continuing activities."*** Their interpretation of sustainable dengue prevention and control may differ from other dengue issues because this meaning was based on the participants' direct dengue experiences, or those of their family or neighbors. Second, ten domains were agreed upon to form an initial conceptual definition, which was originally built from the literature review [22, 39].

The last, not surprisingly, was that all community leaders, such as the local administrative organization officials, formal community leaders, teachers and students, religious leaders, health workers, village health volunteers, and non-community leaders, such as villagers, were held equally responsible for sustainable dengue prevention and control. Although non-community leaders were the key stakeholder for conducting and maintaining dengue solution activities, their sense of the role of community leadership and network partnerships was that of a need for more involvement with the dengue problem. Sustainable dengue prevention and control strategies require community capacity building, such as improved stakeholder participation, developed community leadership, more empowered organizational structures, improved resource mobilization, stronger network partnerships, and increased program management [4, 40].

**Limitations**

A certain number of limitations of this study can be identified, such as the sampling method and the sample size. The researchers tried to select sub-districts already using best practices for dengue prevention and control, in high dengue risk provinces, and where people were available to assist in the study. The sub-districts were identified as the best-practice areas of their respective provinces. Another possible limitation of this qualitative study is that the findings may be misunderstood or interpreted with a bias, due to the key informants' responses. Finally, although it is true that focus groups and interviews, as research methods in general, have a

limitation in the randomness of their sampling, with the possibility that the results may not be generalizable, they are still effective ways of gathering data. This is particularly true when they are used to obtain information about the feelings, opinions, perceptions, insights, beliefs, misconceptions, attitudes, and receptivity of a group of people concerning an idea.

## Conclusion

This paper reports the findings from in-depth interviews and focus group discussions with community members, both leaders and villagers, in four sub-districts in Southern Thailand. The dengue problem was perceived as a community problem, and the participants had been conducting previous activities aimed at solving the problem. The results identified the means of achieving sustainable community-based dengue prevention and control, and contained common themes for the success of a sustainable dengue problem/solution program. These domains have been documented in other community capacity-building conceptual works [22, 39]. However, in contrast to just a few work periods, the focus group discussions and in-depth interviews in this study provided detailed insights into the success factors of a sustainable dengue problem/solution program. Moreover, the 120 participants in the four sub-districts pointed out that successful larval control was possible only if carried out by all households and all sectors in a community, and if control agents were available and accessible. The routine methods identified are as follows: covering drinking water containers, cleaning water containers every week, keeping fish in containers with water plants, destroying mosquito breeding places, and using fogging or chemicals only at critical times. The participants' perception of a successful and sustainable dengue control program was that it must have the following: all community members' participation, the leadership of community leaders, a core dengue activities group, a problem-solving needs assessment, dengue information transfer, a sense of community for dengue problem-awareness, a partnership network, critical dengue-situation management, and continuing dengue prevention and control activities.

## Acknowledgements

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**Appendix E**

**Characteristics of Leaders and Non-leaders in Pilot-testing**

# Characteristics of Leaders and Non-leaders in Pilot-testing

The characteristics of all 60 leaders and 60 non-leaders were more than half participants were female (65.0%, 81.7%). A large majority of leaders and non-leaders (68.3%, 58.3%) was Buddhist. 78.3% and 61.7% were married. 40% and 63.3% had an elementary level education. Business and unskilled laborer were almost occupation of leaders group (30.0%), whereas business was the main occupation of non-leaders (38.3%).

**Table** 1 Characteristics of leaders and non-leaders

| Characteristics | Leaders group | | Non-leaders | |
|---|---|---|---|---|
| | **Frequency** | **%** | **Frequency** | **%** |
| **Gender** | | | | |
| Male | 21 | 35.0 | 11 | 18.3 |
| Female | 39 | 65.0 | 49 | 81.7 |
| **Religion** | | | | |
| Buddhist | 41 | 68.3 | 35 | 58.3 |
| Muslim | 19 | 31.7 | 25 | 41.6 |
| **Marital status** | | | | |
| Single | 9 | 15.0 | 15 | 25.0 |
| Married | 47 | 78.3 | 37 | 61.7 |
| Widowed, Divorced, Separated | 4 | 6.7 | 8 | 13.3 |
| **Education level** | | | | |
| No education | 2 | 3.3 | 0 | 0 |
| Elementary | 24 | 40.0 | 38 | 63.3 |
| High school | 18 | 30.0 | 9 | 15.0 |
| Diploma | 5 | 8.4 | 9 | 15.0 |
| Bachelor degree | 11 | 18.3 | 4 | 6.7 |
| **Occupation** | | | | |
| Farming | 6 | 10.0 | 4 | 6.7 |
| Business | 18 | 30.0 | 23 | 38.3 |
| Government officer | 7 | 11.7 | 2 | 3.3 |
| Unemployed | 2 | 3.3 | 6 | 10.0 |
| Unskilled laborer | 18 | 30.0 | 17 | 28.3 |
| Housewife | 6 | 10.0 | 1 | 1.7 |
| Fisherman | 1 | 1.7 | 0 | 0 |
| Other | 2 | 3.3 | 7 | 11.7 |

Almost position in community of leaders group was village health volunteer (51.6%). For non-leaders group, 100% were villagers that no position in the community involved dengue situation. These detail showed in Table 2.

**Table** 2 Position in community of leaders and non-leaders

| Position in community *(more than a position)* | Leaders group | | Non-leaders | |
|---|---|---|---|---|
| | **Frequency** *(N=60)* | **%** | **Frequency** *(N=60)* | **%** |
| Community committee | 3 | 5 | | |
| LAO member | 7 | 11.7 | | |
| Community leader | 6 | 10 | | |
| Religious leader | 3 | 5 | | |
| Community club member | 5 | 8.3 | | |
| Village Health Volunteer | 31 | 51.6 | | |
| School health | 5 | 8.3 | | |
| Non-leaders | | | 60 | 100 |

The participants had received information concerning dengue prevention and control in the last 12 months in leaders (55%), and non-leaders (30%). Almost half, 65.0%, of the leaders had experience with the illness, mostly with an experience from neighbor (45%). In other hand half of non-leaders group had experience (50%) and almost via from neighbor as showed in Table 3.

**Table** 3 Characteristics of leaders and non-leaders

| Characteristics | Leaders group | | Non-leaders | |
|---|---|---|---|---|
| | **Frequency** *(N=60)* | **%** | **Frequency** *(N=60)* | **%** |
| **Receiving dengue knowledge in past 12 months** | | | | |
| Have | 33 | 55 | 18 | 30 |
| **Having dengue illness experience** | | | | |
| Have | 39 | 65 | 30 | 50 |
| **Having dengue illness experience** *(more than a answer)* | 2 | 3.3 | 3 | 5 |
| Themselves | | | | |
| Family member | 7 | 11.7 | 6 | 10 |
| Neighbor | 27 | 45 | 16 | 26.7 |
| Other | 4 | 6.7 | 6 | 10 |

The age of the leaders were average age of 45.93 years (SD=14.33) and non-leaders were average age 45.90 (SD=14.45). The average monthly family income of leaders was 12,670.49 baht (SD=29,128.19) and non-leaders was 12,765.00 baht (29,364.56). The leaders had lived in the community an averaged of 36.84 years (SD=18.37) and non-leaders had lived in the community an averaged of 36.65 years (SD=18.46). Dengue education time of leaders in the past 12 months had average 0.57 time (SD=1.07) and non-leaders had average 0.58 time (SD=1.07). These details showed in Table 4.

**Table** 4 Characteristics of leaders and non-leaders

| Characteristics | Leaders | | Non-leaders | |
|---|---|---|---|---|
| | **Mean** | **SD** | **Mean** | **SD** |
| Year **(yrs.)** | 45.93 | 14.33 | 45.90 | 14.45 |
| Family monthly income (Baht) | 12,670.49 | 29,128.19 | 12,765.00 | 29,364.56 |
| Length of time residing in the community **(yrs.)** | 36.84 | 18.37 | 36.65 | 18.46 |
| Dengue education time in past 12 months (Time) | .57 | 1.07 | .58 | 1.07 |

**Appendix F**

**Results of   Phase III: The Application of the New Tool**

# Results of   Phase III: The Application of the New Tool

The objective of the application of the new tool was to apply the Dengue Community Capacity Assessment Tool (DCCAT) for sustainable community-based dengue prevention and control.  Participatory approach was conducting on a high dengue incidence village in Nakhorn Si Thammarat province Southern Thailand. This phase was carried on 5 months during December 2008 to April 2009. The results of using tool were consisted of sections, 1) level of dengue community capacity of non-leaders and leaders and 2) practice guideline of using DCCAT

## Dengue Community Capacity

To confirm the application of using DCCAT, the results of using tool to assess dengue community capacity consisted of 4 sections: 1) characteristics of participants, 2) level of dengue community capacity of non-leaders and leaders 3) households environment and 4) Larval indices.

### Characteristics of Participants

As showed in Table1, the age of the participants ranged from 18 to 60 years old, with average age of non-leaders 49.80 years (SD = 14.54) and leader 50.72 years (SD=14.30). The average monthly income of family of non leader was 5292.53 baht (SD=4057.07) and leader was 11790.63 baht (SD=13044.44). The non leader group had an averaged staying time in community 27.75 years (SD= 18.56) and in leader group 34.88 years (SD= 20.38). The fewest of dengue education time in 12 months ago of non leader group had averaged .33 years (.87) and 1.19 years (2.42).

**Table**1 Standard Deviations (SD), Minimum and Maximum scores for continuous demographic variable of non-leader group (*N*= 174) and leaders (*N*= 32)

| Variable | Non-leaders | | Leaders | |
|---|---|---|---|---|
| | $\overline{X}$ | **SD** | $\overline{X}$ | **SD** |
| Age | 49.80 | 14.54 | 50.72 | 14.30 |
| Family income | 5292.53 | 4057.07 | 11790.63 | 13044.44 |
| Staying time in community | 27.75 | 18.56 | 34.88 | 20.38 |
| Dengue education time in 12 months ago | | | | |
| | .33 | .87 | 1.19 | 2.42 |

Table 2 describes the demographic characteristics of all 174 non-leaders and 32 leaders. Characteristics of both groups found almost all of non leader group and leaders group were female (77.0%, 90.6%), Buddhist (54%, 78.1%), married (75.3%, 62.5%), Elementary (Basic) (53.4%, 28.1%), unskilled labor occupation (28.7%, 28.1%), and having dengue experience illness (25.3%, 34.4%). Almost half (50%) of leaders, but fewest (16.1%) of non-leaders were receiving knowledge of dengue in 12 months ago.

**Table** 2 Characteristics of non-leaders

| Characteristic | Non leader | | Leader | |
|---|---|---|---|---|
| | *N* (174) | % | *N* (32) | % |
| **Gender** | | | | |
| Male | 40 | 23 | 3 | 9.4 |
| Female | 134 | 77 | 29 | 90.6 |
| **Religion** | | | | |
| Buddhist | 94 | 54 | 25 | 78.1 |
| Muslim | 80 | 46 | 7 | 21.9 |
| **Marital status** | | | | |
| Single | 20 | 11.5 | 3 | 9.4 |
| Married | 132 | 75.3 | 20 | 62.5 |
| Windowed, Divorced, Separated | 23 | 13.2 | 9 | 28.1 |
| **Education level** | | | | |
| Non | 10 | 5.7 | 3 | 9.4 |
| Elementary (Basic) | 93 | 53.4 | 9 | 28.1 |
| Elementary (High) | 29 | 16.7 | 4 | 12.5 |
| Junior high school | 13 | 7.5 | 4 | 12.5 |
| Senior high school | 12 | 6.9 | 2 | 6.3 |
| Diploma (Basic) | 5 | 2.9 | 2 | 6.3 |
| Diploma (High) | 7 | 4.0 | 2 | 6.5 |
| Bachelor degree | 5 | 2.9 | 6 | 18.8 |
| **Occupation** | | | | |
| Farming | 20 | 11.5 | 7 | 21.9 |
| Business | 34 | 19.5 | 3 | 9.4 |
| Gov. officer | 1 | .6 | 3 | 9.4 |
| Unemployed | 18 | 10.3 | 1 | 3.1 |
| Unskilled labor | 50 | 28.7 | 9 | 28.1 |
| Housewife | 34 | 19.5 | 3 | 9.4 |
| Fisherman | 10 | 5.7 | 2 | 6.3 |
| Student | 2 | 1.1 | | |
| Others | 5 | 2.9 | 4 | 12.5 |

**Table** 2 Characteristics of non-leaders *(Cont.)*

| Characteristic | Non leader N (174) | | Leader N (32) | |
|---|---|---|---|---|
| | Frequency | % | Frequency | % |
| **Receiving dengue knowledge 12 months ago** | | | | |
| Have | 28 | 16.1 | 16 | 50.0 |
| **Having dengue experience illness** | | | | |
| Have | 78 | 44.8 | 19 | 59.4 |
| **Having dengue experience illness** | | | | |
| Themselves | 7 | 4 | 2 | 6.3 |
| Family's member | 24 | 13.8 | 8 | 25.0 |
| Neighborhood | 44 | 25.3 | 11 | 34.4 |
| Others | 3 | 1.7 | 3 | 9.4 |

Table 3 showed characteristics of leaders group were almost all positions in community were 24 Village Health Volunteers (75%), community club members (15.6%) and teachers (15.6 %).

**Table** 3 Leader position and staying time of position in community

| Characteristics of leaders *N(32)* | Frequency | % |
|---|---|---|
| **Position in community** | | |
| Community committee | 3 | 9.4 |
| Local Administrative Organization member | 1 | 3.1 |
| Community leader | 1 | 3.1 |
| Religion Leader | 0 | 0 |
| Community club member | 5 | 15.6 |
| Village Health Volunteer | 24 | 75.0 |
| Teacher | 5 | 15.6 |
| Health worker | 0 | 0 |

**The Level of Dengue Community Capacity**

The Dengue Community Capacity Assessment Tool (DCCAT) divided into two data sets, leaders and non-leaders.

**The Level of Dengue Community Capacity of Leader (L)**

The 32 leaders showed the total dengue community capacity level was high level ($\overline{X}$=30.34, SD= 58.82 and 95%CI=339.26-381.68). One of 14 domains of leaders was very high level that "senses of community domain" ($\overline{X}$=44.31, SD=6.45 and 95%CI=41.98-46.64). Almost half (7 domains) were high level and nearly half (6 domains). The detail showed in Table 4:

**Table** 4 Level of dengue community capacity of leader (L)

| Component | Component label | Dengue Community Capacity of leader (N= 32) | | | |
|---|---|---|---|---|---|
| | | $\overline{X}$ | SD | 95%CI | level |
| L1 | Critical situation Management | 30.34 | 4.61 | 28.68-32.01 | High |
| L2 | Personal leadership | 40.09 | 7.15 | 37.51-42.67 | High |
| L3 | Health care provider capacity | 27.91 | 5.70 | 25.85-29.96 | High |
| L4 | Needs assessment | 25.84 | 4.96 | 24.05-27.63 | High |
| L5 | Senses of community | 44.31 | 6.45 | 41.98-46.64 | Very high |
| L6 | Leader group networking * | 34.13 | 7.63 | 31.37-36.88 | High |
| L7 | Communication of dengue information | 27.56 | 10.46 | 23.79-31.34 | Moderate |
| L8 | Community leadership | 22.00 | 7.31 | 19.36-24.64 | Moderate |
| L9 | Religion capacity | 21.13 | 9.74 | 17.61-24.64 | Moderate |
| L10 | Community and leader group networking * | 23.31 | 5.13 | 21.46-25.16 | High |
| L11 | Resources mobilization | 9.88 | 4.01 | 8.43-11.32 | Moderate |
| L12 | Dengue working group | 16.53 | 6.26 | 14.27-18-79 | Moderate |
| L13 | Community leader participation* | 17.88 | 3.85 | 16.48-19.27 | Moderate |
| L14 | Continuing activities | 19.56 | 4.34 | 18.00-21.13 | High |
| | **Total** | **360.47** | **58.82** | **339.26-381.68** | **High** |

**The Level of Dengue Community Capacity of Non-leaders (NL)**

The 174 non-leaders showed the total dengue community capacity level was moderate level and almost domains of dengue community capacity were moderate level ($\overline{X}$ =205.66, SD= 60.09 and 95%CI=196.67-214.65). Two low level of domains were "religion capacity component domain" ($\overline{X}$ =16.51, SD=11.04 and 95%CI=14.85-18.16) and "communication of dengue information domain" ($\overline{X}$ =12.97, SD=8.90 and 95%CI=11.63-14.30). The detail showed in Table 5.

**Table** 5 Level of dengue community capacity of non-leaders (NL)

| Domain | Domain label | Dengue Community Capacity of Non- leader (N=174) | | | |
|---|---|---|---|---|---|
| | | $\overline{X}$ | SD | 95%CI | level |
| NL1 | Critical situation management | 33.51 | 12.10 | 31.69-35.32 | Moderate |
| NL2 | Personal leadership | 20.48 | 8.41 | 19.22-21.74 | Moderate |
| NL3 | Religion capacity | 16.51 | 11.04 | 14.85-18.16 | Low |
| NL4 | Community leadership | 18.48 | 9.07 | 18.48-17-12 | Moderate |
| NL5 | Health care provider capacity | 17.59 | 5.23 | 16.81-18.38 | Moderate |
| NL6 | Senses of community | 29.91 | 6.42 | 28.95-30.87 | Moderate |
| NL7 | Communication of dengue information | 12.97 | 8.90 | 11.63-14.30 | Low |
| NL8 | Continuing activities | 15.13 | 5.76 | 14.26-15.99 | Moderate |
| NL9 | Dengue working group | 17.18 | 7.89 | 16.00-18.37 | Moderate |
| NL10 | Resources mobilization | 10.57 | 4.97 | 9.83-11.32 | Moderate |
| NL11 | Needs assessment | 13.34 | 5.28 | 12.55-14.14 | Moderate |
| | **Total** | **205.66** | **60.09** | **196.67-214.65** | **Moderate** |

**Household Environment Characteristics of all Participants**

Household environmental characteristics consisted of house distribution, housing type, material use to build the house, house surrounding and community characteristics. Table 6 showed total 206 households that consisted of non leaders 174 households and leader 32 households. Most houses scattering of the people (68.0%) were single house. Half of housing type (46.6%) was one storey house with low basement. Most of material used to build the house (68.4%) was Wood with concrete. Half people in community (50.5%) had house surrounding tidy surrounding disposal discarded containers. Community characteristics: most of people (44.7%) was rural and near market.

**Table** 6 Household environment characteristics of all the participants

| Household environmental characteristics | Frequency N(206) | Percent (%) |
|---|---|---|
| **Scattering of house** | | |
| -Single house | 140 | 68.0 |
| -A cluster 1-5 houses | 26 | 12.6 |
| -A cluster >6 houses | 40 | 19.4 |
| **Housing type** | | |
| -One storey house with high basement | 13 | 6.3 |
| -One storey house with low basement | 96 | 46.6 |
| -One storey house with basement adjacent to the ground | 68 | 33.0 |
| -Two storey | 27 | 13.1 |
| -Commercial building/Town houses | 2 | 1.0 |
| **Material used to build the house** | | |
| -Wood | 21 | 10.2 |
| -Wood with concrete | 141 | 68.4 |
| -Concrete | 43 | 20.9 |
| -Others | 1 | .5 |
| **House surrounding** | | |
| -Tidy surrounding disposal discarded containers | 104 | 50.5 |
| - Untidy surrounding with discarded container such as old tires broken jar etc. | 102 | 49.5 |
| **Community characteristics** | | |
| -Urban | 2 | 1.0 |
| -Urban and near market | 12 | 5.8 |
| -Semi-urban | 34 | 16.5 |
| -Semi-urban and near market | 14 | 6.8 |
| -Rural | 52 | 25.2 |
| -Rural and near market | 92 | 44.7 |

**Larval Indices**

Larval survey was conducted to determine type of container and larval indices. The results are shown in Table 7. The total of 2,269 containers was sampled cover community area found containers positive for larval on 372 (16%). The first levels of percentage of containers positive for larval per number of containers inspected showed 38% of discarded containers surround house, 15% of consuming water, and 14% of drinking water.

**Table** 7 Type of container inspected, containers positive for larval and percentage

| Type of container | No. of containers inspected | No. of containers (+) for larval | Percentage (%) of containers (+) for larval |
|---|---|---|---|
| 1. Drinking water | 456 | 60 | 13 |
| 2. Water containers in bathroom and toilet | 388 | 41 | 11 |
| 3. Consuming water | 431 | 64 | 15 |
| 4. Vases | 211 | 16 | 8 |
| 5. Cupboard saucers (ant-trap) | 95 | 8 | 9 |
| 6. Plant related containers | 281 | 25 | 7 |
| 7.Discarded containers surround household i.e.old tires, broken jar, can, and coconut shell | 407 | 158 | 39 |
| **Total** | **2269** | **372** | **16** |

Larval indices were shown that Household Index (HI), Breteau Index (BI), and Container Index (CI) in community were higher than standard level (BI<50, HI<10, and CI<0). The Table 8 showed that the total houses inspected were sample 206 houses and 75 were found houses positive for larval, and 2269 containers inspected and 372 containers positive for larval. The results showed BI = 185%, HI = 37 %, and CI = 16 %.

**Table** 8 Number of houses inspected, houses positive for larval, containers inspected, containers positive for larval and larval indices

| Household | No. of houses inspected | No. houses(+) for larval | No. of containers inspected | No. of containers(+) for larval | Larval Indices | | |
|---|---|---|---|---|---|---|---|
| | | | | | BI (%) | HI (%) | CI (%) |
| **Total** | 201 | 75 | 2269 | 372 | 185 | 37 | 16 |

### The Practice Guideline of Using Dengue Community Capacity-Assessment Tool (DCCAT)

The practice guideline of using tool based on community participatory approach. It consisted of five steps i.e. community preparation step, assessment step, community hearing meeting step, plan and implement, and reassessment.

#### Community Preparation Step

The community preparation step was consisted of consulting and discussing, setting DLG and dengue supporting team.

1) Consulting and discussing with the formal leaders of sub-district i.e. health care workers, local administrative organization officers, and formal community leaders. Morbidity and mortality of dengue from secondary in past 5 years were discussion issues for consensus of solving problem.

2) Setting "Dengue Leader Group" as the key group for conducting on dengue prevention and control, they were volunteers and available time for dengue activities. The DLG included leaders and non-leaders group.

3) Defining dengue supporting team consisted of health workers, local administrative organization officers, and religion leaders

#### Assessment Step

The step was collecting data, estimating sample size, assessing data and data analysis.

1) Collecting data team. The village health volunteers were trained about gathering data skills and described the objective of the study and utilities of results for plan and implement dengue prevention and control.

2) Estimating sample size of leaders and non-leaders. The number of participants based on context of community.
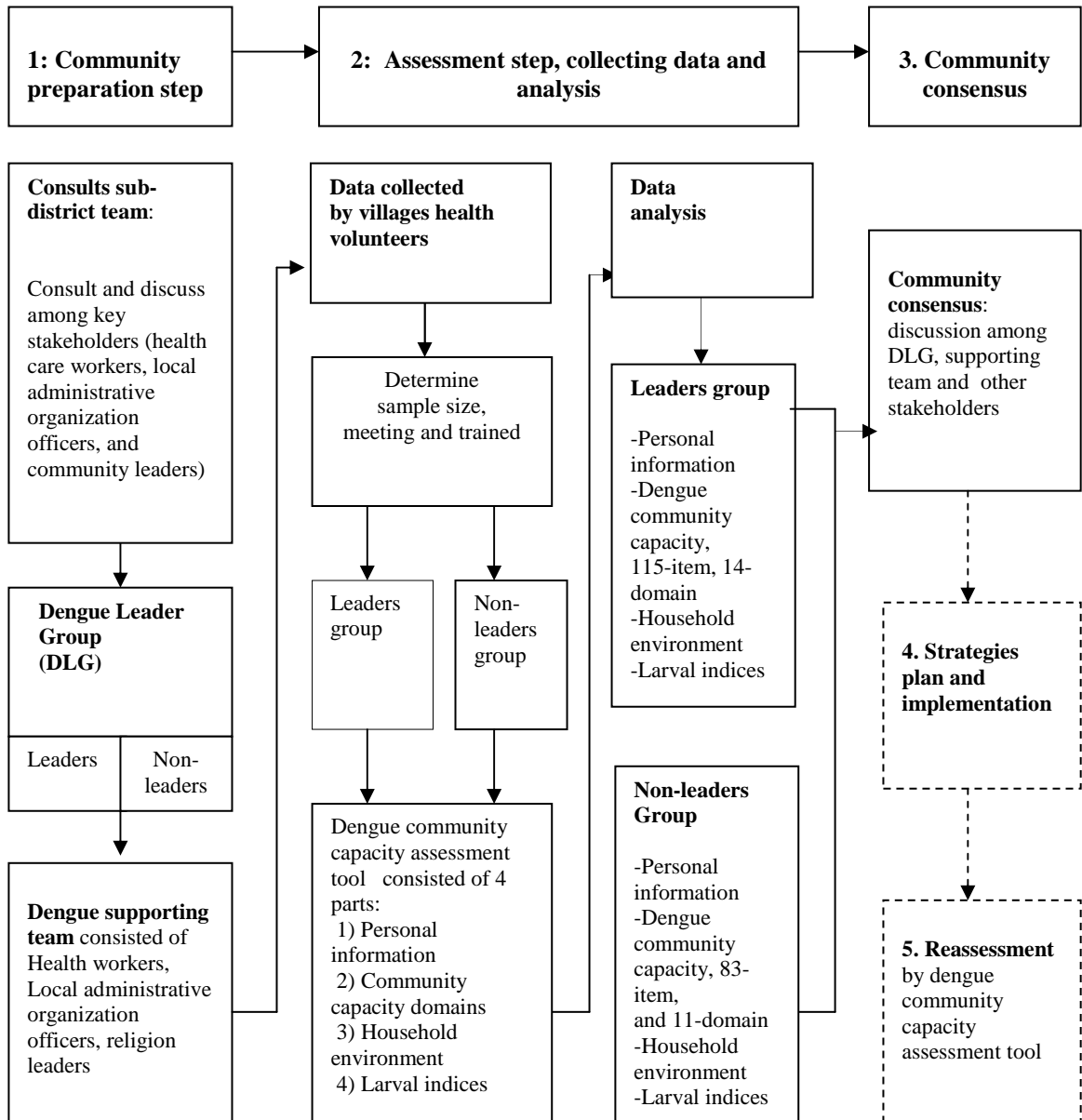
3) Assessing data with DCCAT, the format consisted of 4 parts: (1) general characteristics, (2) the dengue community capacity-assessment questionnaires consisted of leader (14 domains and 115 items) and non-leader (11 domains and 83 items), (3) household environment observation and (4) larval indices survey form.

4) Data analysis was followed the assessment format. The level of dengue community capacity of leaders and non-leaders were clearly cut-off point of mean score of each domain and total score.

#### Community Hearing Meeting Step

The step was meeting for discussion among DLG, supporting team and other stakeholders. The results of collecting data can use in this step as data based for planning and setting strategies dengue prevention and control. Plan and implement of dengue prevention and control and reassessment were offered in this step. The study was showed only three steps but two steps, "the plan and implement step" and "reassessment step" were offered from community hearing meeting that required for building community capacity for sustainable dengue prevention and control. Then there were 5 steps for application of the DCCAT as showed in Figure 1.

**Figure**1 The practice guideline of using the DCCAT to assess community capacity of sustainable community-based dengue prevention and control

| 1: Community preparation step | 2: Assessment step, collecting data and analysis | 3. Community consensus |
|---|---|---|

**Consults sub-district team**:

Consult and discuss among key stakeholders (health care workers, local administrative organization officers, and community leaders)

**Dengue Leader Group (DLG)**

| Leaders | Non-leaders |
|---|---|

**Dengue supporting team** consisted of Health workers, Local administrative organization officers, religion leaders

**Data collected by villages health volunteers**

Determine sample size, meeting and trained

| Leaders group | Non-leaders group |
|---|---|

Dengue community capacity assessment tool consisted of 4 parts:
 1) Personal information
 2) Community capacity domains
 3) Household environment
 4) Larval indices

**Data analysis**

**Leaders group**

-Personal information
-Dengue community capacity, 115-item, 14-domain
-Household environment
-Larval indices

**Non-leaders Group**

-Personal information
-Dengue community capacity, 83-item,
and 11-domain
-Household environment
-Larval indices

**Community consensus**: discussion among DLG, supporting team and other stakeholders

**4. Strategies plan and implementation**

**5. Reassessment** by dengue community capacity assessment tool

**Conclusion**

The application of dengue community capacity-assessment tool showed the level of dengue community capacity of community both leaders and non-leaders and the practice guideline of using DCCAT. The results were confirmed the new tools can measure level of dengue community capacity. The practice guideline of using tools was five possible steps: 1) community preparation, 2) assessment, 3) community hearing meeting, 4) plan and implement, and 5) reassessment. The DLG (15 village health volunteers and 15 people) was the key group for conducting on collecting data and intervention. The dengue community capacity of leaders and non-leaders were integrated with entomology surveys. The new DCCAT format was gathering qualitative and quantitative data. It consisted of 4 parts: general data, dengue community capacity questionnaires, household's environment and larval indices. Survey results of households environment and larval indices were consonant the level of dengue community capacity of leaders and non-leaders. In particular, the community hearing meeting step was defined dengue problem solution needs and discuss the results of assessment tool as qualitative data which covering data collection.

**Appendix H**

**A List of Experts**

# LIST OF EXPERTS

1. รศ. ดร. เบญจา ยอดดำเนิน-แอ็ตติกจ์     คณะประชากรและวิจัยสังคม มหาวิทยาลัยมหิดล

2. ผศ. ดร. อารีย์วรรณ อ่วมตานี     คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

3. ดร. วรรณภา สุวรรณเกิด     สำนักงานป้องกันและควบคุมโรคที่ 10 จังหวัดเชียงใหม่ กรมควบคุมโรค

4. ดร. สุวิช ธรรมปาโล     สำนักงานป้องกันและควบคุมโรคที่ 12 จังหวัดสงขลา กรมควบคุมโรค

5. คุณกรรณิการ์ พินิจ     พยาบาลวิชาชีพ 7 พยาบาลผู้เชี่ยวชาญ แผนกเวชกรรมสังคม โรงพยาบาลระยอง จังหวัดระยอง

6. คุณสมบัติ ใจสว่าง     อดีตหัวหน้าศูนย์ควบคุมโรคติดต่อนำโดยแมลง สำนักงานป้องกันและควบคุมโรคที่ 11 จังหวัดนครศรีธรรมราช กรมควบคุมโรค

7. รศ. ดร. เพชรน้อย สิงห์ช่างชัย     คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์

8. นายวิเชษฐ ขวัญแก้ว     ปลัดองค์การบริหารส่วนท้องถิ่นอำเภออ่าวนาง อำเภออ่าวนาง จังหวัดกระบี่

9. นางวิไลวรรณ ศรทอง     อาสาสมัครสาธารณสุขประจำหมู่บ้าน ตำบลนาวง อำเภอห้วยยอด จังหวัดตรัง

10. นายทัศน ประทุมวรรณ     เจ้าหน้าที่สาธารณสุข สถานีอนามัยเขารูปช้าง ตำบลปาดังเบซาร์ อำเภอสะเดา จังหวัดสงขลา

11. นางปราณี เกาะกลาง     อาสาสมัครสาธารณสุขประจำหมู่บ้าน ตำบลอ่าวนาง อำเภออ่าวนาง จังหวัดกระบี่

12. นางสมใจ นุกูลวรรณ     อาสาสมัครสาธารณสุขประจำหมู่บ้าน ตำบลปากพูน อำเภอเมือง จังหวัดนครศรีธรรมราช

13. นางสาวนพมาศ หนูกัน     เจ้าหน้าที่สาธารณสุข สถานีอนามัยบ้านศาลาปางปู ตำบลปากพูน อำเภอเมือง จังหวัดนครศรีธรรมราช

14. นางลักคณา ทองดียิ่ง     เจ้าหน้าที่สาธารณสุข สถานีอนามัยบ้านโพธิ์โทน ตำบลนาวง อำเภอห้วยยอด จังหวัดตรัง

# BIOGRAPHY

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**Education:**

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| M.S.N. | Master Science of Nursing (Parents and Child) Prince of Sonkhla University, Songkhla Province, Thailand |
| B.Sc. | Bachelor of Science in Nursing (Nusing and midwifery) Songkhla Nursing College,  Songkhla Province, Thailand |
| B.Sc. | Bachelor of Public Health science (Occcupation Health and safety) Sukhothai Thammathirat Open University, Nontabury Province, Thailand |

**Short Course:**

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|---|---|
| Epidemiology course | Epidemiology course I, II and field work at Phuket Province, Prince of Sonkhla University, Songkhla Province, Thailand |
| Nurse Practioner | Certificate in Nurse Practioner (NP), Walailak University, Nakhon Si Thamarat  Province, Thailand |
| Clinical Teaching | Certificate in Concentration Teaching in Clinical Nursing, Nakhon Si Thamarat Nursing College, Nakhon Si Thamarat Province, Thailand |

**Professional Experience:**

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|---|---|
| 2007 | WHO Technical Assistance for Communication for Behavioural Impact (COMBI) for Dengue Prevention and Control in four Provinces in Lao PDR |
| 2003- Current. | Lecturer at School of Nursing, Walailak University, Nakhon Si Thamarat  Province, Thailand |
| 2003- Current. | Certificate APN; Advance Practice Nurse (Pediatric), Thai Nursing Council and Midwifery, Bangkok  Thailand |
| 1988 - 2003. | Registered Nurse (C1-7) at Pediatric Department,  Songkhla Hospital, Songkhla Province, Thailand |

**Selection Poster/ Oral Presentations**

-Suwanbamrung, C., et al. (2008). *Community Capacity Domains of Sustainable Community-based Dengue Prevention and Control in Southern Thailand.* Poster presentation in the second International Conference on Dengue and Dengue Haemorrhagic Fever 15-17 December 2008, Phuket, Thailand.

-Suwanbamrung, C., et al. (2007*). Communication for Behavioral Impact (COMBI) Implementation for Prevention and Control: A Case Study of Pre-*Survey *in Loa PDR*. Poster presentation at the Joint International Tropical Medicine Meeting 2007 "Health Security in the Tropics" 29-30 November 2007, Imperial Queen's Park Hotel, Bangkok, Thailand.