Risk factors related to dengue infections in primary school students: Exploring students' basic knowledge of dengue and examining the larval indices in southern Thailand

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Summary Dengue is a major problem in southern Thailand.
Objectives: (1) To determine students' basic knowledge of dengue and (2) to examine the larval indices in primary schools and in the students' households.
Methods: This study employed a cross-sectional quantitative and qualitative approach involving meetings with students, discussions with groups of teachers, a questionnaire investigating students' basic knowledge of dengue, and a survey of the larval indices in primary schools and in the students' households. The study consisted of three stages: (1) community preparation, (2) data collection and analysis, and (3) feedback.
Results: A total of 306 students (from primary education levels 4—6) from five primary schools in the community were included in the study. Of a total of 15 items on the basic dengue questionnaire, only five were answered correctly by more than 80% of the students. Most of the knowledge items showed statistically significantly different distributions of correct, incorrect, and unknown answers ($P \leq 0.05$, $P \leq 0.01$, and $P \leq 0.001$). The larval indices surveyed in the five schools and in 302 student households showed a high risk of dengue, with high indices in the five schools (Breteau Index: BI = 200; House Index: HI = 60; and Container Index: CI = 7.94) and in the students' households (BI = 754; HI = 77; and CI = 35).

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Conclusion: Risk factors for dengue were related to the students' basic knowledge of dengue and to the larval indices in both the schools and the students' households. Additionally, a coordinated effort will be required to eliminate *Aedes aegypti* mosquito breeding sites in the community.

Introduction

Dengue is one of the most important arthropod-borne viral infections affecting humans. Worldwide, an estimated 2.5 billion people are at risk of dengue infection. Of those, approximately 975 million live in tropical and sub-tropical countries [1]. In Thailand, dengue has been a significant public health problem for the past fifty years [2]. Although the mortality rate of hospitalized patients has decreased, the morbidity rate has increased in all areas from 1998 to 2009. Dengue is problematic in southern Thailand due to the high morbidity rate and high larval indices. The dengue incidence may be higher in southern Thailand than in other areas due to factors such as its greater number of rainy days, more rainfall, higher relative humidity, and warmer temperatures [3].

There are many risk factors that must be understood by all stakeholders before the community can reduce the incidence of dengue. Eco-bio-social, climatic, and environmental factors must be considered in conjunction with human behaviors that impact vector breeding in peridomestic and intradomestic areas, which are more important infection sites than schools and public areas. In particular, breeding sites such as outdoor water containers, water supplies, and waste disposal sites are associated with *Aedes aegypti* breeding and dengue illness [4—6]. Vulnerable populations, including those with poor educations, low incomes, irregular water service, and overcrowded housing [6], as well as those in rural communities in which lakes serve as the water supply, are all at a enhanced risk of dengue [7]. Moreover, all risk factors are closely related to mitigation strategies based on multiple interventions [4].

The Kamphaeng Sao sub-district is a rural and semi-rural area of the Nakhon Si Thammarat province in southern Thailand. This sub-district has been implementing dengue prevention and control measures since 2009. This community has been the subject of several studies aiming to identify successful approaches to reducing the incidence of dengue, such as the training of village health volunteers, the use of high school-based programs, and the development of a community network for dengue prevention and control [8,9]. However, the primary schools in the sub-district lack an intervention program for dengue prevention and control. The community did not report any dengue morbidity in the past two years (2010 and 2011), but there was a dengue outbreak in April 2012 [8]. The first child diagnosed with dengue was considered the index case for the outbreak. The natural route of dengue transmission includes humans, mosquitos, and the environment. However, the morbidity rate within this sub-district (5 per 100,000 populations) was lower than the Thai Ministry of Public Health disease standard (<20 per 100,000 populations). The results of the dengue study showed that continuing community activities are needed to empower citizens in this region [10]. The morbidity rate indicated a high risk of a dengue epidemic, as almost all the student households were in the Kamphaeng Sao sub-district. Primary school students were considered a vulnerable group due to the lack of protection from and prevention of mosquito bites.

Community-based educational interventions are considered to be valuable methods for reducing the incidence of dengue because they are associated with decreases in larval breeding sites [11]. The larval index is the classical index used in the study of dengue [11,12]. A study carried out in primary schools investigated the impacts of a community-based project for children on knowledge, behavior, and residential mosquito infestation. This research showed that children and their parents require effective knowledge about dengue to change their behaviors regarding dengue prevention and control. Moreover, school programs increase parental knowledge about dengue through directed messages [13]. A dengue prevention and control attitude survey in nine primary schools in Thailand showed that the education program successfully impacted all stakeholders [14]. However, the schools need a clear model for activities and an integration program that is suitable for a primary school. The results of the study were compared with those of a qualitative study of community and school-based education programs. This study showed that there were many factors involved in developing an effective dengue knowledge program for children, such as equipment, content (i.e., information about dengue),