รูปแบบการควบคุมและป้องกันมาลาเรียบูรณาการด้วยสิ่งแวดล้อมศึกษา
Model of Malaria Prevention and Control Integrated with
Environmental Education

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Abstract

The objective of research was to develop the causal relationship model of malaria knowledge and environmental education affecting malaria prevention and control behavior through inspiration of health care and inspiration of public mind for malaria prevention and control. The populations were people in Somdej District which covers 3 Sub-districts of Sangbadan, Mahachai and Pasawoei in Kalasin Province in Northeastern region of Thailand. The Simple random sampling technique was used to collect from 400 subjects. The questionnaire was used as an instrument for data collection. Structural Equation Model (SEM) was used for model verification. The results revealed that when considering the structural model confirmatory factors of Malaria Knowledge (MK) and Environmental Education (EE) were able to explain the variation of endogenous factors of Inspiration of Health Care (IHC) with 62.00. EE had the most effect to IHC with 0.85 and IHC had the most effect to Beh with 0.52 and had the most effect to Inspiration of Public Mind for Malaria Prevention and control (IPM) with 0.95. However, the results indicated that if we want to meet the highest outcome of malaria prevention and control behavior, it need to promote people to have Malaria Knowledge, Environmental Education and Inspiration of Health Care.

Keywords: model, Malaria prevention and control, behavior

บทคัดย่อ

วัตถุประสงค์การวิจัยเพื่อพัฒนารูปแบบความสัมพันธ์เชิงโครงสร้างรูปแบบความรู้มาลาเรีย และสิ่งแวดล้อม ศึกษา มีผลต่อพฤติกรรมการการควบคุมและป้องกันมาลาเรียผ่านแรงบันดาลใจในการดูแลสุขภาพและแรงบันดาลใจ ในการมีจิตสาธารณะเพื่อการการควบคุมและป้องกันมาลาเรีย ประชากรเป็นประชาชนในอำเภอสมเด็จที่ครอบคลุมพื้นที่ 3 ตำบลคือ แซงบาดาล มหาชัย และผาเสวย จังหวัดกาฬสินธุ์ ในภาคตะวันออกเฉียงเหนือ ประเทศไทย ใช้เทคนิคการสุ่ม อย่างง่ายในการรวบรวมตัวอย่าง 400 คน โดยใช้แบบสอบถามเป็นเครื่องมือในการเก็บรวบรวมข้อมูล และใช้รูปแบบ ความสัมพันธ์เชิงโครงสร้างในการตรวจสอบสอดคล้องของข้อมูลเชิงประจักษ์กับสมมุติฐานการวิจัย ผลการวัยพบว่า เมื่อพิจารณารูปแบบโครงสร้างองค์ประกอบเชิงยืนยันของปัจจัยความรู้มาลาเรีย และสิ่งแวดล้อมศึกษา สามารถอธิบาย ความแปรปรวนของแรงบันดาลใจในการดูแลสุขภาพร้อยละ 66.00 โดยสิ่งแวดล้อมศึกษามีอิทธิพลมากที่สุด 0.85 และ แรงบันดาลใจในการดูแลสุขภาพมีอิทธิพลต่อพฤติกรรมการควบคุมและป้องกันมาลาเรียมากที่สุดเท่ากับ 0.52 และมี อิทธิพลต่อแรงบันดาลใจในการมีจิตสาธารณะเพื่อการควบคุมและป้องกันมาลาเรียเท่ากับ 0.95 จากผลการวิจัยพบว่า

หากจะต้องการให้พฤติกรรมการควบคุมและป้องกันมาลาเรียประสบผลสูงสุดต้องส่งเสริมให้ประชาชนมีความรู้เกี่ยวกับโรคมาลาเรีย ร่วมกับการประยุกต์ใช้หลักการสิ่งแวดล้อมศึกษา รวมทั้งสร้างเสริมแรงบันดาลใจในการดูแลสุขภาพของประชาชน.

คำสำคัญ: รูปแบบ, การควบคุมและป้องกันมาเลเรีย, พฤติกรรม

Introduction

Malaria disease is prevalent in tropical and subtropical regions because of rainfall, warm temperatures, and inactive waters supply resulting in environmental circumstances for mosquito larvae development. There are five species of Plasmodium infecting humans and female Anopheles mosquito is a vector for transmitting. *The P. falciparum and P. vivax* cause massive death, *while P. ovale, and P. malariae* cause commonly milder forms of malaria with less mortality. However, the zoonotic species *P. knowlesi*, is widespread in Southeast Asia and causes malaria in macaques but it can also cause severe infections in humans. Tthe disease is generally transmitted by a bite from an infected female Anopheles mosquito and it introduces the organisms from its saliva into a person's circulatory blood system. Transmission takes place accidentally by blood transfusion, organ transplantation, needle sharing, or congenitally from mother to fetus. In the blood stream, the parasites migrate to the liver to mature and reproduce. Malaria causes typical symptoms of fever and headache and in severe cases can advancement to coma or death (Arguin and Tan, 2013).

Malaria is one of the top five most important diseases in the world because each year as compared other four diseases which are pneumonia, diarrhea, HIV and tuberculosis. Mortality rate was infection from this parasite is approximately 300-500 millions and they died about one million annually in particular children in Africa. Africa, Central and South America, parts of the Caribbean, Asia (including South Asia, Southeast Asia, and the Middle East), Eastern Europe, and the South Pacific are prevalent with malaria transmission occurrence (Wilairatana et al., 2010; Wilairatana et al., 2010; Arguin and Tan, 2013).

However, malaria infection is a foremost cause of mortality in the Asia Pacific region, with approximately 2.2 billion people at risk for this disease (RBM Partnership, 2008). In this region, malaria-endemic countries have been report for approximately 30 million malaria cases. It represented 84% of global malaria cases outside Africa (RBM Partnership, 2012). Although, various countries have made main speeds in reducing malaria occurrence and morbidity over the last ten years but the malaria transmission are still extreme contribute to receptive areas (RBM Partnership, 2012; Feachem et al., 2009; Sinka et al., 2012).

The summarized information from the World Malaria Report in 2013, received from malaria-endemic countries and other sources together with updates the analyses presented in the 2012 report. It emphasizes the progress made towards global malaria targets set for 2015 and describes existing challenges for global malaria control and eradication. The international community steadily moves towards a post-2015 development agenda, therefore the world most vulnerable populations must be paid seriously attention. The concept of worldwide treatment stands for both a social value and approach to health care that produces for whole populations for reduction of social disparities and protect people from poverty provoked by health care costs. The key concept is already placed at the center of the global health dispute, and the debate also about the next set of development

goals. Progress against malaria provides good evidence of concrete benefit for population extensively access to life saving involvements (World Health Organization, 2013).

In general, malaria symptoms are unspecific and most frequently consist of fever, malaise, weakness, gastrointestinal complaints (nausea, vomiting, and diarrhea), neurologic complaints (confusion, disorientation, dizziness, and coma), headache, back pain, myalgia, chills, and/or cough. The diagnosis of malaria should also be considered in any person with fever of unidentified source without regarding to travel history (CDC, 2013). Therefore, patients suspected of having malaria infection should be immediately evaluated. However, treatment for malaria should not be initiated until diagnosis has been confirmed by laboratory investigations. Presumptive treatment without the benefit of laboratory confirmation should be reserved for severe conditions (strong clinical suspicion, severe disease, impossibility of obtaining prompt laboratory confirmation, usually by microscopy). Laboratory diagnosis of malaria can be made through microscopic examination of thick and thin blood smears. Thick blood smears are more sensitive for identifying malaria parasites because the blood is more concentrated allowing for a greater volume of blood to be examined; however, thick smears are more difficult to interpret. Thin smears assist in parasite species classification and quantification. Blood films need to be read immediately in any time by experienced persons to perform this role (CDC, 2013).

Environmental education concept comprises of environmental knowledge, attitude, awareness, and participation are introduced to this study since the malaria knowledge could only encourage people to change their behaviors in particular malaria prevention and control. Previous different researches had proven that the integration with environmental education concept is able to support the diverse knowledge such as self-health care knowledge, water conservation knowledge, forest conservation knowledge, flood response knowledge and forest fire prevention knowledge and dengue fever knowledge to for behavioral change (Phinnarach et al., 2012a; Udonboon et al., 2012b; Suebsing et al., 2013a; Mongkonsin at al., 2013b; Kotchakote et al., 2013a; Artwanichakul et al., 2012a). The goals of environmental education are firstly, to foster clear awareness of and concern about, economic, social, political and ecological interdependence in urban and rural areas. Secondly, to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment. Thirdly to create new patterns of behavior of individuals, groups and society as a whole toward the environment with public mind and responsibility (UNESCO 1977; Thiengkamol, 2011e; Thiengkamol, 2011i; Thiengkamol, 2011j; Thiengkamol, 2012a; Thiengkamol, 2012c; Thiengkamol, 2012d; Thiengkamol, 2012h; Thiengkamol, 2012i).

There is a long time dispute between knowledge and behavior in particular daily living behavior. The majority people know that they should eat five to seven servings of fruits and vegetables per day, however their real behaviors normally do not reflect this knowledge. Diverse studies have illustrated that knowledge of an environmental issue is unlikely to be adequate to change behavior. Katzev and Johnson, 1987 conducted a series of studies demonstrating that individuals who received leaflets or tip booklets contained information on energy conservation, they did not significantly change their energy conservation behaviors (Katzev, & Johnson, 1987). Overall, the research shows that there is a gap between environmental knowledge and actions. Stronger sources of motivation are needed because human behavior is often difficult to change (Kollmus, & Agyeman, 2002; McKenzie-Mohr et al., 2012). In contrast, while "declarative knowledge" about environmental problems or issues is unlikely to be sufficient for fostering behavior change, other types of knowledge may be important. This

includes "procedural knowledge," or information on how to perform environmentally-responsible actions, and "behavioral competence", or the feeling of confidence and ability to take action (Hines et al, 1987; Zeleny, 1999). In particular, self health care and malaria prevention and control of behavior are also disputed and that it did not connect directly to knowledge on severity of malaria disease but populations who can practice proper behavior of prevention and control need to have correct knowledge of malaria control and prevention through mosquito elimination, prevention of mosquito bites and medications (Katzev, & Johnson, 1987; Kollmus, & Agyeman, 2002; McKenzie-Mohr et al., 2012; Kajfasz, 2009; Phinnarach et al., 2012a; Jukravalchaisri et al., 2013).

Environmentally responsible behaviors are not occurred in one who is only contact to nature directly but it needs other guildlines to initiate people to take responsibility. A variety of researches are conducting on the effect of exposing one to the natural environmental, thus they are paying attention to changes in knowledge and concerns mentioned and are not strong predictors of future behavior. Programs get people out into the environment, while favorable on many levels may not be the most effectual trail for changing people's actions in their daily lives (Mayer & McPherson-Frantz, 2004).

It is remarkable to note that the foundation of research in this area is not particularly strong for either argument, and more research is needed. Emerging research may propose more insights into the ways that one's link to nature can result in environmental actions (Schultz, 2002). This research suggests that one's level of interconnectedness with nature may influence future environmental actions, particularly for young children. Other factors, such as social influences or action skills, may be much stronger determinants of behavior than spending time in natural surrounding environs, and therefore more vital influences for leverage in environmental outreach

programs (Hungerford & Volk, 1990; Cialdini, 2001). Programs may be more effective in encouragement of such behaviors if they are based on research-supported strategies rather than ones focused on exposing natural habitants.

In order to solve the problem of repeated malaria infection problem, it needs to integrate another exogenous variable of Environmental Education (EE) composing and observed variables of environmental knowledge, attitude, awareness, and participation including intermediate variable of Inspiration of Health Care (IHC) composing observed variables of family inspiration, community people inspiration, local administrative organization education and repeated epidemic infection as endogenous as a latent variable that causes indirect effect of malaria knowledge for prevention and control behavior. Additionally, Inspiration of Public Mind for Malaria Prevention and control (IPM) consists of observed variable self public mind, inspiration from media and public relation, inspiration from malaria epidemic event and inspiration from role model person are also integrated in this study. The previous studies indicate that even though people has knowledge but he or she practices according to their knowledge but to have proper behavior, it needs to have knowledge (Katzev, & Johnson, 1987; Kaplan, 2000; Kollmus, & Agyeman, 2002; McKenzie-Mohr et al., 2012; Hines et al, 1987; Zeleny, 1999; Mayer & McPherson-Frantz, 2004; Chawla,1999 ; UNESCO, 1978; Thiengkamol, 2011e; Thiengkamol, 2011i; Thiengkamol, 2012h; Thiengkamol, 2012i; Phinnarach et al., 2012a; Artwanichakul et al., 2012a; Jukravalchaisri et al., 2013). Therefore, the environmental education, inspiration of health care and inspiration of public mind for malaria prevention and control are introduced to investigate for Malaria Prevention and control Behavior and it proposes to use as intervention variable to assist to people to effectual perform for malaria prevention and control successfully (UNESCO, 1978; Thiengkamol, 2011e;

Thiengkamol, 2011i; Thiengkamol, 2012h; Thiengkamol, 2012i; Artwanichakul et al., 2012a; Phinnarach et al., 2012b; Jukravalchaisri et al., 2013).

Accompanied with different researches proved on inspiration of public mind for environmental conservation and health maintenance, they strongly confirm the inspiration with public mind in different researches were done by herself and her colleagues that inspiration is significant intermediate variable to cause behavioral change since inspiration is entirely different from motivation because the populace are willing to perform for public with their desires from their inside to conduct for environmental conservation and health maintenance. However, the inspiration with public mind or health care might be arisen from insight from oneself and the appreciation of exemplary model from any person, impressive event, or environment and various media perception. They are inspired to perform with public mind for other without the requirement of rewards, money, nobility or admiration but they are willing to do with appreciation or impression to do so (Thiengkamol, 2009a; Thiengkamol, 2009b; Thiengkamol, 2011a; Thiengkamol, 2011e). Concurrently, the various researches were implemented by her colleagues, these have also confirmed that inspiration of public consciousness or public mind are essential for environmental conservation of target groups about environmental management with integration of environmental education principle (Waewthaisong et al., 2012a; Ruboon et al., 2012a; Pimdee et al., 2012a; Donkonchum et al., 2012a; Donkonchum & Thiengkamol, 2012; Morrasri et al., 2012b; Mongkonsin et al., 2013b; Gonggool et al., 2012b; Jongwutiwet, et al., 2012b; Phinnarach et al., 2012a; Artwanichakul, et al, 2012a; Sangsan-anan et al., 2012a; Tumpracha et al., 2012b; Udonboon et al., 2012b).

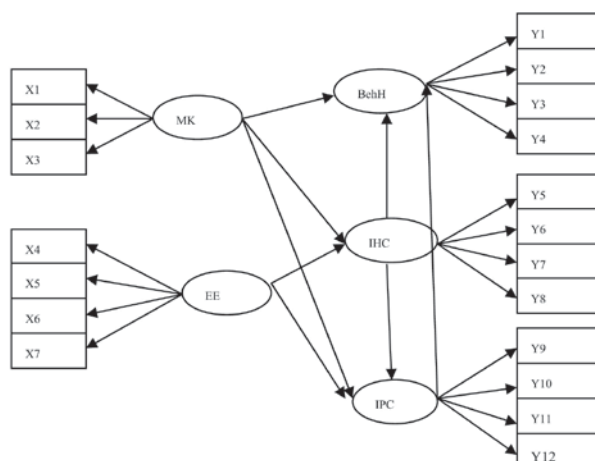Even though, the people in Somdej District cover 3 Sub-districts of Sangbadan, Mahachai and Pasawoei in Kalasin Province in Northeastern region of Thailand have knowledge about malaria disease in terms of prevention and control but the epidemic of malaria was recurrent in the previous year with high mortality from malaria infection. Therefore, the investigation has been conducted on the question of their behavior of malaria prevention is caused by malaria knowledge comprising of observed variable of Malaria Disease Knowledge, Malaria Prevention Knowledge, and Malaria Treatment Knowledge with integration the variables of Inspiration of Health Care (IHC) and Inspiration of Public Mind for Malaria Prevention and control (IPM) as intermediate variable to cause Malaria Prevention and control Behavior (Beh). Inspiration of health care has used the observed variables of family inspiration, community people inspiration, local administrative organization inspiration and repeated epidemic infection inspiration (Thiengkamol, 2011e; Donkonchum et al., 2012a; Phinnarach et al., 2012; Sangsan-anan et al., 2012a; Office of Environmental Health, 2012; WHO, 2014; Thiengkamol, 2011f; Jukravalchaisri et al., 2013).

However, in order to confirm the success of malaria prevention and control behavior through inspiration of health care and inspiration of public mind for malaria prevention and control, this research was conducted with the other aspect of knowledge like as malaria knowledge. This design was similar to the study of Artwanichakul, et al, 2012a.

Objective

The objective of research was to develop the causal relationship model of malaria knowledge and environmental education affecting to malaria prevention and control behavior through inspiration of health care and inspiration of public mind for malaria prevention and control.

Conceptual Framework

The research hypothesis was to verify the effect of malaria knowledge and environmental education to malaria prevention and control behavior through inspiration of health care and inspiration of public mind for malaria prevention and control. This relationship makes us to clear understand the malaria prevention and control behavior and it is able to use for controlling malaria epidemic.

Methodology Population and Sample

The populations were people in Somdej District covers 3 Sub-districts of Sangbadan, Mahachai and Pasawoei in Kalasin Province in Northeastern region of Thailand. The Simple random sampling technique was used to collect the sample for 400 peoples.

Research Tool

The research tool was the questionnaire with 95 items and it was used for data collection. The content and structural validity were determined by Item Objective Congruent (IOC) with 5 experts in the aspects of malaria disease, social science and social research methodology. The reliability was done by collecting the sample group from 50 peoples of Kam Mung District, Kalasin Province which is similar characteristics to Somdej District, Kalasin Province. The reliability was determined by Cronbach's

Alpha. The reliability of malaria knowledge, environmental education, inspiration of health care, inspiration of public mind for malaria prevention and control, malaria prevention and control behavior and the whole questionnaire were 0.900, 0.900, 0.961, 0.954, 0.956 and 0.968 respectively. The reason of use this tool for studying because it can explain the variables that are able to predict the malaria prevention and control behavior with holistic view.

Data Collection

The questionnaire was used for data collecting from people in Somdej District covers 3 Sub-districts of Sangbadan, Mahachai and Pasawoei in Kalasin Province in Northeastern region of Thailand in 2013. The data collection was implemented in these 3 Sub-districts because these areas are heavily infection of malaria.

Statistical Analysis

The descriptive statistics used were frequency, percentage, mean and standard deviation. The inferential statistics used was Structural Equation Model (SEM) and analyzed with LISREL version 8.30 by considering on Chi-Square value differs from zero with no statistical significant at 0.05 level or Chi-Square/df value with less or equal to 5, RMSEA (Root Mean Square Error Approximation) value and RMR (Root Mean Square Residual) with less than 0.05 including index level of model congruent value, GFI (Goodness of Fit Index) and critical number, and index level of model congruent value, AGFI (Adjust Goodness of Fit Index) between 0.90-1.00. Moreover, critical number should be more than 200.

Result

1. Results of Confirmatory factors Analysis of Exogenous Variables

1.1 Confirmatory factors Analysis of Exogenous Variables of Malaria Knowledge (MK)

Confirmatory Factor Analysis of Exogenous Variables of Malaria Knowledge (MK) affecting to Malaria Prevention Behavior (Beh) was revealed as the followings.

Confirmatory factors of GC had Bartlett's test of Sphericity of 41.947 statistically significant level (p< 0.01) and Kaiser-Mayer-Olkin Measure of Sampling Adequacy/MSA) of 0.580.

1.2 Confirmatory Factors Analysis of Exogenous Variables of Environmental Education (EE)

Confirmatory Factor Analysis of Exogenous Variables of Environmental Education (EE) affecting to Malaria Prevention Behavior (Beh) was revealed as the followings.Confirmatory factors of EE had Bartlett's test of Sphericity of 438.316 statistically significant level of 0.01, and Kaiser-Mayer-Olkin Measure of Sampling Adequacy/MSA of 0.744.

2. Confirmatory Factors Analysis of Endogenous Variables

2.1 Confirmatory Factors Analysis of Endogenous Variables of Inspiration of Health Care (IHC)

Confirmatory Factors Analysis of Endogenous Variables of Inspiration of Inspiration of Health Care (IHC) affecting to Malaria Prevention Behavior (Beh) was revealed as the followings.

Confirmatory Factors of IHC had Bartlett's test of Sphericity of 458.684 statistically significant level (p< 0.01) and Kaiser–Mayer–Olkin Measure of Sampling Adequacy/MSA) of 0.670.

2.2 Confirmatory Factors Analysis of Endogenous Variables of (Inspiration of Public Mind for Malaria Prevention and control-- IPM)

Confirmatory Factors Analysis of Endogenous Variables of Inspiration of Public Mind for Malaria Prevention and control (IPM) affecting to Malaria

Prevention and control Behavior (Beh) was revealed as the followings.

Confirmatory Factors of Inspiration of IPM had Bartlett's test of Sphericity of 349.259 statistically significant level (p< 0.01) and Kaiser-Mayer-Olkin Measure of Sampling Adequacy/MSA) of 0.743.

2.3 Confirmatory Factors Analysis of Endogenous Variables of Malaria Prevention and control Behavior

Confirmatory Factors of Beh had Bartlett's test of Sphericity of 983.263 statistically significant level (p< 0.01) and Kaiser-Mayer-Olkin Measure of Sampling Adequacy/MSA) of 0.811.

2.4 Results of Effect among Variables in Model in Terms of Direct Effect and Indirect Effect

1) Confirmatory factors of Malaria Knowledge (MK) had direct effect to Inspiration of Health Care (IHC) no statistically significant at level of 0.05 with effect of -0.02, Inspiration of Public Mind for Malaria Prevention and control (IPM) statistically significant at level of 0.01 with effect of 0.45, and Malaria Prevention and control Behavior (Beh) no statistically significant at level of 0.05 with effect of -0.02. Moreover, confirmatory factors in aspect of Malaria Knowledge (MK) had indirect effect to Malaria Prevention and control Behavior (Beh) through Inspiration of Health Care (IHC) no statistically significant at level of 0.05 with effect of 0.04 and through Inspiration of Public Mind for Malaria Prevention and control (IPM) no statistically significant at level of 0.05 with effect of 0.09.

2) Confirmatory factors of Environmental Education (EE) had direct effect to Inspiration of Health Care (IHC) statistically significant at level of 0.01 with effect of 0.85, and Malaria Prevention and control Behavior (Beh) no statistically significant at level of 0.05 with effect of -0.32. Moreover, confirmatory factors

of Environmental Education (EE) had indirect effect to Malaria Prevention and control Behavior (Beh) statistically significant at level of 0.05 with effect of 0.44 through Inspiration of Health Care (IHC).

3) Confirmatory factors of Inspiration of Health Care (IHC) had direct effect to Malaria Prevention and control Behavior (Beh) statistically significant at level of 0.01 with effect of 0.52 and indirect effect no statistically significant at level of 0.05 with effect of -0.21.

4) Confirmatory factors of Inspiration of Public Mind for Malaria Prevention and control (IPM) had direct effect to Malaria Prevention and control Behavior (Beh) no statistically significant at level of 0.05 with effect of -0.22.

5) Considering on structural model confirmatory factors of Malaria Knowledge (MK) and Environmental Education (EE) were able to explain the variation of endogenous factors of Inspiration of Health Care (IHC) and Inspiration of Public Mind for Malaria Prevention and control (IPM) to cause Malaria Prevention and control Behavior (Beh) with 24.00 percent as the following in equation (1).

$$Beh = 0.52*IHC - 0.22*IPM - 0.02*MK - 0.32*EE \ldots(1)$$

$$(R^2 = 0.066)$$

Equation (1) factors that had the most effect to Malaria Prevention and control Behavior (Beh) was Inspiration of Health Care (IHC) with effect of 0.52, and subsequence were Malaria Knowledge (MK) with effect of -0.02, Inspiration of Public Mind for Malaria Prevention and control (IPM) with effect of -0.22 and Environmental Education with effect of -0.32. These were able to explain the variation Malaria Prevention and control Behavior (Beh) with 6.60 percent.

6) Considering on structural model confirmatory factors of Malaria Knowledge (MK) and Environmental Education (EE) were able to explain the

variation of endogenous factors of Inspiration of Health Care (IHC) to cause Malaria Prevention and control Behavior (Beh) with 62.00 percent as the following in equation (2).

$$IHC = -0.08*MK + 0.85*EE \ldots(2)$$

$$(R^2 = 0.62)$$

Equation (2) factors that had the most effect to Inspiration of Health Care (IHC) was Environmental Education (EE with effect of 0.85, and subsequence was Malaria Knowledge (MK) with effect of -0.08 These were able to explain the variation Malaria Prevention and control Behavior (Beh) with 62.00 percent.

7) Considering on structural model confirmatory factors of Malaria Knowledge (MK) and Inspiration of Health Care (IHC) were able to explain the variation of endogenous factors of Inspiration of Public Mind for Malaria Prevention and control (IPM) to cause Malaria Prevention and control Behavior (Beh) with 71.00 percent as the following in equation (3).

$$IPM = 0.96*IHC + 0.45*MK \ldots(3)$$

$$(R^2 = 0.71)$$

Equation (3) factors that had the most effect to Inspiration of Public Mind for Malaria Prevention and control (IPM) was Inspiration of Health Care (IHC) with effect of 0.96, and subsequence was Malaria Knowledge (MK) with effect of 0.45. These were able to explain the variation Malaria Prevention and control Behavior (Beh) with 71.00 percent.

Considering on Chi-Square value/df was 1.745 that was less than 5, therefore it was accepted that hypothetical model of research was congruent to empirical data. Moreover, it was considered on other statistical values to verify the congruence that were Goodness of Fit Index (GFI) and Adjust Goodness of Fit Index (AGFI) were 0.96 and 0.91 respectively (GFI > 0.90 and AGFI > 0.90), RMSEA =0.042, RMR= 0.012 (RMSEA <0.05

and RMR <0.05) and critical number = 317.35 which was more than 200. It indicated that model was congruent to empirical data.

The results of analysis of causal relationship model and analysis of path effect as presented in figure 1.
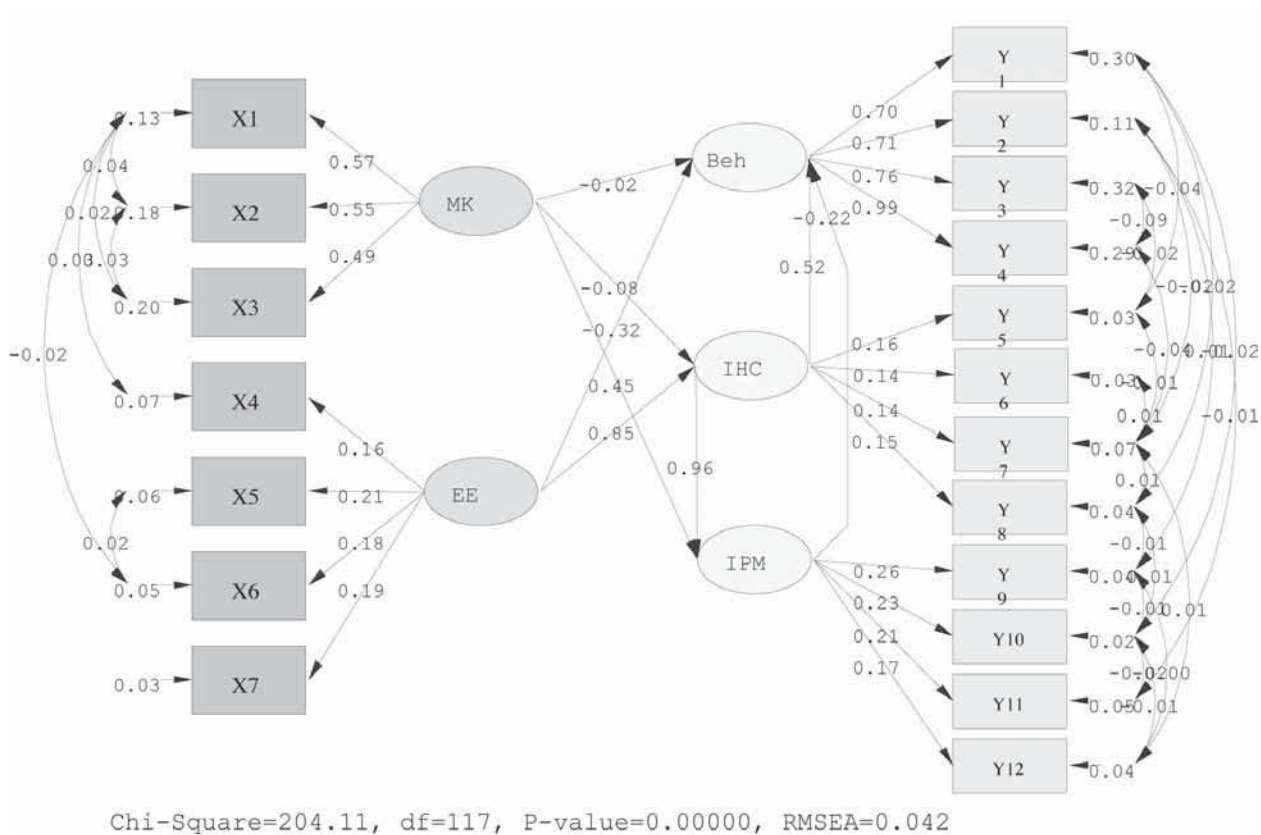

Chi-Square=204.11, df=117, P-value=0.00000, RMSEA=0.042

Figure 1 Model of Malaria prevention and control integrated with environmental education

Table 1

Direct and Indirect Effect of MK and EE Affecting BeH via IPM and IHC

Causal variable	Result variables								
	IHC			IPM			BeH		
	TE	IE	DE	TE	IE	DE	TE	IE	DE
MK	-0.02 (0.064)	-	-0.02 (0.064)	0.45** (0.23)		0.45** (0.23)	0. (0.034)	0.03 (0.041)	-0.02 (0.040)
EE	0.85** (0.045)	-	0.85** (0.045)	-	-	-	-	0.32** (0.05)	-0.32 (0.071)
IPM	-	-	-	-	-	-	-0.22 (0.071)	-	-0.22 (0.071)
IHC	-	-	-	0.96** (0.52)	-	0.96** (0.52)	0.31** (0.042)	-0.21 (0.045)	0.52** (0.051)

χ^2 = 204.11; df = 117	CN = 317.35	χ^2 / df = 1.745
GFI = 0.96 AGFI = 0.91	RMSEA = 0.042	RMR = 0.012

TE: Total Effect, IE: Indirect Effect, DE: Direct Effect

Discussion

The findings indicated that Malaria Knowledge (MK) had direct effect to Malaria Prevention and control Behavior (Beh) no statistically significant at level of 0.05 with effect of -0.02. Considering from observed variable of Malaria Infection Knowledge (X_1), was highest correlation to Malaria Knowledge (MK) with 0.60 and subsequences were Malaria Prevention and control Knowledge (X_2) and Malaria Treatment Knowledge (X_3) with 0.57 and 0.50 respectively. This might be explained that the sample groups who are people in Somdej District have recognized to the importance of Malaria Infection Knowledge, Malaria Prevention and control Knowledge and Malaria Treatment Knowledge are most equally. However, they don't pay attention to control and protect seriously according to their knowledge. Simultaneously, their malaria knowledge had direct effect to Inspiration of Public Mind for Malaria Prevention and control (IPM) statistically significant at level of 0.01 with effect of 0.45 but it had no direct effect to Inspiration of Health Care (IHC). This indicated that Inspiration of Public Mind for Malaria Prevention and control (IPM) is an important variable to cause their malarial prevention and control behavior, therefore, it should develop their inspiration of public mind for malaria prevention and control for decreasing malaria epidemic effectively.

However, Inspiration of Public Mind for Malaria Prevention and control (IPM) was predicted by the observed variables of Inspiration from Malaria Epidemic Event (Y_{11}), and Self Public Mind (Y_9) had prediction power for Inspiration of Public Mind for Malaria Prevention and control (IPM) with 50% and 44%, therefore, it is obviously indicated that these two observe variables are able to use for challenging the people in Somsej District to realize to practice themselves and participate to control and prevent the malaria epidemic responsibly.

Simultaneously, Confirmatory factors of Environmental Education (EE) had direct effect to Inspiration of Health Care (IHC) statistically significant at level of 0.01 with effect of 0.85, and had indirect effect to Malaria Prevention and control Behavior (Beh) statistically significant at level of 0.05 with effect of 0.44 through Inspiration of Health Care (IHC). Moreover, Inspiration of Health Care (IHC) had direct effect to Malaria Prevention and control Behavior (Beh) statistically significant at level of 0.01 with effect of 0.52. This might be imply that the Environmental Education (EE) and Inspiration of Health Care (IHC) are significant variable to assist people to change their Malaria Prevention and control Behavior (Beh).

Finally, observed variables of Community Participation Behavior for Malaria Prevention and control (Y_4), Environmental Maintenance Behavior for Malaria Prevention and control (Y_2), Chemical Use for Malaria Elimination Behavior (Y_3), and Malaria Self-Prevention and control Behavior (Y_1) are able to predict Malaria Prevention and control Behavior (Beh) with 99.50%, 85.00%, 77.00% and 72.00%. It is obviously seen that Community Participation Behavior for Malaria Prevention and control (Y_4) was the highest prediction power with 99.50% and subsequences were Environmental Maintenance Behavior for Malaria Prevention and control (Y_2) with 85.00%, Chemical Use for Malaria Elimination Behavior (Y_3) with 77.00%, and Malaria Self-Prevention and control Behavior (Y_1) with 72.00%. It indicated that their malaria prevention and control behavior would be better if the environmental education concept, inspiration of health care and public mind for malaria prevention and control are integrated to malaria knowledge.

Concepts of public mind for malaria prevention and control and inspiration of health care were applied in this study, the findings go together with Thiengkamol concept (Thiengkamol, 2009a; Thiengkamol, 2009b;

Thiengkamol, 2011e; Thiengkamol, 2011f, and her different studies and her colleagues (Thiengkamol, 2011f; Thiengkamol, 2011i; Thiengkamol, 2011j; Thiengkamol, 2012d; Thiengkamol, 2012g; Thiengkamol, 2012h; Donkonchum, & Thiengkamol, 2012; Pimdee, et al, 2012b; Phinnarach, et al, 2012a; Chomputawat et al., 2013b; Kotchakote et al., 2013a; Koonboonchan et al., 2013a; Petchang et al., 2013a; Prasertsri et al., 2013b; Suebsing et al., 2013a; Mongkonsin et al., 2013b; Sangsan-anan et al., 2012a; Jongwutiwet et al., 2012b) that the results illustrated that environmental knowledge in various issues influencing through inspiration of public mind for environmental conservation to perform better environmental behaviors whether consumption behavior, energy conservation behavior, waste management behavior, traveling behavior and knowledge transferring and supporting for environmental conservation when they had real practice through environmental conservation with inspiration of environmental conservation with public mind and health care inspiration as well.

Therefore, the research results should be integrated in the environmental education concept, public mind for malaria prevention and control and inspiration of health care. In particular environmental education process is formal, informal, non-formal and lifelong education process that can be implemented by training process for public health volunteer to be a trainer and educator for malaria knowledge transferring with health care inspiration and emphasizing on epidemic infection event by inspiration community people to reach target of self prevention and control including participate to community

to eliminate malaria infection at Somdej District and other epidemic areas intentionally with public mind (Thiengkamol, 2009b; Thiengkamol, 2011e; Thiengkamol, 2011f; Thiengkamol, 2011j; Thiengkamol, 2012g; ; Donkonchum, & Thiengkamol, 2012; Donkonchum, et al, 2012a; Gonggool, et al, 2012b; Jongwutiwet, et al, 2012b; Morrasri, et al, 2012b; Phinnarach, et al, 2012a; Pimdee, et al, 2012a; Ruboon, et al, 2012a; Sangsan-anan, et al, 2012b; Tumpracha, et al, 2012b; Udonboon, et al, 2012b; Waewthaisong, et al, 2012a; Mongkonsin, et al, 2013b; Koonboonchan et al., 2013a).

Conclusions

It might be shown whether MK, EE, IHC and IPM latent variables are play important functions to cause malaria prevention and control behavior of environmental maintenance behavior for malaria prevention and control, community participation behavior for malaria prevention and control, chemical use for malaria elimination behavior, malaria self-prevention and control behavior through IHC. Therefore, the model of MK and EE affecting through IHC and IPM to Beh verified the proposed model and was fitted with all observed variables according to criteria of Chi-Square value which differs from zero with no statistical significant at 0.01 level or Chi-Square/df value with less or equal to 5, RMSEA (Root Mean Square Error Approximation) and RMR (Root Mean Square Residual) values with less than 0.05 including index level of model congruent value, GFI (Goodness of Fit Index) and index level of model congruent value, AGFI (Adjust Goodness of Fit Index) between 0.90-1.00.

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