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Effect of Educational Intervention Based on the Health Belief Model and Self-Efficacy in Promoting Preventive Behaviors in a Cholangiocarcinoma Screening Group

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Abstract

Cholangiocarcinoma (CCA) is a neoplasm known as one of the most common causes of cancer-related deaths in Southeast Asia, particularly in Thailand, Laos, and Cambodia. Prevention and health education are required. Therefore, this study aimed to determine the effectiveness of an educational intervention to prevent CCA among a rural population in Thailand based on the health belief model (HBM) and self-efficacy frameworks. In this quasi-experimental study, 60 participants (30 participants in the experimental group and 30 participants in the control group) were selected in 2017. The educational intervention for the experimental group consisted of seven training sessions (introduction to CCA, risk factors, complications, benefits and barriers to proper consumption of cooked fish, carcinogenic agents, behavioral protection, and self-efficacy in applying preventive behaviors). A questionnaire that consisted of demographic information, knowledge, and HBM constructs (perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy) was used to measure CCA preventive behaviors before and 3 months after the intervention. Data were analyzed using SPSS-22 via chi-squared, paired *t*-tests, and independent samples *t* tests at a significance level of 0.5. Three months after the intervention, the experimental group showed a significant increase in the knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, self-efficacy, and CCA preventive behaviors compared to the control group. This study showed the effectiveness of the intervention based on the HBM constructs and self-efficacy in the adoption of CCA preventive behaviors 3 months post intervention in the risk group. Thus, these models may serve as a framework for designing and implementing educational interventions for the prevention of CCA.

Keywords Educational intervention · Health belief model · Self-efficacy · Promoting preventive behaviors · Cholangiocarcinoma

Introduction

Cholangiocarcinoma (CCA) is a neoplasm that involves the epithelial cells of the bile duct. CCA originates in the bile duct, which drains bile from the liver into the small intestine. CCA is also known as one of the most common causes of cancer-related deaths in Thailand, and it has been reported that Thailand has the highest incidence worldwide [22, 25]. CCA has an annual incidence rate of 1–2 cases per 100,000 in the Western world; however, the rates of CCA have been increasing worldwide over the past several decades [17, 19]. CCA is considered an incurable and rapidly lethal disease unless all tumors are fully resected. Three-year survival rates of 35 to 50% are achieved only in a subset of patients who have negative histological margins at the time of surgery [1]. The mortality rates of liver cancer in different regions of Thailand have been reported, and the Nakhon Ratchasima province has 13.67–16.2 cases per 100,000 individuals [24]. Multifactorial causes are recognized for CCA development. However, liver fluke infection caused by *Opisthorchis viverrini* is the major causative factor that induces cholangiocarcinoma (CCA) in Thailand, Lao PDR, Vietnam, and Cambodia [4, 6, 9, 10, 23, 26]. The infection is endemic among human populations in northeast and north Thailand, where the most common raw fish

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is frequently consumed [8]. A nationwide survey in Thailand was reported by Wongsaroj et al. [30] and indicated that the prevalence was 5.1%, with the highest prevalence identified in the northeast (9.2%) and north regions (5.2%). The early diagnosis of liver fluke infection and CCA stages 1 and 2 may enhance patient survival. Surveillance and health education of the population at risk for liver fluke and CCA are required.

Behavior modification programs regarding the prevention and control of liver fluke infection are essential for decreasing the disease, including CCA prevention. Numerous control programs have been implemented in liver fluke endemic areas, particularly the provinces with the highest prevalence [27]; however, despite initial decreases in liver fluke following the introduction of these programs, the rates of CCA remain high in the northeast and north. Thus, liver fluke and CCA continue to place a severe burden on the health services, and a solution is urgently needed. Previous studies have investigated the knowledge, attitude, and practice related to liver fluke infection in rural communities [8]. Improvements in knowledge, perception, and practice regarding diseases depend on the varieties of health education. Bloom [3], Becker et al. [2], and Janz and Becker [7] indicated that successful behavior modification should include many methods and continuous intervention. In addition, self-efficacy and social support that influences behavior modification are commonly used in health education programs [5]. An educational program is performed based on the health belief model (HBM), which is used to investigate health-related issues. HBM is also widely employed to describe the liver fluke and CCA control behavior in many areas of Thailand, which has increased participants' perceived susceptibility [11–14, 16, 18, 20]. According to serious data on CCA in the high-incidence areas, this study aimed to determine the effectiveness of an educational intervention to prevent CCA among a rural population in Thailand based on the health belief model and self-efficacy among a risk group in Kaeng Sanam Nang City, Nakhon Ratchasima Province, Thailand. The health behavior modification program may be useful and effective in CCA prevention and control in epidemic communities.

Materials and Methods

Study Design, Setting, and Participants

This experimental pretest–posttest study was conducted for 4 months from January 2017 to April 2017. The research population included individuals 30–80 years old from Kaeng Sanamnang Subdistrict, Kaeng Sanamnang District, Nakhon Ratchasima Province, Thailand. The study area is located in the northeast region of Thailand. It is 395 km from Bangkok (the capital of Thailand) and has an area of approximately 46 km^2. The subdistrict is divided into nine villages with approximately 6929 individuals (Fig. 1). Sixty-six participants were included from 5484 populations. Regarding the sample volume formula, the total number of samples considering 20% downfall in participants was estimated to be 60 individuals, who were selected from the verbal screening test based on a high-risk score. The inclusion criteria were as follows: aged > 30 years, having a family file in the selected villages, no CCA or other cancers, Thai literate, and willingness to participate in the study (Fig. 1). Populations at risk for CCA were screened using a mini-verbal screening questionnaire, the Korat-CCA; questions were literature reviewed, designed from the possible risk data and strongly associated with CCA [11–14]. The Verbal Screening Test: KCVST consisted of eight questions regarding the history of opisthorchiasis, cholangitis, cholecystitis, or gallstones, a family history of CCA, raw or undercooked cyprinoid fish consumption, praziquantel used, alcohol consumption, agriculture and pesticide used, and naïve northeastern individuals.

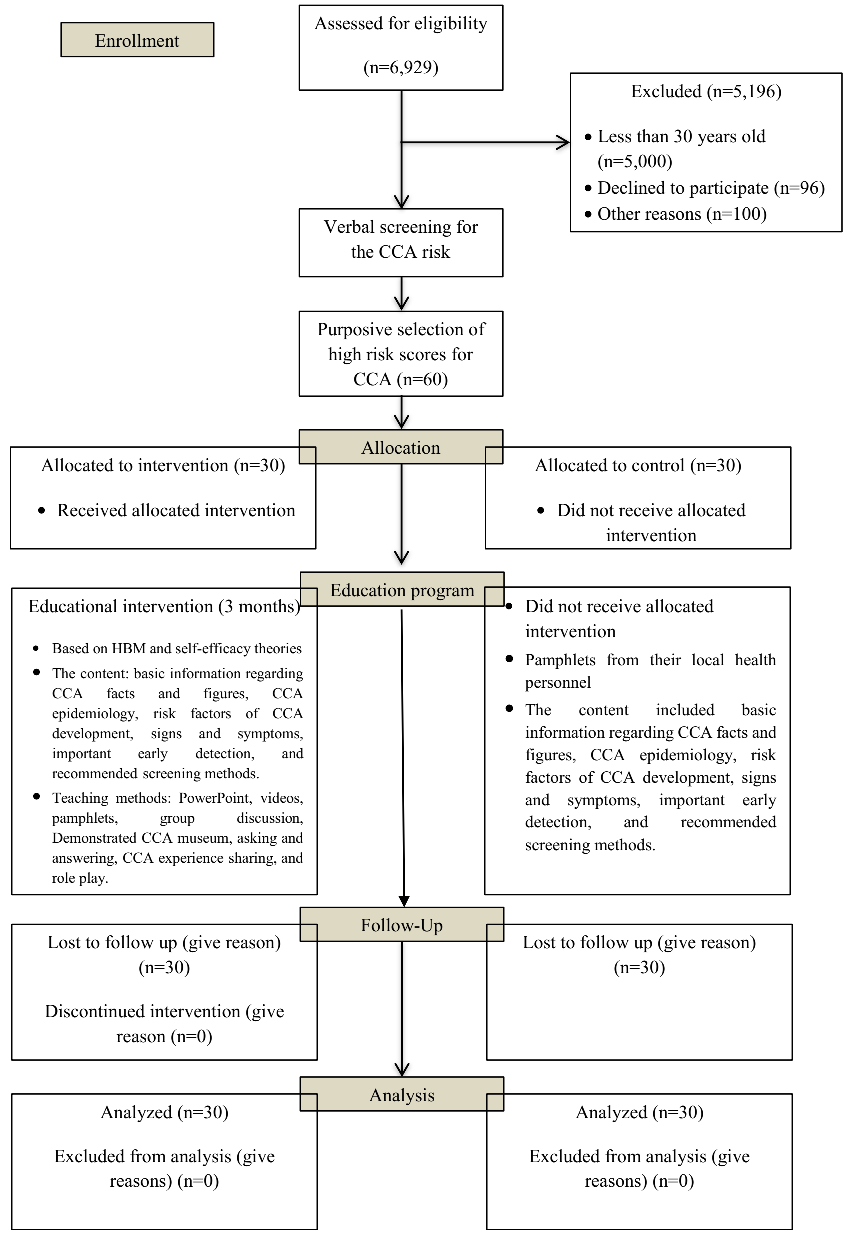
Educational Intervention

The participants in the intervention group received the CCA educational program. The educational intervention consisted of seven teaching sessions, and each session lasted 90–120 min. The content of the educational programs included basic information regarding CCA facts and figures, CCA epidemiology, risk factors of CCA development, complications, signs and symptoms, important early detection, and recommended screening methods. Each group received specific instructions related to health motivation, susceptibility to CCA, perceived benefits and barriers of CCAs, and perceived self-efficacy based on the HBM. During the educational sessions, teaching methods, such as PowerPoint presentations, the presentation of educational videos, group discussion, performing liver fluke examination on models, asking and answering, and two pamphlets entitled "Know more about CCA" and "early detection of CCA" were used. CCA and liver fluke were demonstrated. Finally, the participants shared the CCA experiences of their related members with others (Fig. 2). The follow-up was conducted using a village health volunteer (VHV), news and information by the village leader using the village broadcast tower, and home visits by the VHV and local health personnel. Three months after the educational intervention, the posttest was implemented in both the intervention and control groups.

Data Collection Tools

The data collection tool consists of a questionnaire with four sections. Section one was semistructured with open-ended questions related to demographic factors (10 questions related to gender, age, education, occupation, family income, family history of CCA, raw or undercooked fish consumption, history with liver fluke infection, having a natural fresh water reservoir,

Fig. 1 Flow diagram of this study



resources for CCA news and information), section two had questions related to measuring the level of behaviors (25 questions; knowledge: 15 items and practice: 10 items), and section three included questions designed based on the HBM constructs (30 questions). In scoring the questionnaire's items, in the behavior section of knowledge, correct answers were assigned 1 point and wrong answers were assigned a null point (total score range between a minimum of zero and a maximum of 15). Attitude and practice were scored using a 5-point Likert scale from 1 to 5 (strongly agree 5, agree 4, undecided 3, disagree 2, and strongly disagree 1). Section three of the questionnaire included questions related to HBM constructs, including perceived susceptibility (5 items), perceived severity (5 items), perceived barriers (5 items), perceived benefits (5 items), cues to action (5 items), and self-efficiency (5 items), which were scored using a 5-point Likert scale from 1 to 5 (strongly agree 5, agree 4, undecided 3, disagree 2, and strongly disagree 1).

Data were collected through a questionnaire constructed by the researcher, and content validity was used. For this purpose, the questionnaire was evaluated by professors of Suranaree University of Technology, and their corrective comments were applied, the validity and reliability of which had previously been determined by the main investigators as part of their studies toward the Parasitic Disease Research Center. Items with content validity ratios of > 0.68 and content validity indices > 0.70 were accepted. Cronbach's alpha for reliability was obtained as 0.73. The questionnaire stability using Cronbach's alpha was calculated as the perceived susceptibility (0.80), perceived

Fig. 2 Educational sessions and teaching methods, such as PowerPoint presentation, presentation of educational videos, group discussion, performing liver fluke examination on the models, and pamphlets. CCA and liver fluke were demonstrated. Participants shared the CCA experiences of their related members with other individuals

severity (0.82), perceived benefits (0.85), perceived barriers (0.87), perceived self-efficacy (0.82), and cues to action (0.84).

Statistical Analysis

The obtained data were analyzed using SPSS version 11.0 (IBM, USA). Descriptive analyses (means, standard deviations, and percentages) were utilized to summarize the participant variables and present the participant characteristics. Chi-square, independent t tests, and paired t tests were used in the data analysis. In all tests, the level of significance was $\alpha < 0.05$.

Ethical Considerations

This study was approved by the Ethics Committee affiliated with Suranaree University of Technology (2017). In this study, the researchers were committed to the ethical issues of obtaining informed consent from the participants, respecting voluntary participation and informing the participants of the study purpose.

Results

The majority of the participants were female (61.7%), aged 40–49 years old (41.7%), had primary (68.3%), were farmers (32%), and < $35 (41.7%). The participants reported CCA in family members (16.7%), raw or undercooked fish consumption (91.7%), and a history with liver fluke infection (21.7%). Resources for CCA news and information included village health volunteers (55%), followed by local health personnel (33.3%). Other descriptive indicators of the variables assessed are presented in Table 1.

The results of comparing the mean scores of the HBM subscales before and after the educational intervention within and between the intervention and control groups are described by

Table 1 Comparison of background variables in experimental and control groups

Variables	Experimental group *n* (%)	Control group *n* (%)	*P* value	Statistic
Gender				
Male	12(40.0)	11(36.7)	0.184	0.542*
Female	18(60.0)	19(63.3)		
Age (years)				
30–39	3(10.0)	5(16.7)	0.125	1.491*
40–49	12(40.0)	13(43.3)		
50–59	8(26.7)	7(23.3)		
60–69	5(16.7)	4(13.3)		
70–79	2(6.7)	1(3.3)		
Education				
Illiterate	1(3.3)	3(10.0)	0.231	1.625*
Primary	21(70.0)	20(66.7)		
Secondary	6(20.0)	5(16.7)		
Academic	2(6.7)	2(6.7)		
Job status				
Housewife	4(13.3)	6(20.0)	0.209	1.591*
Employed	1(3.3)	2(6.7)		
Famer	21(70.0)	19(63.3)		
Government officer	2(6.7)	1(3.3)		
Trade	1(3.3)	2(6.7)		
Family income ($, per month)				
< 35	12(40.0)	13(43.3)	0.318	2.274*
36–160	8(26.7)	6(20.0)		
161–350	7(23.3)	1(3.3)		
351–500	1(3.3)	6(20.0)		
501–650	1(3.3)	4(13.3)		
> 650	1(3.3)	0		
History of CCA in family members				
Yes	7(23.3)	3(10.0)	0.743	1.278*
No	23(76.7)	27(90.0)		
Raw or undercooked fish consumption				
Yes	28(93.3)	27(90.0)	0.518	1.462*
No	2(6.7)	3(10.0)		
History with liver fluke infection				
Yes	7(23.3)	6(20.0)	0.224	0.946*
No	23(76.7)	24(80.0)		
Resources for CCA news and information				
Village health volunteer	19(63.3)	14(46.7)	0.084	2.115*
Health personnel	8(26.7)	12(40.0)		
Medical doctor or nurse	0	2(6.7)		
Village broadcast tower	2(6.7)	1(3.3)		
Community radio station	1(3.3)	1(3.3)		

Data presented as frequency (%). *Chi-square

Table 2 Comparison of changes in mean scores of health belief model constructs after educational intervention between two groups, mean ± SD

Variables	Experimental group ($n = 30$)				Control group ($n = 30$)				*P* value**
	Before	After	Difference	*P* value*	Before	After	Difference	*P* value*	
Perceived susceptibility	3.3 ± 1.2	4.6 ± 0.2	1.3 ± 0.8	0.05	3.1 ± 1.3	3.2 ± 1.3	0.1 ± 1.2	1.434	0.001
Perceived severity	3.0 ± 1.8	4.9 ± 1.3	1.9 ± 1.4	0.001	3.0 ± 1.8	3.1 ± 1.8	0.1 ± 1.2	1.572	0.001
Perceived benefits	3.4 ± 1.7	4.7 ± 1.0	1.7 ± 1.2	0.001	3.2 ± 1.8	3.1 ± 1.8	0.1 ± 1.5	1.092	0.001
Perceived barriers	3.3 ± 1.9	4.6 ± 1.3	1.3 ± 1.5	0.05	3.1 ± 1.7	3.2 ± 1.8	0.1 ± 1.7	1.289	0.001
Cues action	3.1 ± 1.6	4.8 ± 1.4	1.7 ± 1.5	0.001	3.0 ± 1.6	3.1 ± 1.6	0.1 ± 1.6	1.215	0.001
Self-efficacy	3.0 ± 1.6	4.0 ± 1.0	1.0 ± 1.2	0.05	2.9 ± 1.5	3.0 ± 1.6	0.1 ± 1.6	1.946	0.001

*Paired *t* test and **independent *t* test

paired *t* tests and independent *t* tests, which showed that before the intervention, the mean health belief scores in the two groups were similar in almost all subscales. Three months after the educational intervention, the mean scores of perceived susceptibility ($t = 2.325$, 95%CI = 1.23, 2.71), perceived severity ($t = 2.385$, 95%CI = 1.13, 1.54), perceived barriers ($t = 2.852$, 95%CI = 1.30, 1.94), perceived benefits ($t = 2.255$, 95%CI = 1.13, 1.54), cues for action ($t = 3.374$, 95%CI = 2.30, 3.49), and self-efficacy ($t = 2.057$, 95%CI = 1.46, 2.13) were significantly higher in the intervention group (Table 2).

The results of comparing the mean scores of the behavioral subscales before and after the educational intervention within and between the intervention and control groups are described by independent *t* tests and paired *t* tests, which showed that before the intervention, the mean scores of the behavioral subscales in the two groups were similar in almost all subscales. Three months after the educational intervention, the mean scores of knowledge ($t = 1.731$, 95%CI = 1.53, 2.81) and practice ($t = 0.615$, 95%CI = −1.53, 2.11) were significantly higher in the intervention group (Table 3). Knowledge and practice regarding the risk factors for CCA were measured with questionnaires before the intervention in the experimental and control groups. The incorrect knowledge of the participants was measured and indicated that the "anti-helminthic drug (praziquantel) could often be used in daily life with no effect, stool examination is not necessary before taking an anti-helminthic drug for liver fluke treatment, and the reinfection and chronic infection with liver fluke are two causes of cholangiocarcinoma development". In addition, the practices regarding the risk factors for CCA prior to the intervention and in the control group were frequently identified in the question of "raw or undercooked cyprinoid fish consumption and did not have a stool examination to diagnose liver fluke infection". However, 3 months after the educational intervention, the mean scores for knowledge and practice were different and significantly higher in the intervention group.

Discussion

Our study results indicated significant increases in the knowledge, perceived susceptibility, perceived severity, perceived barriers, perceived benefits, cues to action, and self-efficacy after the educational intervention. These differences in the mean scores of knowledge between the two groups may likely be attributed to using an efficient, diverse, flexible, and interesting method of educational intervention in the current study. The study educational program was performed based on the HBM. This model is a behavioral science theory that is used to investigate health-related issues. It is also widely used for describing liver fluke and CCA control behavior [11–14, 16, 18, 20]. Phatisena et al. [20], in a study on behavioral modification regarding liver fluke and CCA with a health belief model using integrated learning, stated that the HBM increased participants' perceived susceptibility, which is in agreement with the current study. Kaewpitoon et al. [11–14] and Phatisena et al. [20] showed in their studies that perceived severity is very effective in adopting CCA behavior, which

Table 3 Comparison of change in mean score of cholangiocarcinoma screening behavior between two groups, mean ± SD

Variables	Experimental group ($n = 30$)				Control group ($n = 30$)				*P* value**
	Before	After	Difference	*P* value*	Before	After	Difference	*P* value*	
Knowledge	12.2 ± 2.6	14.9 ± 0.4	2.7 ± 2.2	0.001	11.9 ± 2.7	11.8 ± 2.6	0.1 ± 0.5	1.261	0.001
Practice	3.2 ± 0.3	4.3 ± 0.6	1.1 ± 0.3	0.05	3.2 ± 0.6	3.3 ± 0.6	0.1 ± 0.6	1.186	0.05

*Paired *t* test and **independent *t* test agrees with the current findings. Kaewponpek [15] and Seti [21] applied the health belief model for preventive behavior of liver fluke and CCA among primary school students and showed that participants' perceived benefits in the context of CCA behavior showed a significant difference in the experimental group after the intervention compared to the control group, which is in line with the current research.

The studies of Thongnamuang and Duangsong [28], which aimed to evaluate the effect of training on the basis of the HBM on CCA behavior in participants, showed that after an intervention based on the perceived barriers model, the test group had significantly improved compared to before training ($P < 0.001$), and these results are consistent with our findings. In addition, Kaewpitoon et al. [11–14] developed a health education modification program regarding liver flukes and CCA in high-risk areas using self-efficacy and motivation theory and showed that participants' cues to action and self-efficacy in the context of CCA behavior showed a significant difference in the experimental group after the intervention compared to the control group, which is in line with the current research. This continuous good self-efficacy and practice are dependent on the motivation and social support that influence behavior modification, which is similar to Becker et al. [2], Janz and Becker [7], and House and Kahn [5]. We previously investigated the effectiveness of a health education program based on self-efficacy and social support in different areas of Kang Sanam Nang district, Nakhon Ratchasima province [11–14] and Tha Tum district, Surin province, Thailand [11–14]. These results showed a successful program for liver fluke and CCA avoidance. Kaewpitoon et al. [11–14] aimed to evaluate the effect of training on behaviors using the HBM and showed that the average self-efficacy score was increased 3 months after the intervention compared with both before the intervention and the control groups ($P < 0.001$); these results are consistent with the current findings. The present study showed that an internal cue to action encourages an individual to perform CCA behavior and forces them to feel responsible for their health. The development of a community-based approach to liver fluke and CCA control has been recommended. With respect to integrated liver fluke control in northeast Thailand, the Lawa project has been shown to be the best model [27]. Therefore, we used this model to solve the problem in the areas that have a population at risk based on the HBM and self-efficacy frameworks. The results indicate that after the intervention, the experimental group had significantly higher mean scores for knowledge and practice regarding CCA prevention and control than before the intervention and the control group. This result is similar to that of Bloom [3], who suggested the success of behavioral modification should be composed of various activities. Thus, in the previously discussed studies, an appropriate training intervention is performed with regard to the identification of appropriate behavioral factors on the basis of the HBM, as well as appropriate designing, which justifies the necessity of acquiring awareness for changing the behavior, and training had an important role in the HBM framework in reducing perceived barriers to adopting CCA behaviors. In a study, Thongnamuang and Duangsong [28] aimed to determine the predictive level of the HBM construct in adopting liver fluke and CCA and showed that there are statistically significant differences in the liver fluke and CCA self-efficacy construct between the groups who do and do not practice liver fluke and CCA ($P < 0.001$); moreover, it was also the most powerful predictor of liver fluke and CCA behavior in individuals, and these results are consistent with the current findings. Viriuagul [29] in a study determined the effect of training on knowledge and behaviors using the HBM and showed that the average score of the internal cause of action was increased 3 months after the intervention compared with both before the intervention and the control groups; these results are consistent with the current findings. In addition, the resources for CCA news and information of the participants included a village health volunteer, followed by the local health personnel, village broadcast tower, and village radio station. The recommendations of the health care team, as well as the village broadcast and village radio programs may be crucial in decreasing CCA and increasing self-efficacy as the most important external cues to action, and it is necessary to pay attention to these factors when developing training programs to change behavior.

Conclusion

It seems that the health education program designed based on the HBM is effective in the development of CCA behavior; moreover, based on the findings of this study, it may be concluded that CCA behaviors require a positive attitude toward prevention. Therefore, we suggest that educational programs should be designed and implemented with an emphasis on changing attitudes to promote the health of risk groups.

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Compliance with Ethical Standards

Conflicts of Interest The authors declare that they have no conflict of interest.

References

1. Akamatsu N, Sugawara Y, Hashimoto D (2011) Surgical strategy for bile duct cancer: advances and current limitations. World J Clin Oncol 10(2):94–107
2. Becker MH, Maiman LA, Kirscht JP (1974) A new approach to explaining sick role behavior in low income population. Am J Public Health 64(3):205–216

3. Bloom BS (1971) Handbook on formative and summative of student learning. Mc Graw-Hill Book Company, New York
4. Edwards SW, Spofford EM, Price C, Wright HL, Salao K, Suttiprapa S, Sripa B (2018) Opisthorchiasis-induced cholangiocarcinoma: how innate immunity may cause cancer. Adv Parasitol 101:149–176
5. House JS, Kahn RL (1985) Measures and concepts of social support. In: Cohen S, Syme SL (eds) Social support and health. Academic Press, New York, pp 83–108
6. IARC (1994) Infection with liver flukes (*Opisthorchis viverrini*, *Opisthorchis felineus* and *Clonrochis sinensis*). IARC Monogr Eval Carcinog Risks Hum 61:121–175
7. Janz NK, Becker MH (1984) The health belief model: a decade later. Health Educ Q 11(1):1–47
8. Kaewpitoon N, Kaewpitoon SJ, Pengsaa P, Pilasri C (2007) Knowledge, attitude and practice related to liver fluke infection in northeast Thailand. World J Gastroenterol 13(12):1837–1840
9. Kaewpitoon N, Kaewpitoon SJ, Pengsaa P (2008) Opisthorchiasis in Thailand: review and current status. World J Gastroenterol 14(15):2297–2302
10. Kaewpitoon N, Kootanavanichpong N, Kompor P, Chavenkun W, Kujapun J, Norkaew J, Ponphimai S, Matrakool L, Tongtawee T, Panpimanmas S, Rujirakul R, Padchasuwan N, Pholsripradit P, Eksanti T, Phatisena T, Loyd RA, Kaewpitoon SJ (2015) Review and current status of *Opisthorchis viverrini* infection at the community level in Thailand. Asian Pac J Cancer Prev 16(16):6825–6830
11. Kaewpitoon SJ, Loyd RA, Rujirakul R, Wakkuwattapong P, Tongtawee T, Matrakool L et al (2016a) Primary care intervention to prevent and control cholangiocarcinoma: lesson from Nakhon Ratchasima, Thailand. J Med Assoc Thail 99(Suppl 7):S144–S150
12. Kaewpitoon SJ, Rujirakul R, Loyd RA, Panpimanmas S, Matrakool L, Tongtawee T, Kompor P, Norkaew J, Chavengkun W, Wakkhuwattapong P, Kujapun J, Ponphimai S, Phatisena T, Eaksunti T, Polsripradist P, Joosiri A, Sukkasam I, Padchasuwan N, Kaewpitoon N (2016b) Surveillance of populations at risk of cholangiocarcinoma development in rural communities of Thailand using the Korat-CCA verbal screening test. Asian Pac J Cancer Prev 17(4):2205–2209
13. Kaewpitoon SJ, Rujirakul R, Wakkuwattapong P, Benjaoran F, Norkaew J, Kujapun J, Ponphimai S, Chavenkun W, Kompor P, Padchasuwan N, Kaewpitoon N (2016c) Development of a health education modification program regarding liver flukes and cholangiocarcinoma in high risk areas of Nakhon Ratchasima province using self-efficacy and motivation theory. Asian Pac J Cancer Prev 17(6):2947–2951
14. Kaewpitoon SJ, Thanapatto S, Nuathong W, Rujirakul R, Wakkuwattapong P, Norkaew J, Kujapun J, Padchasuwan N, Kaewpitoon N (2016d) Effectiveness of a health educational program based on self-efficacy and social support for preventing liver fluke infection in rural people of Surin province, Thailand. Asian Pac J Cancer Prev 17(3):1111–1114
15. Kaewponpek R (2009) The effectiveness of application by protection motivation theory and social support for preventive behavior of opisthorchiasis to cholangiocarcinoma among primary school student in Saithong sub district, Subunreuang district, Nonbualamphu province, Thailand. Master of Public Health thesis in Health Education and Health Promotion, Graduate School, Khon Kaen University. Thai
16. Kompor P, Muang Karn R, Norkaew J, Kujapun J, Photipim M, Ponphimai S et al (2016) Population-based intervention for liver fluke prevention and control in Meuang Yang district, Nakhon Ratchasima province, Thailand. Asian Pac J Cancer Prev 17(2): 685–689
17. Landis SH, Murray T, Bolden S, Wingo PA (1998) Cancer statistics, 1998. CA Cancer J Clin 48(1):6–29
18. Padchasuwan N, Kaewpitoon SJ, Rujirakul R, Wakkuwattapong P, Norkaew J, Kujapun J, Ponphimai S, Chavenkun W, Kompor P, Kaewpitoon N (2016) Modifying health behavior for liver fluke and cholangiocarcinoma prevention with the health belief model and social support theory. Asian Pac J Cancer Prev 17(8):3721–3725
19. Patel T (2002) Worldwide trends in mortality from biliary tract malignancies. BMC Cancer 2:10
20. Phatisena P, Eaksanti T, Wichantuk P, Tritipsombut J, Kaewpitoon SJ, Rujirakul R, Wakkhuwattapong P, Tongtawee T, Matrakool L, Panpimanmas S, Norkaew J, Kujapun J, Chavengkun W, Kompor P, Pothipim M, Ponphimai S, Padchasuwan N, Kaewpitoon N (2016) Behavioral modification regarding liver fluke and cholangiocarcinoma with a health belief model using integrated learning. Asian Pac J Cancer Prev 17(6):2889–2894
21. Seti S (2009) The effect of comparison preventive liver fluke behavior between application health belief model with participation and handbook in risk group's cancer of liver, Nonsang District, Nongbualamphu Province. Master of Public Health thesis in Health Education and Health Promotion, Graduate School, Khon Kaen University. Thai.
22. Shin HR, Oh JK, Masuyer E (2010) Epidemiology of cholangiocarcinoma: an update focusing on risk factors. Cancer Sci 101(3): 579–585
23. Sithithaworn P, Andrews RH, Nguyen VD, Wongsaroj T, Sinuon M, Odermatt P et al (2012) The current status of opisthorchiasis and clonorchiasis in the Mekong Basin. Parasitol Int 61(1):10–16
24. Sripa B (2008) Concerted action is needed to tackle liver fluke infections in Asia. PLoS Negl Trop Dis 2(5):e232
25. Sripa B, Kaewkes S, Sithithaworn P, Mairiang E, Laha T, Smout M, Pairojkul C, Bhudhisawasdi V, Tesana S, Thinkamrop B, Bethony JM, Loukas A, Brindley PJ (2007) Liver fluke induces cholangiocarcinoma. PLoS Med 4(7):e201
26. Sripa B, Kaewkes S, Intapan PM, Maleewong W, Brindley PJ (2010) Food-borne trematodiases in Southeast Asia: epidemiology, pathology, clinical manifestation and control. Adv Parasitol 72: 305–350
27. Sripa B, Tangkawattana S, Laha T, Kaewkes S, Mallory FF, Smith JF, Wilcox BA (2015) Toward integrated opisthorchiasis control in northeast Thailand: the Lawa project. Acta Trop 141(Pt B):361–367
28. Thongnamuang S, Duangsong R (2012) The effectiveness of application by health belief model and social support for preventive behavior of opisthorchiasis and cholangiocarcinoma among primary school students in Moeiwadi district, Roi-Et province, Thaiiland. KKU Res J (GS) 12(2):80–91
29. Viriuagul C (2015) Effectiveness of health belief regarding health modification in the population at risk for liver cancer and cholangiocarcinoma in Kokkland sub-district, Lau Amnat, Amnat Charoen province, Thailand. J ODPC 10th Ubon Ratchathani 13(1):43–51
30. Wongsaroj T, Nithikathkul C, Rojkitikul W, Nakai W, Royal L, Rammasut P (2014) National survey of helminthiasis in Thailand. Asian Biomed 8(6):779–783