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Effects of Integration of Social Marketing and Health Belief Model for Preventing Cholangiocarcinoma in High-Risk Areas of Thailand: A Community Intervention Study

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Abstract

Introduction/Objective: To examine the effects of applying social marketing and Health Belief Model (HBM) in preventing cholangiocarcinoma (CCA) in high-risk areas of Thailand. **Methods:** About 2 randomized high-risk areas of CCA from multiple-stage sampling were assigned as study areas. The 150 participants were allocated to the experimental group, which received a 12-week health education program that applied social marketing and HBM. The comparison group received the usual services. Data were collected by a questionnaire created by the researchers. We employed descriptive, inferential statistics (paired *t*-test and independent *t*-test) for normal distribution, while Analysis of Covariance (ANCOVA) was used for mean scores differing before the experiment. **Results:** After the experiment, the mean scores of the perceived risk of CCA, perceived severity of CCA, perceived benefits of CCA prevention, perceived barriers to CCA prevention, and correct behaviors of CCA prevention in the experimental group were significantly higher than those before the experiment the .05 level. They were also considerably higher than those of the comparison group at the .05 level. **Conclusion:** This is the first study to integrate social marketing and HBM for CCA prevention. Therefore, formulating policies or measures to prevent disease through public communication will form a model to avoid CCA and create a channel for distributing useful information to the general public.

Keywords

social marketing, health belief model, cholangiocarcinoma, *Opisthorchis viverrini*, disease prevention

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Introduction

According to the global cancer incidence and mortality estimates in the GLOBOCAN 2018 database, liver cancer was the fifth-highest incidence and second-highest mortality of all cancers worldwide.[1] In Thailand, liver and bile duct cancers are the most common cancer in males (33.9 per 100 000 population) and second in females (12.9 per 100 000 population) after breast cancer. If assessed by geographic area, the Northeast region of Thailand has the highest incidence of liver and bile duct cancers in both sexes (43.5 and 18.4).[2] In addition, the occurrence of cholangiocarcinoma (CCA) has been associated with a higher prevalence of liver fluke (*Opisthorchis viverrini*, OV) infection.[3-5] A survey in Thailand in 2009 reported that the top 3 provinces with the highest OV prevalence were Nakhon Phanom (60.8%), Sisaket (38.6%), and Amnat Charoen (32.0%).[6] However, 10 years later, the last nationwide survey was conducted

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in 2019. Despite the downward trend at the regional level, some provinces still experienced the exact high prevalence, such as Sakon Nakhon, Kalasin, and Sisaket.[7] Thus, this problem is necessary to be addressed, and it should be considered developing intervention programs to reduce CCA.

The Sisaket Province plan has driven the 10-year strategic plan to eradicate OV and CCA (2015-2025), which covers all 22 districts intending to raise public awareness to avoid and reduce the risk factors of CCA.[8] However, the districts with a high prevalence of OV infection have activities that include: (1) educating the general public and the risk group, (2) organizing public relations using visual media, (3) organizing campaigns to encourage restaurants to use cooked fermented fish for cooking, (4) checking for OV eggs in the risk group feces, and (5) treating OV infection by praziquantel. However, despite using various strategies in Thailand, there are still restrictions on accessing information that should be obtained. Moreover, some Thais people in rural areas also adhere to traditional values or community beliefs that have been practiced for a long time. For this reason, the government's projects have not yet been achieved as they should be as specified in the set goals.

According to the Health Belief Model (HBM),[9,10] health-related action is dependent on the simultaneous occurrence of 3 types of factors: (1) There is sufficient motivation (or health concern) to bring health issues to the forefront or make them relevant; (2) Belief in one's susceptibility (vulnerability) to a serious health problem or the consequences of that illness or condition is commonly a perceived threat; and (3) The belief is that adhering to a specific health recommendation would be beneficial in reducing the perceived threat at a subjectively acceptable cost.

Behavioral practices can help reduce the disease's risk or severity.[11] In addition, such procedures should not cause psychological barriers that influence one's practice. When there is a health threat, people will start looking for things that can help them maintain good health, reduce admission to health service units, and satisfy them. Therefore, health education is essential to health services and knowledge dissemination.[12] Health education that focuses on the individual or the community through traditional methods may not be effective. Therefore, the scope of health education has been expanded. External factors motivate people to make decisions to follow the practices. It can be seen that, at present, social media has been developed to be more modern and suitable for different contexts, cultures, and beliefs.[13]

The marketing mix is used to strengthen thoughts and proper behaviors. Knowledge is transformed into a tangible object or an object that can be remembered and correctly followed through training and public relations through personal media, print media, and social media. This has made the body of knowledge up-to-date and accessible without cost and wasted opportunity and time in daily life. It also enhances motivation by creating campaigns or special events for service users to search for a variety of new knowledge.

As mentioned above, social marketing employs various communication strategies and marketing techniques to promote healthy behavior. Social marketing methods to health-related beliefs and behaviors may change health behaviors to prevent CCA in some areas. However, evidence providing the critical role of social marketing and HBM in health promotion in CCA has been investigated, particularly in Thailand. To the best of our knowledge, there remains unclear evidence preventing CCA from applying social marketing. HBM will lead to a change in behaviors to avoid CCA, particularly in high-risk areas of Thailand, such as in Sisaket Province. Therefore, the present study aimed to examine the effects of applying social marketing and HBM in preventing CCA in high-risk areas of Thailand. The study findings may be formulating policies and contributing to developing a health education program to prevent and reduce CCA to educate people, raise health awareness and produce health innovations suitable and harmonious with the community's way of life and culture.

Methods

Study Design

This study was a community intervention study (community trial), one of intervention or experimental studies. The experimental group received a health education program that applied social marketing concepts and the HBM. In contrast, the comparison group received regular health education from public health officers. The experimental period was 12 weeks. In addition, we collected data on health beliefs and preventing behaviors for CCA before and after the experiment of the experimental and comparison groups.

Ethical Considerations

This study was approved by the Human Research Ethics Committee of Sisaket Provincial Public Health Office based on the Declaration of Helsinki and the ICH-GCP Guidelines (Ref. No. SPPH 2020-046).

Designation of the Study Areas

Multiple-stage sampling was employed with the following steps.

Step 1: The 3 provinces in Thailand with the highest prevalence of OV infection, namely Nakhon Phanom Province (60.8%), Sisaket Province (38.6%), and Amnat

Charoen Province (32.0%),[6] were randomized by a simple random sampling method. Finally, Sisaket Province was randomly assigned as a study area.

Step 2: Simple random sampling was administered to draw 1 district from the first 5 districts with the highest prevalence of OV infection in Sisaket Province.[8] Khukhan District was randomly drawn as the study area.

Step 3: The sub-districts with OV prevalence above the standard were simple random sampling. There were 10 sub-districts in Khukhan District.[14] The first random, Si Trakul Sub-District, was an experimental area. Cha Kong Sub-district was designated as a comparison area from the second random.

Step 4: Simple random sampling was administered to select the villages with similar contexts. It was done by lottery drawing twice. For the first time, 1 village (Ban Non) was randomly drawn from 7 villages in Si Trakul Sub-District as an experimental area. About 1 village (Ban Ta Sud) was randomly drawn from 9 villages in Cha Kong Sub-District as a comparison area for the second time.

Population and Samples

The population in this study was 71 354 people aged 20 years and over living in Khukhan District, Sisaket Province.[15] The sample size was calculated from previous studies conducted among cancer patients in communities.[16,17] The sample size in this study was at least 56 people per group. However, as this study was a community intervention study, the sample was assigned to 150 people per group (a total of 300 people) to maximize the process of community involvement. We randomized the samples using the population data from Sub-District Health Promoting Hospitals in both areas based on the following inclusion criteria: (1) people aged 20 years and over reside in the study areas undergoing CCA screening by village health volunteers (VHVs). If it found any of the following, they were considered at risk: has OV detected in feces, or there was a family member who has a history of illness or death from CCA by counting 3 classes of lines: father, mother, and child of the patient, (2) being able to read and write, (3) voluntarily participating in the research project, and (4) not having severe medical conditions affecting the research conduction. Exclusion criteria were as follows: (1) the samples requested withdrawal during the research conduction, and (2) the samples moved to other areas. The inclusion of study groups is significant in an intervention study to avoid bias. Although the experimental and comparison groups' inclusion criteria used the same standards, the 2 villages were discrete areas and were approximately 36 km apart. Therefore, it was ensured that the 2 sites were experimentally free from contamination.

Research Instruments and Quality Assessment

There were 2 types of research instruments in this research.

(1) The instrument used in the experiment was the 12-week program that applied social marketing concepts and the HBM to prevent CCA used by the experimental group. First, 5 experts verified the content validity. As a result, the program's item objective congruence (IOC) index was 1.00. Moreover, we developed the *Application Stop CCA* on the computer by bringing the desired content stored in the drive. Then it was created in the Glide App. When it is done, the last step will get a QR Code. The importance of this App is that it is a collection of knowledge about OV and CCA, divided into 5 sections as follows: (1) Educating about CCA (types, symptoms, epidemiology, and treatment), (2) Educating about OV, (3) Video collecting the knowledge about CCA, (4) Cartoon series about CCA prevention, and (5) Activity to answer questions to review knowledge. A researcher assigned as an admin can monitor the number of users throughout the implementation. There was a check of the usage amount each week. In addition, the App has a detailed user ID to check who has accessed it. The details from an Excel file can be checked, separating or reducing redundancy. As a result, everyone participated in all 12 weeks of activity.

(2) The data collection instrument was a questionnaire. The questionnaire's IOC also came from 5 experts with an average of .78. The questionnaire consisted of 3 parts: Part 1: general information consisting of 10 items with multiple choices and open-ended questions; Part 2: Health Belief Scale developed by the researchers based on the literature review and HBM. It consisted of 4 facets of 40 items. Responses used a four-point rating scale (from 0 = less to 5 = very high). Based on this scale, the obtained scores ranged from 1.00 to 4.00 points. Scores of 1.00 to 1.75 were assigned to "least perceived" and 3.26 to 4.00 to "most perceived" health belief. Each facet contained 10 items covering 4 facets perceived risk of CCA, perceived severity of CCA, perceived benefits of CCA prevention, and perceived barriers to CCA prevention. The scale was reliable, with a Cronbach's alpha of .71. Part 3: the assessment of behaviors of CCA prevention (10 items), we used a 4-point scale, where 1 = "never practice," 2 = "ever practice but now quit," 3 = "sometimes practice," and 4 = "always practice." The overall mean scores are classified into 3 levels of frequency: < 1.75 = low,

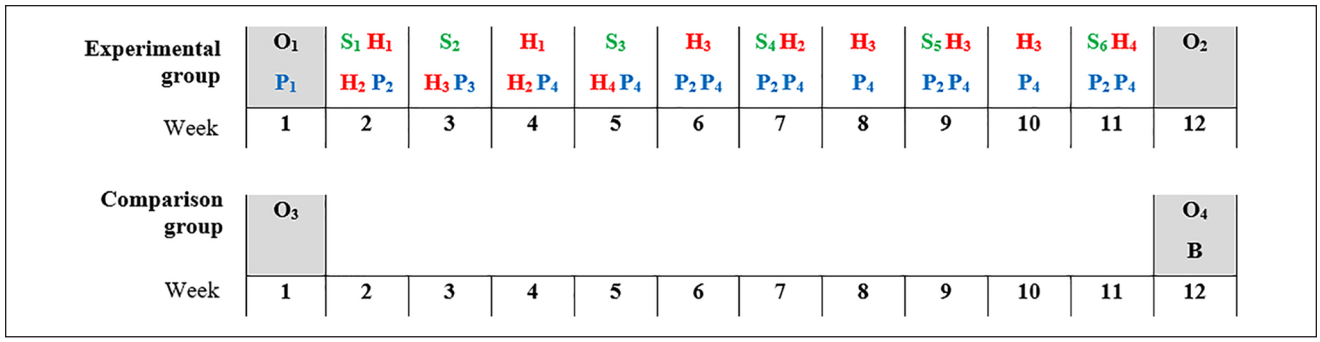

Figure 1. The study flow.

1.76 to 2.50=moderate, and >3.26=higher health behaviors of CCA prevention. The reliability with a Cronbach's alpha of the entire questionnaire was .74.

Data Collection

(1) Preparation: This step was to prepare the researchers and the research instruments and coordinate with the experimental and comparison areas agencies to request permission to research the area.

(2) Planning: The research team planning meeting was organized to collect data in the experimental and comparison areas carefully.

(3) Operation: It was conducted based on the following sample groups.

(3.1) The experimental group: A 12-week program applying social marketing concepts and the HBM to prevent CCA consisted of the following activities (Figure 1). A 12-week attendance monitoring process was proactive by having VHVs check the names of participants both on-site and online. In addition, we have the *Application Stop CCA*, which is a way for participants to search for information and ask questions anytime and anywhere. The researcher can verify the understanding and correctness of the practice from the participants' answers through the App. Finally, the researchers can collect the data for all participants for final analysis.

- Week 1: Public relations was launched to invite volunteers to participate in various channels, such as community news broadcasting towers, signs at the entrance and exit of the village/town hall, and signs and posts at shops and public places. The VHVs also distributed leaflets to invite volunteers in the responsible area to join the activity. We promoted the launch of the activities on the channels mentioned above throughout the 12 weeks. After recruiting the volunteers to join the training, the researchers clarified the research objectives. Data were collected before the experiment (O_1), and the campaign to promote social marketing was organized (4Ps: Product, Price, Place, Promotion) (P_1). It was an activity where the volunteers could ask questions about the action. We provided the channels for asking and answering questions and exchanging knowledge. There was a network in the community. The project called "*Application Stop CCA*" was introduced to the volunteers in the area.
- Week 2: The activity, called "*Have You Known. . . CCA*"? was held (S_1). It was an activity promoting awareness about CCA, risk, and severity of CCA through the community news broadcasting tower twice a week. Designing story-based content takes 20 min (H_1, H_2). The knowledge was presented through public relations signs. In addition, we introduced the access to health information developed by the researchers by scanning QR Code to use the *Application Stop CCA* (P_2). The VHVs also disseminated knowledge to the public using brochures.
- Week 3: The activity called "*Little Villain*" was organized (S_2). It was an activity that increased the benefits of CCA prevention. This activity was promoted through the community news broadcasting tower twice a week. The content design was storytelling, taking 20 min (H_3). The knowledge was presented through public relations signs. The access to health information in social networks was tracked. The VHVs also provided home visits (P_3).
- Week 4: The knowledge about the risk factors for CCA and OV screening was disseminated twice a week through the community news broadcasting tower. The content design was a 20-min presentation of academic and research work (H_1, H_2). The participation of volunteers in accessing health information in social networks was assessed. Giving lucky draw coupons was used to motivate participants (P_4).
- Week 5: The activity, called "*Stop Eating Raw Food, Eating Cooked Food, Reducing the Risk*," was organized (S_3). The movement promoted awareness of

the barriers to preventing CCA. It focused on educating the experimental group on nutrition knowledge and the correct attitude toward food consumption, a risk factor for CCA. This activity was promoted through the community news broadcasting towers twice a week. Content design for sharing experiences of community leaders and housewives takes 20 to 30 min (H_4). In addition, the knowledge was presented through public relations signs. The access to health information in social networks was tested by asking and answering questions about the diet that is the risk factor for CCA. The rewards were given to the participants/people who correctly answered the questions (P_4).

- Week 6: The knowledge about nutrition and the right attitude on foods that can prevent CCA was disseminated. This activity was promoted through the community news broadcasting tower twice a week. Content design for sharing VHVs experiences takes 20 min. (H_3). In addition, the knowledge was presented through public relations signs. The access to health information in social networks was checked by asking and answering questions about the diet that is the risk factor for CCA (P_4). The rewards were given to the participants/people who correctly answered the questions (P_2).
- Week 7: The activity, called "*Change, Adjust, Increase Awareness*," was organized (S_4). The action raised awareness of the severity of CCA. It aimed to educate the experimental group on CCA prevention by modifying personal behaviors and dietary habits. This activity was promoted through the community news broadcasting tower twice a week. Revolving content design for participants to share their experiences takes 20 min (H_2). In addition, the knowledge was presented through public relations signs. The access to health information in social networks was tested by asking and answering questions about behavior modification to prevent CCA (P_4). We rewarded the participants/people who correctly answered the questions (P_2).
- Week 8: The knowledge about CCA prevention and practice preventing CCA was disseminated through public relations signs and the community news broadcasting tower twice a week. Designing content for participants to share their experiences takes 20 min (H_3). People were recommended to increase their awareness of health information in social networks (P_4).
- Week 9: The activity called "*If I Had Known It Would Be Like This. . .I Would Have Done It a Long Time Ago* (S_5)." This activity reviewed the knowledge of CCA prevention behaviors and good nutrition helping to prevent CCA. It took 20 min to design content by having volunteers share their experiences (H_3). This activity was promoted through the community news broadcasting tower twice a week. In addition, the knowledge was presented through public relations signs. The access to health information in social networks was checked by asking and answering questions about behaviors in CCA prevention (P_4). The rewards were given to the participants/people who correctly answered the questions (P_2).
- Week 10: The knowledge on behaviors in CCA prevention and good nutrition helping to prevent CCA was disseminated through public relations signs and the community news broadcasting tower twice a week. It took 20 min to design educational content by public health personnel (H_3). People were recommended to increase their awareness of health information in social networks (P_4).
- Week 11: The "*Knowing About CCA Prevention*" activity was organized (S_6). The action raised awareness of the barriers of preventing CCA. This activity was promoted through the community news broadcasting tower twice a week. The content was designed by presenting the barriers to CCA prevention each participant encountered, which took 20 min (H_4). In addition, the knowledge was presented through public relations signs. Finally, the access to health information in social networks was tested by asking and answering questions about CCA (P_4). The rewards were given to the participants/people who correctly answered the questions (P_2).
- Week 12: The data after the experiment were collected, and the people's satisfaction was assessed (O_2).
- 3.2 Comparison group
- Week 1: The area and the comparison group were prepared. The research objectives and data collection were clarified before conducting the research (O_3).
- Weeks 2 to 11: The comparison group received routine services or usual care provided by health professionals at their community health center (Sub-District Health Promoting Hospital).
- Week 12: The data were collected after finishing the research using the same questionnaire (O_4). Moreover, before completing the project, we carried overall intervention procedures given to the experimental group to the comparison group (B).

Data Analysis

The SPSS Software version 26.0 (IBM Company, Chicago, USA) was used for data analysis.

(1) General information, perceived HBM, and right behaviors in CCA prevention were analyzed by frequency, percentage, mean, and standard deviation distribution.

(2) The mean scores of the perceived HBM and right behaviors in CCA prevention within the experimental and comparison groups before and after the experiment were compared by the paired sample *t*-test.
(3) The mean scores of the perceived HBM and right behaviors in CCA prevention between the experimental and comparison groups before and after the experiment were compared by the independent sample *t*-test.
(4) We employed in the case that both groups had different mean scores of perceived HBM and right behaviors in CCA prevention, the Analysis of Covariance (ANCOVA) for data analysis.

Results

According to the data analysis results of the general information of 300 participants (Table 1), they were equally divided into the experimental group and the comparison group (150 people in each group). We found that most of the experimental group were female (60.67%), aged 60 years and over (30.67%). Their marital status was married (69.33%). The education level mainly was primary school level (56.00%). They mostly worked as a farmer (78.67%). The income was less than 3000 baht (48.00%). Moreover, they used to have a stool examination for OV eggs once (38.00%), and OV eggs were found (52.67%). However, most of them had never been treated with OV medicines (83.33%) and had no relatives with CCA (92.67%). The majority of the comparison group were female (63.33%), aged 50 to 59 years (32.00%). Their marital status was married (72.00%). The education level mainly was primary school level (51.33%). They mostly worked as a farmer (84.00%). Their income was less than 3000 baht (58.00%). They had never had a stool examination for OV eggs (44.00%). Most of them had never used drugs to treat the OV (88.67%). They had no relatives with CCA (97.33%). Both groups used a household toilet (100%), and they used it every time they excreted (100%).

Table 2 shows the study results of the program after the experiment were as follows. First, the mean score of the perceived risk of CCA of the experimental group was (Mean difference 6.39, 95% CI 5.95-6.84). Second, the mean score of perceived severity of CCA was (Mean difference 5.42, 95% CI 5.13-5.72). Third, the mean score of perceived benefits of CCA prevention was (Mean difference 5.32, 95% CI 5.00-5.64). Fourth, the mean score of perceived barriers to CCA prevention was (Mean difference 5.54, 95% CI 5.06-6.02). Finally, the mean score of right behaviors in preventing CCA was (Mean difference 6.72, 95% CI 6.33-7.11). These mean scores were significantly higher than before the experiment ($P < .001$).

Table 1. General Information of the Experimental Group and the Comparison Group.

	Experimental group	Comparison group
General information	Number (%)	Number (%)
Gender		
Male	59 (39.33)	55 (36.67)
Female	91 (60.67)	95 (63.33)
Age (years)		
20-29	17 (11.32)	14 (9.34)
30-39	19 (12.67)	21 (14.00)
40-49	25 (16.67)	32 (21.33)
50-59	43 (28.67)	48 (32.00)
>60	46 (30.67)	35 (23.33)
Marital status		
Single	23 (15.33)	23 (15.33)
Married	104 (69.33)	108 (72.00)
Divorced	7 (4.67)	3 (2.00)
Separated	1 (0.67)	1 (0.67)
Widowed	15 (10.00)	15 (10.00)
Education		
Uneducated	4 (2.67)	1 (0.67)
Primary school	84 (56.00)	77 (51.33)
Junior high school	15 (10.00)	35 (23.33)
High school	31 (20.67)	24 (16.00)
Diploma or equivalent	3 (2.00)	7 (4.67)
Bachelor's degree or above	13 (8.67)	6 (4.00)
Occupation		
Unemployed	9 (6.00)	8 (5.33)
Farmers	118 (78.67)	126 (84.00)
Hire workers	15 (10.00)	9 (6.00)
Traders	2 (1.33)	3 (2.00)
Government service/state enterprise employees	6 (4.00)	4 (2.67)
Income (Baht)		
<3000	72 (48.00)	87 (58.00)
3001-6000	54 (36.00)	44 (29.53)
>6001	24 (16.00)	19 (12.67)
Do you have a toilet at home?		
Yes	150 (100.00)	150 (100.00)
Do you use the toilet every time you excrete?		
Yes	150 (100.00)	150 (100.00)
Have you ever had a stool examination for OV?		
Never	50 (33.33)	66 (44.00)
1 time	57 (38.00)	64 (42.67)
2 times	36 (24.00)	8 (5.33)
3 times	3 (2.00)	8 (4.00)
>3 times	4 (2.67)	6 (4.00)
Have you ever detected OV eggs?		
Never	48 (32.00)	67 (44.67)
OV eggs were detected	79 (52.67)	65 (43.33)
OV eggs were not detected	23 (15.33)	18 (12.00)

(continued)

Table 1. (continued)

General information	Experimental group Number (%)	Comparison group Number (%)
Have you ever used drugs to treat OV?		
Never	125 (83.33)	133 (88.67)
1 time	19 (12.67)	15 (10.00)
2 times	6 (4.00)	1 (0.67)
>3 times	0 (0.00)	1 (0.67)
Do you have any relatives with CCA?		
No	139 (92.67)	146 (97.33)
Grandparents	1 (0.67)	1 (0.67)
Aunt-uncle	4 (2.67)	1 (0.67)
Parents	1 (0.67)	1 (0.67)
Son-daughter	5 (1.33)	1 (0.67)
Grandchildren	3 (2.00)	0 (0.00)

Table 3 shows the before and after the experiment between the experimental and comparison groups. First, after using the health program, the mean score of the perceived risk of CCA of the experimental group was (Mean difference 5.21, 95% CI 4.71-5.72). Second, the mean score of perceived severity of CCA was (Mean difference 3.42, 95% CI 3.08-3.76). Third, the mean score of perceived benefits of CCA prevention was (Mean difference 3.65, 95% CI 3.32-4.00). Fourth, the mean score of perceived barriers to CCA prevention was (Mean difference 4.38, 95% CI 3.84-4.92). Finally, the mean score of right behaviors in CCA prevention was (Mean difference 5.61, 95% CI 5.15-6.06). These mean scores were significantly higher than those of the comparison group ($P < .001$).

Discussion

The program integrating social marketing concepts and the HBM for CCA prevention used the health education process to promote health knowledge, understanding, and behavior modification in CCA prevention. We also used randomization to control the threat to internal validity to control the contamination of the usual policy. After the experiment, the mean scores of the perceived risk of CCA, perceived severity of CCA, perceived benefits of CCA prevention, perceived barriers to CCA prevention, and correct behaviors in CCA prevention of the experimental group were significantly higher than those of the comparison group at the .05 level ($P < .001$). This was consistent with Thongnamuang and Duangsong[18] studying program effectiveness by applying the HBM and social support to modify OV-CCA prevention behavior among primary school students in Moeiwadi District, Roi-et Province. It was found that after the experiment, the mean scores of knowledge, perceived susceptibility, and perceived severity of OV-CCA, perceived benefits, and perceived barriers to OV-CCA prevention of the experimental group were significantly higher than those of before the experiment and the comparison group ($P < .001$).[18]

The activities under a 12-week program followed a health education program based on a review of previous studies. It consists of training,[13,19] giving lectures,[20] watching videos,[19,20] listening to the families' experiences with CCA patients,[13] doing group activities for learning and exchanging knowledge,[21] using role models and images,[19] cooking demonstrations,[13] and organizing campaigns of not consuming raw fish.[21] The materials used in training included videos, brochures, posters, flip charts, handbooks for OV-CCA, the model of OV eggs, microscopes, and slides about OV eggs. It is believed that people will express certain health behaviors to avoid disease when they think that they are at risk of contracting the disease, and the disease will cause violence and affect their daily life. They also believe that it would be helpful to follow the instructions. Also, the practice should not affect behavior modification.[22] When considering the perception based on the HBM in each aspect, it was found that the mean differences in perceived risk of CCA were higher than those of other HBMs. This resulted in a higher mean of right behaviors in CCA prevention. This was consistent with Thubthim and Duangsong[23] evaluating the effects of the HBM and social support for CCA behavioral modification. After the experiment, knowledge, perceived susceptibility, severity, benefits, and barriers for OV prevention were higher than before and in the comparison group.

Health behaviors are reactions, expressions, or actions that a person does or refrains from acting in a way that affects their health to promote, restore, and prevent health. These actions require knowledge, understanding, belief, and feelings.[24] Health behaviors must be desirable behaviors that encourage people to continue to practice permanently. Undesirable behaviors will inevitably affect health.[19] Moreover, Songserm et al[25] studied the effects of the risk communication program through the Cambodian folk song to prevent OV-CCA. The results revealed that the mean scores of health beliefs, social support, and prevention behavior in the experimental group were higher than those of the comparison group with statistical significance. It was consistent with a study by Chavengkun et al[26] which found that most people had relatively low knowledge of OV. They knew that eating raw fish was the cause of the disease, but they did not know how to treat the OV. They also did know about the side effects of taking OV medications frequently. They perceived that eating raw fish was a traditional way of life and had never thought to stop consuming food, causing disease risk. It is necessary to encourage individuals to carry out healthy behaviors. The health behaviors of each depend on the learning process that a person develops at different ages. It is the process of enabling a person to

Table 2. The Comparison Results of the Mean Scores of Perceived Health Belief Models of CCA Prevention Before and After the Experiment Within the Experimental Group and the Comparison Group.

	Before the experiment		After the experiment				
Perception	Mean	SD	Mean	SD	Mean difference	95% CI	*P*-value
Experimental group							
Risk	28.22	2.75	34.61	2.49	6.39	5.95, 6.84	<.001
Severity	26.68	1.83	32.10	1.45	5.42	5.13, 5.72	<.001
Benefit	27.10	1.96	32.42	1.50	5.32	5.00, 5.64	<.001
Barrier	27.66	1.65	33.20	2.96	5.54	5.06, 6.02	<.001
Behavior	27.51	2.11	34.23	2.18	6.72	6.33, 7.11	<.001
Comparison group							
Risk	27.20	2.07	29.40	1.95	2.20	1.91, 2.49	<.001
Severity	26.79	1.75	28.68	1.53	1.89	1.66, 2.13	<.001
Benefit	27.18	1.83	28.77	1.48	1.59	1.36, 1.81	<.001
Barrier	27.13	1.58	28.82	1.65	1.69	1.50, 1.89	<.001
Behavior	26.64	1.88	28.63	1.82	1.99	1.74, 2.24	<.001

Table 3. The Comparison of the Mean Scores of Perceived Health Belief Models of CCA Prevention Before and After the Experiment Between the Experimental Group and the Comparison Group.

		Experimental group		Comparison group				
Perception	Experiment	Mean	SD	Mean	SD	Mean difference	95% CI	*P*-value
Risk	Before	28.22	2.75	27.20	2.07	1.02	0.47, 1.57	<.001
	After	34.61	2.49	26.40	26.40	5.21	4.71, 5.72	<.001*
Severity	Before	26.68	1.83	26.79	1.75	−0.11	−0.51, 0.30	.606
	After	32.10	1.45	28.68	1.53	3.42	3.08, 3.76	<.001
Benefit	Before	27.10	1.96	27.18	1.83	−0.08	−0.51, 0.35	.715
	After	32.42	1.50	28.77	1.48	3.65	3.32, 4.00	<.001
Barrier	Before	27.66	1.65	27.13	1.58	0.53	0.17, 0.90	.004
	After	33.20	2.96	28.82	1.65	4.38	3.84, 4.92	<.001*
Behavior	Before	27.51	2.11	26.64	1.88	0.87	0.42, 1.33	<.001
	After	34.23	2.18	28.63	1.82	5.61	5.15, 6.06	<.001*

**P*-value from ANCOVA analysis.

change destructive behaviors into right behaviors, focusing on reducing admission to health service units using the method of health education.

Health education is essential for disseminating knowledge to accelerate behavior modification in society. Or it is an innovation using marketing techniques for the benefit of humanity. It is based on the belief that the target audience's knowledge, attitudes, thoughts, and needs are essential in determining effective communication.[19] The marketing mix (4Ps) is used. Social marketing is a concept that uses marketing principles to induce changes in attitudes and behaviors for the better in the long run. The application of the 4Ps can improve HBM in terms of perceived risk, perceived severity, perceived benefit, and perceived barrier. Although the individual is aware of the information, there is a need for reminders and awareness through HBM, which will increase health awareness even further.[27] The development of 4Ps to raise awareness of CCA prevention in this study include: (1) Product is the knowledge and right behaviors in preventing CCA. What is more expected is that people feel fear about CCA. (2) Price is that people will not have to pay for participating in the activities. But they will benefit from participating in the activities and reinforcing the right behaviors to prevent CCA. (3) Place means that the activities are organized in the community. It is a place where people do not have to travel far, and all age groups can reach. (4) Promotion is the public communication in the community through print media, personal media, online media, and community news broadcasting towers.

The social marketing concepts can be applied to complex social diseases. However, few studies have been found using social marketing concepts to other health theories. Only 2 studies that applied social marketing concepts to the HBM were found from the research review. Suriyan[28]

studied the effects of using the social marketing process and HBM in promoting breast self-check of women of reproductive age in Khon Kaen Province, Thailand. The activities in providing knowledge consisted of giving lectures, handbooks, brochures, and VCDs on breast self-check, group discussions, demonstrations, and breast self-check practice. Also, Wichachai et al[20] investigated the effects of applying social marketing theory with the HBM in cervical cancer screening promotion for women at Sisaket Province, Thailand. The activities included providing training and knowledge. They used videos to offer knowledge about cervical cancer, the importance and severity of the disease screening, and the advantages of screening and treatment.

Currently, many agencies are trying to push for early screening for CCA. Screening is provided for persons aged 40 years and over who used to be detected with OV eggs and those found with abnormalities in the bile ducts by the ultrasound.[29] This is of great benefit to the people. But CCA screening combined with health education would greatly benefit the people. Solving public health problems requires action to enable individuals, families, and communities to have healthy behaviors that are most conducive to solving health problems. To develop health behaviors, a person must have the proper knowledge, understanding, attitudes, good health awareness, and sufficiently good health skills in defining activities. So, learning, content, and health education media must be compelling enough and cover the area and target groups.[21] Behavior modification is essential in providing health information through community participation,[30] and proactive action by VHVs.[31,32] It will provide suggestions on illnesses, disease incidence, risk factors, disease prevention, and health promotion.

This study has some limitations, including: (1) Due to the Coronavirus Disease 2019 (COVID-19) epidemic widely within Thailand, the government has taken various measures to control the outbreak of the disease. It also impacted community activities, which caused the study to be delayed. Notably, the experimental program must be organized under government measures with the provincial public health office. However, we have taken strict standards. Before participating in the activity, volunteers must check their temperature, wear a mask, and wash their hands with alcohol gel. Group or collective activities were adapted to brainstorming via paper or raising an opinion. The chair arrangement of the participants was arranged in a social distancing style with a distance of 1 m between people. In addition, community trials are used to submit activities via the *Application Stop CCA* or submitting worksheets to the VHVs. (2) Some participants' access to online material for searching for information is also limited. Because they are not used to searching for information, but for other uses such as entertainment. Therefore, communication channels need to be added, such as brochures, publicity banners, training manuals, and the *Application Stop CCA*.

Conclusion

This study is the first to integrate social marketing and HBM for CCA prevention. It should implement guidelines for CCA prevention by applying social marketing concepts and HBM through public communication and health education. It can be used as a strategy for CCA prevention activities. More importantly, people will have to change their behavior to prevent CCA correctly and sustainably. Academics or policymakers have learned from this issue that it may maintain health education's importance by integrating social marketing into the process. It should guide these issues into public health policy recommendations, practical improvements, and further research studies.

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