The Collaborative Model Among Multidisciplinary Team and Farmers Can Increase Protective Behaviors and Decrease Severity of Chemical Accumulation in Bloodstream Among Orchardists, Thailand

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Abstract:- This participatory action research aimed to develop a collaborative model among multidisciplinary teams and Thai farmers for enhanced chemical hazard prevention and evaluated the effects of the model among 18 Longan orchardists (Age 42.50±10.43 years). Participants who met the research criteria were selected using purposive sampling. The research was conducted for a period of six months. Results reported that the model in this study comprised of 4 stages including: 1)the collaborative goal setting for chemical hazards prevention; 2) supporting self-management participation; 3) encouraging and monitoring behaviors; and 4)collaborative reflection and making adjustment to goal attainment. Finding indicated that participants demonstrated significant increase self-management behaviors, with a decrease severity of chemical level accumulation in bloodstream than baseline, and had high satisfaction. The model in this study is effective to encourage self-management for chemical hazard prevention among Longman orchardists. Further research should be replicated over a longer time frame.

Keywords:- *collaborative model, multidisciplinary team, orchardists, chemical hazard prevention, orchardists.*

I. INTRODUCTION

Thailand has a tendency to use pesticides continuously since the import of chemicals over five decades. The use of pesticide covers a wide range and is increasing rapidly. In 2010, the chemicals imported amounted to 117,698,480 kg, of which the active ingredients amounted to 69,868,409 kilograms. The total value of these chemicals was 17,924,407,345 Baht. The results of a study on pest control, agricultural pest control, Department of Disease Control found that for every one hundred thousand baht increase in chemical sales, the rate of illness increased by 0.11 percent, or increased the number of patients to 110 per 100,000 population [1]. According to the study of agricultural chemicals, their main use was herbicides, more than 70%, follow by almost insecticides, about 15%, plant chemicals 10%, and others. These imported chemicals are listed on the list of toxic chemicals or dangerous substances that must be monitored by the Department of Agriculture. In addition, it was found that the number of farmers with high, unsafe levels of chemical pesticides in their blood may actually be between 200,000 and 400,000 per year, and likely to increase in accordance with the import and use of was of chemicals in the country [2].This number does not take into account cases of self-harm or patients who were not admitted to the system, nor illness caused by various chronic diseases where it was unclear whether it was related to chemical substances.

The impact of pesticides on the health status was acute causing chronic toxicity. The acute toxicity includes nausea, vomiting, headache, muscle aches, diarrhea, dizziness, blurred vision, etc. However, the more serious danger was the continuous accumulation of toxic pesticides. No matter how near one is to agricultural areas heavily using pesticides and chemicals, it will absorb pesticide residues, which result in chronic diseases such as cancer, diabetes, Parkinson's disease, paralysis, dermatitis, sterility, neonatal disability or sexual dysfunction, etc. Importantly, the large numbers of deaths from cancer was another sign that Thai society was fighting the risk of chemical use and pollution [3].Safe chemical hazard handling protocols must be started by the farmers who were the chemical user. They should be aware of and understand the dangers of chemical misuse. Although there was a campaign designed to educate farmers on how to take care of their own health by reading the labels to understand how to use pesticides and the importance of wearing the appropriate safety equipment; hats, goggles, gloves and masks before and during spraying, the morbidity rate of farmers from the occupation still has not decreases at all. The study of pesticide danger preventative behaviors of pangasian farmers in Phrao District, Chiang Mai Province showed that the farmers had scored behavioral protection against pests at a moderate score[4].The inappropriate behaviors were mixing the pesticides with bare hands, unlikely to wear glasses, not covering the nose and mouth while spraying, stopping to smoke while spraying pesticides, drinking water while spraying, eating without changing clothes after spraying, using a mouthpiece to blow or suck on the spray device when there was a blockage, and washing the spraying equipment in natural water sources. In addition to pesticides protection, there were two ways way to dispose of the pesticides after the fact. First was how to prevent the chemicals from getting in to the body. Second was how to reduce the accumulation of chemicals in the body. The prior study found that some herbs were recognized as having detoxifying properties [5]. The importance of protection against the accumulation of the pesticides in the body was that the

farmer must be aware of his or her actions to prevent the toxicity from chemicals.

Self- management is an important strategy to achieve desired health outcomes. It is a set of everyday behaviors that individuals or families follow in order to cope with conditions that will keep them in good health[6].These changes in behavior will have a positive effect on the chronic diseases and will produce good effects in many diseases with better health outcomes. Therefore, the self-management approach may be useful in preventing harm from chemical hazards or to correct the farmers when faced with a problem of using the pesticides. However, the problem of using chemicals incorrectly was very common. Some farmers were knowledgeable about prevention, but they were still not aware of the proper management of hazards because of the adverse effects from the chemical, although eventually acute, were not immediately obvious. Because the danger from the accumulation of chemicals in the body is gradual, the symptoms are not obvious so the farmers were not inclined to be careful while using the pesticides. One important strategy in promoting self-management to prevent chemical hazards in these farmers was to promote farmers' participation and related persons including agricultural scientists, health educators, community leaders, etc. They should collaboratively design the appropriate protection according to academic principles and identifying the real possibilities at the beginning. Then, follow up periodically to be able to properly perform and assess health status by measuring the level of blood chemistry compared to a non-hazardous level. This approach was likely to be important in preventing harmful chemicals from being misused. In addition, it was found that the promotion of farmers' participation led to a change of attitudes and improved practices in the prevention of harm from pesticide misuse [7].

Chanthaburi is the province where most of the population is engaged in agricultural occupations and use chemicals most of the time. From the Chanthaburi Provincial Health Office's report on blood screening in fiscal year 2015, 30,136 people were examined. There were 5,529 people at risk levels and insecure blood with cumulative chemical depositionat 18%, while the overall picture of the country in 2014 was at risk and unsafe from pesticides. 34.3 percent [3].Chanthaburi had the highest number of herbicides and fungi use. The study on the prognosis of agricultural pesticide poisoning reported that Chanthaburi is one of the five provinces with the highest rates of pesticide poisoning [8]. In addition, the Chanthaburi Provincial Health Office in 2015 reported that there were 469 farmers in Klong Yai Subdistrict, Pong Nam Ron district, Chanthaburi province who had longan production outside of the regular season. It was found that these people had a higher chemical level in their blood than others, with 82% of them at risk, leading to acute health problems. In addition, the blood chemistry screening in Klong Yai area in the year 2016 found they had an accumulated chemical level of 42.07%, which is higher than the national level (32.45%). It was urgent to find a way to prevent the danger of accumulated chemicals for these people.

This study; therefore, to develop the cooperation model among multidisciplinary team, the farmers, and community leaders for the protection against the accumulation of the pesticides in the farmers. We hope that it would be useful for sustainable behavioral modification for protective behaviors in decreasing chemical level in blood and promoting good health and quality of care for the farmers. The objective of this study was to develop the collaborative model among a multidisciplinary team and farmers for enhanced chemical hazard prevention of farmers in Chanthaburi, Thailand, and to evaluate the effectiveness of the model.

II. METHODOLOGY

A. Research design: The design used for this study was a participatory action research

B. Population and sample: 18 Orchardists from Chanthaburi, Thailand that met the research criteria were recruited for the study: 1) aged 20-60 years; 2) being the Longan orchardists at Mu 4, Klong Yaisub district, Chanthaburi province; 3) used the pesticides or conducted work related to pesticide use; 4) Thai people that could speak, read, and write in Thai; 5) didn't have chronic diseases that required them to take the medicine regularly; and 6) the chemical level in their blood was at risk or danger level. The exclusion were: 1) prefer to stop participating in the research project; 2) participated the project less than 20 percent; and 3) had sickness that required them to take the medicine during the research project.The samples were selected using purposing sampling.

C. Materials and Methods: The research instruments were:1) the Self-awareness in cumulative chemical deposition prevention questionnaire;2)the Self-management behavior questionnaire; and 3) the orchardists' satisfaction questionnaire. The content validity index was 0.90, 0.87, 0.93 and the Cronbach's alpha co-efficiency were 0.76, 0.88, and 0.72, respectively; 3) the questions guideline for focus group discussion of the farmers and the multidisciplinary team.

*D. Data collection***:** The study was approved by the Ethics Committee for Human Research in Chanthaburi province. The informed written consent was obtained from all participants before data collection. The objectives, process of the study; and the right to refuse or withdraw at any time from the study without affected health care service were explained. Participant's confidentiality was maintained throughout the study. The research was conducted from December 2015 to February 2017 with the steps of conducting research and collecting data as follows:1) Preparation phase or pre-research phase: to conduct meetings, research teams, and stakeholders to share objectives, research goal and discuss the guidelines in order to achieve knowledge and understanding in the role in the research project; 2)Research phase: 2.1) Blood chemistry screening for selection of subjects to participate in the study program based on inclusion criteria; 2.2) Focus group discussion for pesticides used analysis and

created the temporary model among farmers and the multidisciplinary team for enhanced bio-cumulative chemical deposition prevention, and 3) Monitoring and evaluating phase: evaluated the self-awareness in protection against pesticides behaviors, self-management behaviors, chemical levels accumulated in blood, and farmers 'satisfaction.

E. Data analysis: Descriptive statistics were computed to summarize the demographic data. The qualitative data was analyzed using content analysis and constant comparative analysis. The outcome difference between the beginning of the project, before developing the model, and at 6 months later was examined using Paired t-test, and Mc Neman's test.

III. RESULTS

A. Patients characteristics

In this study, initially 18 participants were enrolled. Most of them were male (13 persons) , and married (11 persons), most finished primary school (16 persons), had monthly income between 100,000 Baht - 200,000 Baht per year (7 persons). The types of pesticides used in the past month were herbicides (2 persons), insecticide (1 person), pesticides and herbicides (15 persons). Accordingly, the jobs related to pesticides included: mixing the chemical (1 person) mixing and spraying (4 persons), towing and spraying (1 person), mixing, towing, and spraying (6 persons). The frequency of work related to chemical use was 1-2 times a month (3 persons), 3-4 times a month (11 persons), 5 times a month and over (4 persons). Most of participants never had acute toxic problems (11 persons), never attend health education related to preventing the harmful effects of pesticide misuse (17 persons) and had no blood testing for cumulative chemicals in blood (14 persons).

B. The Collaborative model among multidisciplinary team and farmers for enhanced chemical hazards prevention

The model development in this study comprised of 4 stages including: 1) collaborative goal setting in the prevention of chemical hazards; 2) supporting Self-management participation to prevent chemical hazards; 3) encouraging and monitoring to prevent chemical hazards; and 4) collaborative reflection and making adjustment to goal attainment as show in the figure 2.

C. The Effectiveness of the Collaborative model among the multidisciplinary team and farmers for enhanced chemical hazards prevention

- The comparison of self-awareness in protection against pesticides of participant and self-management behaviors to prevent chemical hazards of participants at the beginning of the project and 6-month after model development

Results reported that the self-awareness in protection against pesticides of participant and self-management behaviors to prevent chemical hazards of participant 6-month after model development was statistically significantly higher than before developing the model($p < .001$) as shown in table 1.

Table1.Self-awarenessin protection against pesticides and self-management behaviors to prevent chemical hazards of participants at before and 6-month after model development (n=18)

variable	before		6-month		t-test	*p-value*
	$\bar{X}$	*S.D.*	$\bar{X}$	*S.D.*		
Self-awareness in protection against pesticides	84.89	8.61	97.72	2.37	-5.434	.000
Self-management behaviors to prevent chemical hazards	29.94	6.22	37.06	1.83	-4.997	.000

- The comparison of chemical level accumulate in bloodstream at before and 6-month after model development

The results of study using McNamara's test showed that the number of chemical level accumulation in bloodstream of participants at 6-month after developing the model had significant lower severity than baseline ($p < .05$) as shown in table 2.

The chemical level accumulation in bloodstream	baseline			6-month			chemical level accumulation		*p-value*
	unsafe	at risk	safety	unsafe	at risk	safety	decreased	stable	
Number of participants	12	6	0	8	8	2	6	12	.031

3. The orchardists 'satisfaction for the Collaborative model among multidisciplinary team and farmers for enhanced chemical hazards prevention The results showed that participants had satisfaction related to the Collaborative model among multidisciplinary team and farmers for enhanced chemical hazards prevention at high level (4.79±0.25) The highest score was the activities in the model, the beneficence

of activities in chemical hazards prevention and gaining more self-care knowledge(4.93±0.27).

D. Self-awareness changed after participating in the research program

According to the prevention of chemical hazards, it was found that before the development of the model, most of participants did not protect against the chemical hazard seriously before spraying, during spraying, and after spraying. The protection of the body while spraying or towing consisted of wearing long sleeve shirts. Nobody cleaned their body immediately after spraying. Some people ate or drank water after spraying after only hand washing, but still wearing the spraying suit. Someone drank the soft drink to take out the chemical by expiration as mentioned in the following:

I never protected myself during spraying…didn't wear gloves, mask or boot, even the protection suit while spraying because it is inconvenient for working. I drank coca cola for belching the toxin"

After finished spraying, I only washed my hands and ate or drunk water while wearing the same clothes that I wore while spraying. I never took a bath immediately because of tired.."

After developing the model, it was found that most of the participants were more aware of chemical hazards and behavioral changes designed to prevent harm from pesticides. Most participants perceived pesticides as harmful and the benefits of behavior modification before spraying, during spraying, and after spraying. In addition, they focused on the prevention of toxins entering their bodies by changing their practices, even though it had been seen as difficult and inconvenient to reduce the accumulation of chemicals in their body. They realized the benefits of using herbs to remove toxic substances from the body by drinking Thunber gialaurifolia tea (Thai herb) to get rid of the chemical in the bloodstream.

"I wanted to reduce the chemical levels in my body because it was dangerous. I used to hearabout the danger from the chemicals before but I didn't care. However, after joining this project and knew that I had chemical at danger level in my blood, I understood and thought the harm was closer. I wanted to change my behaviors to avoid danger. "

"Now, I put my gloves on when I was spraying in the upwind position. I took a shower in the garden area and ate Thunbergia laurifolia"

IV. DISCUSSION

The results showed that the self-awareness in protection against pesticides of participants and self-management behaviors to prevent chemical hazards of participant 6- month after the model was development was statistically significantly higher than before developing the model. In addition, the level of chemical accumulation in the blood of the participants 6-month after developing the model was significantly lower than the baseline. The finding confirms the beneficial effects of the model as it promoted significant positive change in almost all the outcomes. The activities in this study incorporated increasing self-awareness and self-management skills for the prevention of chemical hazards. It included small group discussion to increase the knowledge of chemical misuse and the effects and practiced collaborative goal setting among the multidisciplinary team and farmers for enhanced chemical hazards prevention. The formulation of action plan, and skill mastery were promoted using games and small group discussions. The participants were taught how to change their health protective behaviors to meet their goals and how to monitor their chemical accumulations in their blood. Through small group discussions, the participants identified the barriers to changing the behaviors required to attain better levels of chemical accumulation. The home visits, giving advice, and monitoring their behaviors were used to reduce these barriers. These methods allowed the researchers to contact participants directly and become more deeply focused on each person's problem. Participants had the chance to gain self-awareness and perceive the benefit of behavioral modification, problem solving, and maintaining the new self-management behaviors. These strategies can encourage participants to have more confidence in their ability to confront their problems. It can be explained that the self-management model to prevent chemical accumulation in Chanthaburi orchardists by participation with the multidisciplinary team using a participatory action research process to promote awareness and behavioral change for the prevention of chemical accumulation.

In addition, the support for participating orchardists in setting goals to reduce blood chemistry, coordinating measures to promote preventive behavior from chemical use dangers, assessing problems and obstacles and adjusting the way to the goal, reflection of mutual performances by self-assessment, and encouraging each other resulted in successfully raising awareness and enabling the participants to adapt their behaviors in a better way. As a result, blood levels of chemical accumulation had decreased significantly. These results were in accordance with the self-management concept [9], which stated that the goal setting between the patient and the health team was to help patients achieve their goals. Although the level of chemical accumulation in the blood of participants at 6-month point did not achieve the safety level in all participants, the change in the numbers of participants who decreased the severity of chemical accumulation in their blood was significantly lower than baseline. In addition, self-management behaviors resulting from participation in this study were defined and shown to be possible and finally achievable. These results were congruent with the study of The pphukhieo and Daensee kaew [10] ,which found that learning from the common source of resources in the community can develop activities to raise awareness and develop skills for farmers. That study reported that after 3 months, flower gardeners had increased their use of safe chemicals and had lower levels of chemical residue in the body. In addition, the results also congruent with the study, that reported the farmers made a change in their attitudes and improved the way they behaved in the prevention of harm from pesticide used [7]. The results of a present study also showed that the samples used Thunbergia laurifolia to drive out the toxins and lower blood chemical levels after spraying pesticides. This is relevant as it supports the findings of the study which found that using Thunbergia laurifolia was effective in significantly reducing blood chemistry levels below dangerous levels among their

participants versus those who did not receive it [5,11]. Moreover, the results of this study showed that participants had a high level of satisfaction in participating the research program. It can be concluded that the collaborative process in every part of the model development between farmers and the multidiscipline team encouraged the actual behaviors that could be used to change behaviors that reduced blood chemical accumulation.

V. CONCLUSION AND RECOMMENDATIONS

The results demonstrate the effectiveness of a model that can be used to raise awareness and behavioral modification to prevent chemical hazards among participants. It can also reduce the intensity of chemical accumulation in the blood.

Suggestions and recommendations: The collaborative model among multidisciplinary team and farmers for enhanced chemical hazard prevention of farmers in this study can be used to modify behaviors to prevent chemical hazards and to reduce the intensity of chemical accumulation in the blood of long an farmers in Pong Nam Ron District, Chanthaburi province, Thailand. It can be the guideline for changing the behaviors of pesticide protection among orchardists in other areas. Further research should replicate the study by monitoring the self-management behaviors and health status of participants in a longer time frame.

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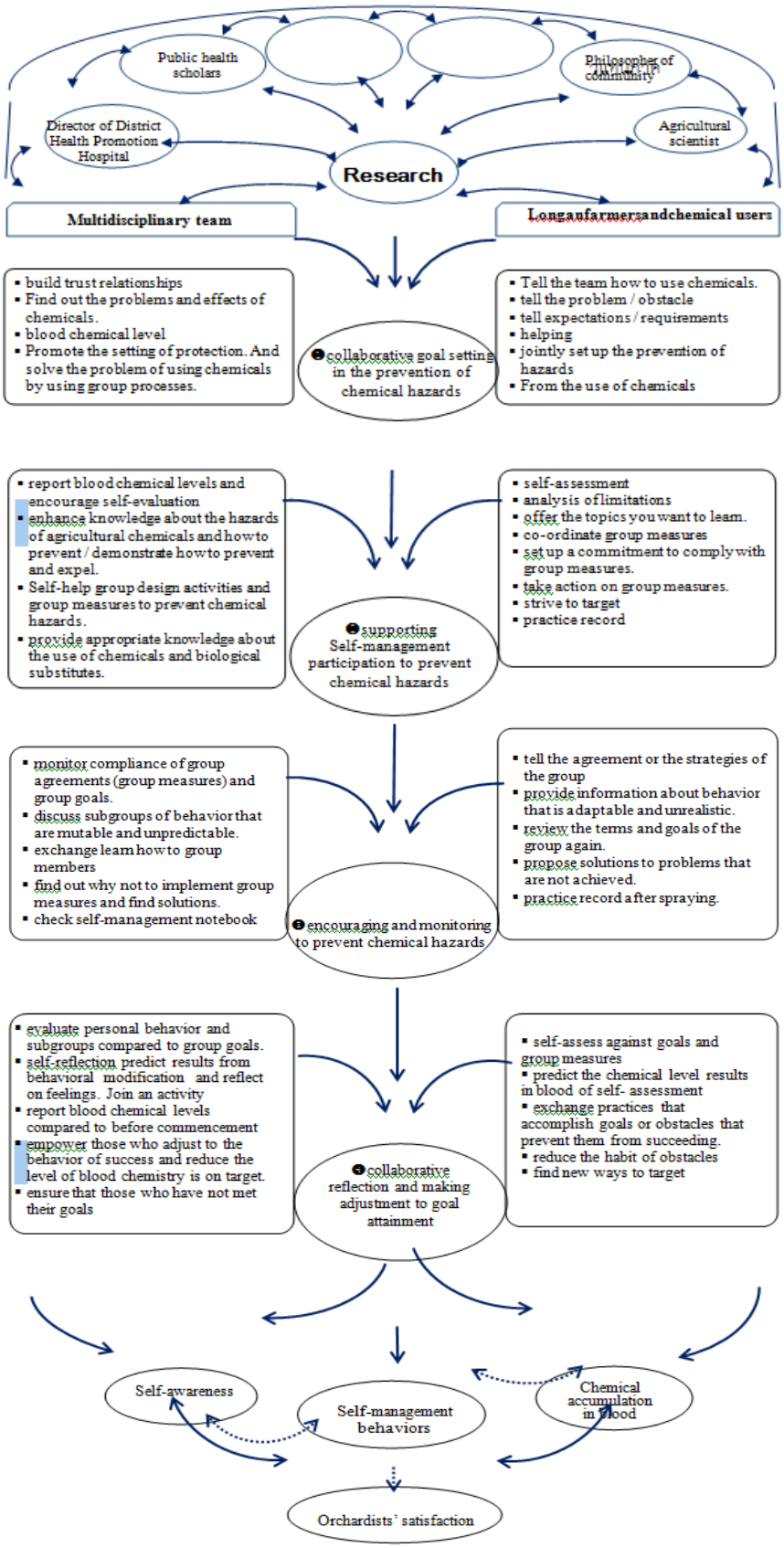

Fig 2:- A Collaborative Model among Multidisciplinary Team and Farmers for Enhanced Chemical Hazard Prevention of Orchardists in Chanthaburi province, Thailand