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Risk behaviors related agrochemical use among rubber farmers in Southern of Thailand

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Abstract

The study objective was to evaluate the knowledge, beliefs and behaviors regarding agrochemical safety behaviors among farmers among farmers in the Khogyang community, Trang province, Thailand between the period September and December 2012. The principles of Health Belief Model and community participatory approach were applied to develop a comprehensive strategy to reduce agrochemical risk their behavior. 316 farmers from 8 villages in Khogyang community were recruited. The mean scores of the 3 variables (knowledge, belief and behavior) regarding agrochemical safety were measured. The results revealed that knowledge of farmer participants on agrochemical use was observed at low level. The level of overall belief regarding agrochemical safety was observed at moderate level. The mean scores of perceived susceptibility, seriousness, barriers, and benefits of agrochemical safety were 3.85 $\pm$ 0.74, 3.52 $\pm$ 0.56, 3.61$\pm$0.39 and 3.66$\pm$0.96, respectively. Behavior of farmer participants on agrochemical safety was also observed at moderate level. There were positive statistically significant correlations between knowledge and behavior scores; and overall belief and behavior scores (r = 0.336 and 0.621, respectively). In addition, statistically significant predictive variables associated agrochemical safety behavior were knowledge and belief on agrochemical use (Beta = 0.120 and 0. 0.576, respectively). These predictors accounted for 39.80 percents of variance. All predictors were positively related to agrochemical use behavior. The most common of agrochemicals use in the Kogyang community was "Glyphosate". Health risk behaviors regarding agrochemical use were lack of attention to safety precautions and the use of inappropriate protective gear. These are an elementary guide that is useful in introducing the ideas of community involvement in agrochemical safety behaviors

Keywords: Agrochemical Risk Behaviours, health belief model, Rubber Farmers

1. Introduction

Agrochemicals are used to promote and protect agricultural products in the world. Agrochemicals especially pesticides not only destroy pests but can also damage the surrounding ecosystem and other living organisms necessary for maintaining ecological balances (WHO, 1990; Panuwet et al., 2012; Robson et al., 2010; Siriwong, 2009; Jaipieam 2009). The trend of imported pesticides in Thailand was steadily increased from 2000 to 2011. The reported cases of pesticide poisoning steadily increase from 2006 to 2011. Reported cases of pesticide poisoning in 2011 was 1,509 persons (Bureau of Epidemiology, MOPH, 2012). The health effects associated with pesticides do not appear to be restricted to only a few chemical classes (Weisenburger et al, 1999; Beseler et al., 2008; Winchester et al., 2009). Short-term exposure can cause irritation of the skin, eyes, nose, as well as impaired lung and visual

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functions. It can also affect one's memory and cause liver, kidney, and stomach discomfort. Both short-term and long-term exposure can affect the nervous system (Ecobichon, 2000; Weisenburger, 1993; Robson et al., 2001; Keifer and Firestone, 2007; Alavanja et al., 2004; Calvert et al., 2008; Tan and Mustafa, 2004; Philip, 1999; Nurhayati, 2011; Robson et al., 2010). Several studies have found that farmers are at elevated risk for various cancers, which is related to their exposure to pesticides (Robson et al., 2010). Pesticide residues can remain in the environment and cause long-lasting effects to humans and the environment long after discontinuation of its use.

Health Belief Model (HBM) encourages a person to adopt positive health actions using the desire to avoid a negative health outcome as the key inspiration (Becker et al., 1978).This study was applied an empirical model of the Health Belief Model linked rubber farmer pesticide risk behaviors and risk perceptions to an environmentally pesticide use (Raksanam B.,2012). The HBM is effective in assessing a person's perceived susceptibility, severity, benefits, and barriers, plus cues to action and self-efficacy as they relate to decisions about whether to take action about a health concern (Becker et al., 1978). The principle of the Health Belief Model is based on the following six key concepts: (1) Perceived susceptibility is an individual's assessment of their risk from occupational agrochemical hazards. (2) Perceived severity is an individual's assessment of the seriousness of the occupational or agrochemical hazards, and their potential consequences. (3) Perceived barrier of agrochemical safety is an individual's assessment of the influences that facilitate or discourage adoption of the promoted occupational agrochemical safety behaviors. (4) Perceived benefit is an individual's assessment of the positive consequences of adopting occupational agrochemical safety behaviors. (5) The cues to action are events, either physical symptoms of a health condition or environmental incidents from agrochemical use that stimulate farmers to take action/adopt protective measures. (6) Self-efficacy is the farmer's belief in being able to effectively and successfully carry out the protective measures necessary to achieve the desired results (Glanz et al., 2002; Arcury et al., 2002, Raksanam B., 2012).

Trang province is located at the southern of Thailand. Rubber farmers who are living in the Khogyang community often not aware that specific issues including pesticide safety, occur in their homes and they may not understand the potential adverse effects of pesticide use on their families' health. Few studies exist that develop model risk behaviors related to pesticide use among rubber farmers in the Southern of Thailand.

The Objectives were: (1) to evaluate the knowledge, beliefs and behaviors regarding agrochemical risk behaviors among rubber farmers and; (2) to evaluate the factors related agrochemical risk behaviors among rubber farmers in the Khogyang community, Trang province, Thailand over the period September to December 2012.

2. Materials and methods

This cross-sectional study was conducted in the Khogyang community between September between December 2012. The eligibility criterion of the participants included were: rubber farmers who had been worked at rubber farms and risk to occupational agrochemical hazards in the Khogyang community, Kuntang, Trang province, Thailand; rubber farmer participants who were willing to participate in the study; rubber farmers who had lived in the Khogyang community and used agrochemical for at least one year; and rubber farmers who had no communication problems. 316 rubber farmers from the 8 villages of Khogyang community were recruited. Data collection was completed using a combination of quantitative and qualitative methods. The study research procedure was separated into two phases: (1) Preparatory phase; and (2) a cross-sectional study phase.

In the preparatory phase included: building connection in the community; the Khogyang community study; rubber farmer participant recruitment; research assistant training; and pilot project in Lamor community, Nayong district, Trang. As well as, face to face in-depth interviews; and observations were performed in a cross-sectional study phase. The research team were: public health experts, healthcare workers, pharmacist nurses; and healthcare volunteers who had experience working and living in the Khogyang community. All interviews lasted between 1

and 1.5 hours, the average been 1.1 hours. Focus group discussions and in-depth interviews were done in a private and quiet place such as the Khogyang health care promotion hospital and the Khogyang village centers.

The research instruments were questionnaires on (1) knowledge, (2) health beliefs, and (3) behaviors regarding pesticide risk use, as well as (4) a focus-group discussion guideline. Content validity of research instruments were verified by five experts on community health, environmental health, behaviors, and social sciences. A pilot project was carried out in the Lamoo community with 30 purposive sampling rubber farmer subjects. Cronbach alpha's Coefficients of belief and behavior were 0.71 and 0.73, respectively.

The questionnaire on knowledge was concerned with basic knowledge of agrochemical risk behaviors. All of the 21 questions in this part were in multiple-choice format. Examples of the questions included: What are the dangers of agrochemicals, especially pesticides? What are the most important reasons to consider when choosing agrochemicals, especially pesticides? What should you do if the nozzle is clogged while you are spraying agrochemicals, especially pesticide?

The belief on agrochemical use questionnaire was divided into four sections including perceived susceptibility, severity, benefits, and barriers to using agrochemicals, especially pesticides. The 22 questions were scored on a five-point Likert scale, ranging between strongly agree, agree, uncertain, disagree, and strongly disagree. The questionnaire asked the rubber farmer participants to rate statements such as: For your safety, you should always read pesticide instructions before use; to reduce the risk of exposure to pesticides, you should spray in the same direction as the wind.

The agrochemical use behaviour questionnaire was divided into three sections of 20 questions specifically on self-care practices before, during, and after handling agrochemicals, especially pesticides. The rubber farmer participants were asked to choose from a four-point Likert's scale ranging between always, often done, sometimes done, and never done. "Always done" meant farmers perform the dangerous protection activities from agrochemicals, especially pesticides every time when they work with pesticides. "Often done" meant farmers almost perform the dangerous protection activities from agrochemicals, especially pesticides when they work with agrochemicals, especially pesticides or the time of doing activities are between 5-9 times from 10 times of using pesticides. "Sometimes done" meant farmers sometimes perform the dangerous protection activities from pesticides when their work related pesticides or the time amount of doing activity are not over 4 from 10 times of for using pesticides. "Never done" meant rubber farmers never perform the dangerous activities related to agrochemicals, especially pesticide exposure. All individual points were sum up for a total score, means and standard deviations were calculated. Possible scores were ranged between 0.00-60.00 score. Scores of behaviors regarding pesticide exposure classified into 3 groups by using Bloom's Theory (Bloom et al., 1956). The scores were sum up. Then, they were classified by percentage, ≤ 60.00 % was low level, >60.00 % - 80.00 % moderate, and > 80.00 % high level. Examples of pesticide use behaviors include: checking tools and equipment before working; using expired pesticides; leaving food near or in the spraying area; conducting a breathing test to determine whether a pesticide is real or fake; discarding empty or expired pesticide containers in regular disposal areas.

The focus group discussion explored agrochemical use in the Khogyang community, environmental health risks related to agrochemicals, especially pesticide exposure, and recommendations for guidelines to improve agrochemicals, especially pesticide safety in the Khogyang community. Examples of the focus group discussion guidelines included: What are rubber farmers' beliefs regarding the severity, susceptibility, barriers, and benefits of agrochemicals, especially pesticide exposure? What observed work-related and socio-cultural factors modify agrochemicals, especially pesticide exposure risks? What do rubber farmers need to reduce risk from pesticide in the Khogyang community? How can guidelines be established to reduce agrochemicals, especially pesticide risk behaviors in Khogyang community?

The study protocol was approved according to the Sirindhorn College of Public Health Trang Ethical Committee review guidelines for the protection of human subjects (Protocol No.13/2013). Data collected was kept confidential by using numbers and codes. Furthermore, written informed consent was obtained from the farmer participants prior to conducting any study-related procedures.

3. Data analysis

Descriptive statistics including frequencies and percentages were used for demographic and occupational data. Means and Standard deviations were used for scoring, knowledge, belief and behavior related to occupational agrochemical risk, especially pesticide risk behaviors. Pearson's correlation was performed to evaluate knowledge, belief and behavior correlations (between knowledge and behavior, belief and behavior). Multiple regression analysis was performed to predict the independent variables (knowledge and belief) on dependent variable (behavior) regarding agrochemical safety. Content analysis was used for the qualitative data. Qualitative data were analyzed by systematically organizing and interpreting information using categories. Patterns and relationships on which to base on analysis of the findings were identified. The data obtained were transcribed and crosschecked with rubber farmer participants before analyzing. The interview transcripts, debriefing summaries, and detailed field notes in their entirety were reviewed.

4. Results

We found that a majority of the farmer participants (54.70%) were female. The average age of the individuals was 49.26 (SD=13.65) years and 30.70 % were between 41 and 50 years old. Most of them (87.70%) were married. Most of them were primary school educated (61.10%). The average income was 10,779.75 baht per month. Most of them (70%) involved in agrochemical spraying during their work sites. The majority of the samples (46.80%) sprayed agrochemicals, especially pesticides more than four times per month. The rubber farmer participants left pesticide containers and pesticide sprayers in their houses, too closed to the area where children could easy access. They were not separate pesticide spraying coats to others. Moreover, they mixed pesticides without rubber gloves, mask, protective glasses, and hat. The major sources of waste chemicals and solid wastes were through contamination including defective and expired bottles and agrochemical's containers. The waste chemical drums and different contaminated solid waste were not placed on impervious floors. Most of the rubber farmers reported using agrochemicals, herbicide products containing "glyphosate" as active ingredient (Figure 1).

Figure 1. Examples of glyphosates found in the Khogyang community
(Photo by Sirindhorn College of Public Health Trang students, 2012)

The results revealed that knowledge of rubber farmer participants on agrochemical, especially pesticide use was observed at low level (average score = 12.14 ± 3.40, total score = 21.00). The level of overall belief regarding pesticide use was observed at moderate level (3.66 ± 0.49, total score = 5.00). Behavior of rubber farmer participants on pesticide use was also observed at moderate level (average score = 2.90.83 ± 0.40, total score = 4.00). Knowledge on agrochemical use of the majority farmer participants (55.37%) was observed at low level. Where 43.04 % of them were observed at moderate level, 1.59 % of them were observed at high level. More than 60 % of rubber farmer participants answered correctly in 13 of 21 questions. The most incorrectly answer given was the question No. 2 (What is the danger of agrochemicals, especially agrochemicals?), which 10.12% correctly answered. The next most incorrectly answer given was the question No. 19 (What is the correct practice?), which 11.71% correctly answered. The scores of perceived susceptibility to agrochemical hazards, perceived seriousness of agrochemical hazards, perceived barriers of agrochemical safety, and perceived benefits of agrochemical safety were 3.85 ± 0.74, 3.52 ± 0.56, 3.61±0.39 and 3.66±0.96, respectively.

Table 1. Correlations between: Knowledge and Behavior; and beliefs and behavior regarding agrochemical use

Knowledge and beliefs on agrochemical use	Agrochemical use Behavior	
	Pearson Correlation	**P-value**
1. Knowledge on agrochemical use	0.336**	<0.001
2. Belief on agrochemical use (overall belief)	0.621**	<0.001
2.1 Perceived severity to agrochemical hazard	0.634**	<0.001
2.2 Perceived susceptibility of agrochemical hazard	0.318**	<0.001
2.3 Perceived barriers of agrochemical safety	0.290**	<0.001
2.4 Perceived benefits of agrochemical safety	0.468**	<0.001

**Significant level at 0.05

The results showed that there were positive statistically significant correlation between knowledge and behavior scores; overall belief and behavior scores; perceived severity to agrochemical hazard and behavior scores; perceived susceptibility of agrochemical hazard and behavior scores; and perceived benefits of agrochemical safety and behavior scores, which r = 0.336, 0.621, 0.634, 0.318, 0.290, 0.468, respectively (Table 1).

Table 2. Multiple regression analysis regarding to knowledge, belief and behavior on agrochemical use

Factors	B	SD	Beta	T	Sig.
Constant	1.002	0.133		7.527	<0.001
Knowledge on agrochemical use	0.014	0.006	0.120	2.529	0.012
Belief agrochemical use	0.470	0.039	0.576	12.186	<0.001

a. Predictors: (Constant), Belief on agrochemical use, Knowledge on agrochemical use

b. Dependent Variable: Agrochemical use Behavior Dependent Variable: agrochemical use behavior

R^2 = 0.398 F =103.541 df = 2, 313 P-value < 0.001

** Significant level at 0.05

Statistically significant predictive variables associated agrochemical use behavior were knowledge on agrochemical use (Beta = 0.120); and belief agrochemical use (Beta = 0. 0.576). These predictors accounted for 39.80 percents of variance. All predictors were positively related to agrochemical use behavior (Table 2).

5. Discussion and Conclusion

Improving rubber farmer agrochemical safety behaviours is very important public health concerns. Although the Khogyang rubber farmers recognize the hazards of agrochemicals, especially pesticides to human health and the environment, transforming this knowledge into practical actions that result in lower levels of exposure might prove a difficult task. Educational and technical support that takes into account cultural and socioeconomic aspects of the farmers are needed to change the scenarios observed in this study. These findings are consistent with Raksanam B. et al (2012); Chalermphol, J., Genesh P. & Shivakoti (2009), Glanz et al., (2002); and Arcury et al., 2002 studies.

According to the principle of the Health Belief Model, to identify modifiable behaviors and environmental factors, and to specify factors that predisposed farmers to change their behaviors, reinforce behavior change and enable positive behaviors related reducing agrochemical risk behaviors. The finding implied that the primary influence that impeded rubber farmers' using personal protective equipment was financial problems. Additionally, rubber farmers did not wear personal protective gears because it interfered with their work. The findings of risk behaviors related to agrochemical use, especially, pesticide use can be applicable to other areas. Although this study was done in the setting of rubber farmers in one community, it is difficult to generalize the findings to other areas in Thailand or other countries. Moreover, variation in beliefs and behaviors can be expected across regions because of variation in origin as well as in language and cultural diversity. Using the questionnaires to measure beliefs and behaviors might not adequately portray actual their beliefs and behaviours. Qualitative approaches, such as observation, in-depth interviews, and focus-group discussions could provide additional aspects besides the information derived from the questionnaires. Further studies, biomarker assessments are recommended. Lastly, these findings are an elementary guide that is useful in introducing the ideas of the Khogyang community involvement in agrochemical safety behaviors.

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