Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol 2, No.2, 2012

Factors Associated with Pesticide Risk Behaviors among Rice Farmers in Rural Community, Thailand

Buppha Raksanam[1,2*] Surasak Taneepanichskul[2] Wattasit Siriwong[2] Mark G. Robson[3,4]

1. Sirindhorn College of Public Health, Trang, P.T.J. Trang, 92000, Thailand
2. College of Public Health Sciences, Chulalongkorn University, Bangkok, 10330, Thailand
3. School of Environmental and Biological Sciences, Rutgers University, NJ, 08901 8525, USA
4. School of Public Health, University of Medicine and Dentistry of NJ, 08901 8525, USA

* E-mail of the corresponding author: sorayanarak@hotmail.com

Abstract

The need to use large amounts of pesticides has raised environmental health and human health concerns. Several reports reveal that many farmers in Thailand continue to be poisoned through unsafe practices in the use of pesticides. Few studies exist that examine pesticide risk behaviors and beliefs among rice farmers in Thailand. The study objective was to evaluate health beliefs and behaviors associated with pesticide risk behaviors among rice farmers in the Khlong Seven community from March to December 2010. Data collection from 482 rice farmers was completed by observation, in-depth interviews, and focus group discussions. We found the main potential exposure pathways included: take-home exposure; ingestion from food intake, especially vegetables and drinking water; environment risks, especially the proximity of family homes to farms, spray drift areas, and; the most concern stemmed from their practice. Major factors of pesticide poisoning in the Khlong Seven community were the unsafe use of pesticides including erroneous beliefs of farmers about pesticide toxicity, lack of attention to safety precautions, environmental hazards, and information about first aid and antidotes written on the container labels, the use of faulty spraying equipment or lack of proper maintenance of spraying equipment, and wearing protective gear and appropriate clothing during the handling of pesticides. This study concludes that an intervention program is necessary to improve safer pesticide behaviors and to decrease pesticide exposure among rice farmers in Khlong Seven community.

Keywords: rice farmers, pesticide exposure, risk behaviors, rural community

1. Introduction

Pesticides are widely used throughout the world to protect or promote industrial agricultural products (WHO 1990; Ecobichon 2001). Pesticide exposure is one of the most important occupational risks among farmers in Thailand (Ecobichon 2001). Short term exposure can cause irritation of the skin, eyes, nose, impaired of lung functions, vision, memory, liver, kidneys and stomach discomfort. Both short and long term exposure can affect the nervous system (Alavanja *et al*. 2004; Blondell *et al*. 2007; Calvert 2008; Keifer *et al*. 2007; MOPH 2009; Klein-Schwartz *et al*. 1997; Weisenburger *et al*. 1992; Winchester *et al*. 1993; Robson *et al*. 2001). The need to use large amounts of pesticides has raised human health and environmental concerns (Hemmi & Cool 1995). The total amount of imported pesticides had dramatically increased in Thailand. The trend of reported cases of pesticide poisonings from 2005 to 2008 had dramatically increased. The amount of cases harmed from the pesticide poisoning in 2008 was 1,705 cases (MOPH 2009).

Khlong Seven community, Khlong Luang district, Pathumthani province is located at the middle part of Thailand, where is located in the low alluvial flats of the Chao Phraya river. Siriwong et al. (2008) found ecological risk and contamination of human food sources from Organochlorines in this area. Few studies exist that examine environmental risk behaviors related to pesticide use among rice farmers. We applied the principles of the Health Belief Model and environmental health behavioral assessment methodology to evaluate health beliefs and behaviors associated with pesticide exposure among rice farmers in Khlong Seven community. This enabled us to learn about the contexts of susceptibility, and perceived risks related to pesticide use among rice farmers. The principle of the Health Belief Model is based on six key concepts (Becker *et al*. 1978; Glanz *et al*. 2002). (1) The perceived susceptibility is an individual's assessment of their risk from occupational pesticide hazards. (2) The perceived severity is an individual's assessment of the seriousness of the occupational or pesticide hazards, and its potential consequences. (3) The perceived barrier of pesticide safety is an individual's assessment of the influences that facilitate or discourage adoption of the promoted occupational pesticide safety behaviors. (4) The perceived benefit is an individual's assessment of the positive consequences of adopting occupational pesticide safety behaviors. (5) The cues to action are events, either physical symptoms of a health condition or environmental incidents from pesticide 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 (Becker *et al*. 1978; Glanz *et al*. 2002). The present study, we focused on perceived susceptibility of pesticide hazards, severity of a pesticide hazards, benefits of pesticide safety, barriers to improving pesticide safety, and knowledge of improving pesticide safety. The study objectives were to evaluate health beliefs and behaviors associated with pesticide exposure among the Khlong Seven rice farmers from March to December 2010.

2. Materials and methods

The study research procedure was separated to two phases: (1) a preparatory phase (building connection; community study; participant recruitment; research assistant training; pilot project) and; (2) a cross-sectional study phase (face to face in-depth interviews, focus group discussion). Data collection from 482 rice farmers was completed by using a combination of quantitative and qualitative methods. Eligibility criteria for rice farmer participants included aged 21-60 years.

The research instruments were health beliefs on pesticide use questionnaire, pesticide use behavior questionnaire, focus group discussion guideline, and observation guideline. The health beliefs on pesticide use questionnaire was divided into 4 sections, including perception toward the susceptibility, severity, benefits of taking action and barriers to take action in using pesticides. This part consisted of 22 questions. The questions were both positive and negative. Each question was scored on a five-point Likert's scale, ranging from strongly agree, agree, uncertain, disagree, and strongly disagree.

The pesticide use behavior's questionnaire was divided into 2 sections. Specifically, self-care practice in personal health and questions concerning self-care practices when using personal protection equipment (comprised 20 questions). These questions included personal health care behavior questions such as cleaning their hands immediately after using pesticides; taking a bath and changing their clothes immediately after spraying; smoking and using pesticide at the same time; wash their shirt and pants immediately after finishing spraying; separate their shirt and pants stained with pesticides from their family's clothes; stand over downwind while they are spraying pesticides and; don't drink or have meal while they are crop-dusting pesticide. The questions regarding the use of personal protective equipments included wearing plastic gloves when they mix or touch the pesticides; wearing a long shirt and button both at the sleeves and neck; wear long trousers while they are spraying pesticides; wearing rubber gloves while they are spraying pesticide; wearing a mask while they are spraying pesticides; wearing a bonnet or hat while spraying pesticides and wearing boots while spraying pesticides. The farmers had to choose one answer from each question on a four-point, Likert's scale which included always done, often done, sometimes done, and never done. All the questions had the meaning as follows: Always done meant farmers perform the dangerous protection activities from pesticides every time when they work with pesticides; Often done meant farmers almost perform the dangerous protection activities from pesticides when they works with 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 is not over 4 from 10 times of for using pesticides; Never done meant farmers never perform the dangerous protection activities from pesticides when they work with pesticides.

The topics in focus group discussion guideline, and observation guideline were addressed: (1) pesticide use in the Khlong Seven community; (2) environmental health risks regarding pesticide exposure and; (3) recommendations for establishing a rice farmer guideline for improving pesticide safety in Khlong Seven community. The interviews and focus group discussions were performed by research team who were trained in interviewing techniques and briefed on the interview and discussion topics. Semi-structured, and unstructured, open-ended interviews were performed in the farmer participants' own homes and their work sites. Unstructured interviews, informal discussions were used to gain rapport with the participants. In semi-structured interviewing, an interview guide of questions was used. Questions focused on knowledge of pesticides, beliefs regarding health risks associated with pesticide exposure, safety practices in the work site, safety practices at home, and beliefs in work-related conditions that contribute to pesticide exposure. The exploratory research questions presented as follows: What belief systems influence the farmers' perceived risk of pesticide exposure? What are farmer's perceptions regarding the severity, susceptibility, barriers and benefits of pesticide exposure? What observed work-related and socio-cultural factors modify pesticide exposure risks? What are the needs of farmers to improve pesticide safety in the Khlong Seven community? All interviews lasted between 1 and 2 hours, the average been 1.5 hours. Focus group discussions and in-depth interviews were done in a private and quiet place such as a primary health care unit and the Khlong Seven community leader's office. Observational data was collected by working alongside farmers in their rice farms and in their homes in the Khlong Seven community, Pathumthani, Thailand. The study protocol was approved according to Chulalongkorn University Ethics Committee review guidelines for the protection of human subjects (under the study protocol No.041.2/53) Consent forms were obtained before the data collection commenced.

3. Data Analysis

Quantitative data was analyzed using descriptive statistics. Frequencies and percentages were used for demographic and occupational data. Mean and Standard deviation were used for scoring beliefs and behaviors related to pesticide exposure. Multiple regression analysis was used for evaluating the predictors associated with pesticide risk behaviors. Data from the questionnaire were analyzed using the SPSS computer software. Qualitative data was analyzed using content analysis. Data were analyzed by systematically organizing and interpreting information using categories, themes and motifs that identify patterns and relationships. We identified patterns relationships on which to base an analysis of the findings.

4. Results

A majority of the farmer participants (54.36 %) were male. The average age of the individuals was 46.53 years and 41.08 % were between from 41 to 50 years old. Most of them (58.78%) were married. Most were primary school educated (45.44%). Most of them (90%) stated that they were involved in pesticide spraying during their work sites, more than half of been working with having worked with pesticides for over 10 years. Most of them (51.42%) rented the farms where they worked. Some of them owned the land for farming, and the others rented for working. Most of them had been involved in agricultural labor for 30.53 years).

The average level of health belief and behavior regarding pesticide exposure was 3.98 and 2.78 respectively (Figure1 and Figure 2). Farmer participants had moderate level of belief on the benefits of pesticide safety and the protective barriers for improving pesticide safety. Receiving information about pesticide hazards increased perceived susceptibility and severity to pesticide risk behaviors and increased the benefits of safer pesticide behaviors. However, their risk behaviors, especially related to the use of improper personal protective equipments, were at a remarkably high level. Where, a high perceived severity of pesticide hazards was also correspondingly high ($p<0.05$) (Table 2).

The main potential pathways regarding pesticide exposures among farmers in the Khlong Seven community included: (1) take-home pesticides resulting from pesticide residues on clothing, skin, and boots that accumulated as farmers were working in fields; (2) ingestion from food intake that might contain pesticide residues in foods such as fruit, vegetables or drinking water; (3) environment causes, especially if the family home was close to the farms caused by pesticide spray or spray drift; (4) a major concern was the farmers' unsafe methods of mixing, loading and applying the pesticides.

Major factors of environmental health risk behaviors related to pesticide exposure in the Khlong Seven community caused from the misuse of pesticides including erroneous beliefs of farmers about pesticide toxicity, lack of attention to safety precautions, environmental hazards, and information about first aid and antidotes given by the label, the use of faulty spraying equipment or lack of proper maintenance of spraying equipment, and protective gear and appropriate clothing during handling of pesticides. More than half of the farmer participants applied higher than recommended concentrations and did not pay any or very little attention to labels on the chemicals and protective clothing instructions. The farmers breathed air containing pesticides as a vapor or aerosol during spraying. They sprayed with another person working close by and would be carried by the wind. Drinking water was often left on their work They directly handled pesticides with their hands. The pesticides were also exposed to their eyes because of improper personal protection such as visors or splash proof goggles. They poured pesticide directly into a spray tank without rubber gloves. Another problem was they often stored the pesticide equipment in their houses, not in a locked storage area. This storage was often close to other household activities and where the children were able to access the storage area. The major sources of waste chemicals and solid wastes were through contamination including defective and expired bottles and pesticide's containers. The waste chemical drums and different contaminated solid waste were not placed on impervious floors. This had the potential to cause contamination of soil, groundwater, cannels, and reservoirs from the leakage and spillage. In most cases, the farmers disposed the empty pesticide containers within the farm (89.94%) by selling, leaving it in the field, or reutilization for other purposes (e.g., for food and water storage). On some farms, the empty containers were taken to the local waste containers or to a pesticide container disposal facility.

Acute pesticide poisoning symptoms mostly found in the Khlong Seven community included nausea, vomiting, dizziness, skin irritation, skin rash, nasal irritation, weakness and eye irritation, headache, fainting and fatigue. Some farmers reported, "I think there is much more awareness of pesticides now than there had been over 30 years ago". They agreed that pesticides helped protect crops but resulted in ill effects for farmers. Although, many farmers knew that regulations existed to protect them from pesticide exposure more than 80% said there was little to no enforcement of the regulations. Regarding protective clothing, the response by one farmer exemplified the view expressed by many other farmers: "personal protective equipments, which were supposed to be worn in some job capacities were hot and uncomfortable and were rarely provided".

Most of the farmers reported using pesticide products containing the organophosphate pesticide as active ingredient, the most popular brand name in the Khlong Seven community was "Abamectin". The next most frequently used active ingredient was carbamate. Among the herbicides, glyphosate was most frequently mentioned. Most of the farmers reported working 8–10 hours a day during the growing season, with pesticide application occurring for 3–8 days each month. Almost all farmers (66.67%) had an area outside the farmhouse for storage of the pesticide products, while the rest reported storing these products inside their houses.

5. Discussion

The primary influence that impeded farmers' using personal protective equipment was financial. Additionally, farmers did not wear personal protective equipment because it interfered with their work. For example, although gloves, boots, protective lenses, and hats are available at local stores, economic barriers may preclude the farmers from purchasing them. In the focus groups discussions, farmers expressed frustration with not being provided personal protective equipments, and some felt that employers should be required to provide this to all farmers, not just those who handle pesticides. Despite the fact that the great majority of the farmer participants in this study had a clear perception that pesticides could harm their health, the use of personal protective equipments during pesticide application was not a common practice in this community. Farmers with little formal education might be at higher risk when using pesticides due to difficulties in understanding the instructions and safety procedures included on the product labels. Although trained health care personnel can provide instructions and safety procedures, this information is not necessarily understood by the farmers and/or incorporated into their daily agricultural practices.

Similarly to this study, Isin & Yildirim (2007) have reported that although, farmers read the recommendations and instructions on pesticide's label, less than 60% of them exactly followed the directions. Some of them prefer to use unsuitable pesticides in order to ensure the yield and quality of fruits. Several factors might account for this apparent reckless attitude regarding self-protection by the farmers. In addition, using the questionnaires to measure the risk behaviors regarding to the use of pesticides might not accurately reflect the actual behaviors of the participants. The successful implementation and program sustainability of pesticide safety relies on maintaining crop yield and increasing farmer earnings. Clearly, there is need for educational intervention efforts to stress the health impacts and environmental issues from pesticide use in this study area. Greater enforcement of regulations regarding field and housing sanitation are needed as well as to enhance the level of substantive dialogue with government policy makers.

6. Conclusions

Although the rice farmers in Khlong Seven community recognize the potential harm of pesticides to human health and the environment, transforming this knowledge into practical actions that result in lower levels of exposure might prove a complex task. We elucidated farmers' pesticide relevant beliefs regarding perceived severity and susceptibility to pesticides especially pesticides, the need to support safety second to financial considerations. In addition, governmental actions, such as interdiction or restrictions on the use of pesticides and enforcement of good agricultural practices, including the use of safety equipment, are needed to decrease the pesticide exposure of the farmers. Recommendation guidelines to improve pesticide safety focused on environmental health safety associated with pesticide exposure, pesticides safe handling and use, pesticides poisoning and management. These findings call for interventions that involve and engage multiple stakeholders aimed at increasing the adoption of pesticide safety behaviors and reducing pesticide exposure in farmers.

7. Acknowledgements

This research was financially supported by Thai Fogarty ITREOH Center (Grant NO. D43TW007849 NIH FIC and NIEHS P30ES005022), the College of Public Health Sciences, Chulalongkorn University, Graduate School, Chulalongkorn University and the Office of the Civil Service Commission, Thailand.

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Buppha Raksanam is Academic Lecturer in Public Health Program (Community Health, Technician Pharmacy, Dental Public Health) At Sirindhon College of Public Health Trang, Thailand. Buppha received Bachelor degree of Pharmacy from Khonkean University, Thailand and Master degree of Pharmacy from Prince of Songkha University, Thailand.

Surasak Taneepanichskul is the Dean of the College of Public Health Sciences (CPHS), Chulalongkorn University. Thailand. He received a M.D. form Faculty of Medicine, Chulalongkorn University, Diploma clinical science (OB & GYN) from Chulalongkorn University, Master of Medicine (Public Health) from National University of Singapore, and Bachelor of Law from Sukhothai Thammathirat Open University, Thailand.

Wattasit Siriwong is a faculty member, Assistant Dean, and an executive board member of the College of Public Health Sciences (CPHS), Chulalongkorn University. Thailand. He received a Bachelor of Science in Biotechnology from Mahidol University, Master of Science degree in Environmental Science from Thammasat University and his Doctoral degree in Environmental Management from Chulalongkorn University, Thailand. Dr. Wattasit is an active researcher in the field of environmental health. He is also a member of the editorial board of International Journal of Occupational and Environmental Health and Journal of Health Research.

Mark Gregory Robson Mark Gregory Robson is the Dean of Agricultural and Urban Programs and Professor of Entomology at Rutgers University-School of Environmental and Biological Sciences and Professor of Environmental and Occupational Health the University of Medicine and Dentistry of New Jersey (UMDNJ) School of Public Health (SPH). He graduated with a B.S. with High Honors (1977) M.S. (1979) and Ph.D.

(1988) from Rutgers University and M.P.H. (1995) from UMDNJ SPH. Dr. Robson received an honorary doctoral degree in Public Health from Chulalongkorn University in 2010.

Table 1. Demographic data

Characteristics (n = 482)	No	(%)
Gender		
Male	262	54.36
Female	177	45.64
Age (Years)		
≤ 30	34	7.05
31-40	79	16.39
41-50	198	41.08
51-60	171	35.48
> 60	0	0.00
Mean ± SD = 46.53 ±11.19		
Range = 21 – 60		
Marital Status		
Single	112	23.24
Married	283	58.71
Widow	50	10.37
Divorced	37	7.68
Education		
Uneducated	-	0.00
Primary school	219	45.44
Secondary 1school	208	43.15
Under Bachelor degree	48	9.96
Bachelor degree & higher	7	1.45
Income (Bath/Month)		
≤ 3500	32	6.64
> 3,500 – 5,000	54	11.20
> 5,000 - 10,000	301	62.45
> 10,000-20,000	85	17.63
> 20,000	10	2.07
Mean ±SD = 6988.35 ±3511.10 baht		
Duration in agriculture occupation		
Mean + SD = 30.53 + 11.19 years		
Range = 1- 55 years		

Characteristics (n = 482)	No	(%)
Type of ownership		
Owner	148	30.71
Renter	248	51.45
Owner and renter	47	17.84

Table 2. Multiple regression analysis regarding to pesticide use behaviors and health beliefs

Factors	B	SD	Beta	T	Sig.
Constant	1.89	.313		6.05	.000
Perceived severity to pesticide hazards	.398	.024	.595	16.29	.001*
Perceived susceptibility of pesticide hazards	-.015	.049	-.011	-.307	.759
Perceived the protective barriers of improving pesticide safety	-.165	.055	-.116	-2.98	.053
Perceived benefits of pesticide safety	-.018	.054	-.013	-.338	.735

** Relationships at statistical significant level 0.05

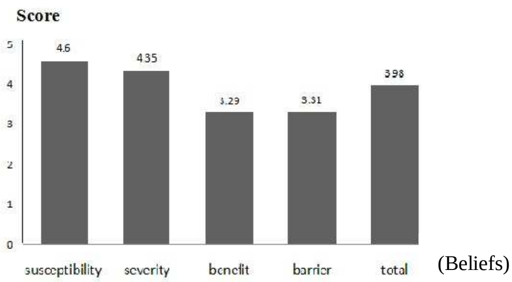

Figure1. Level of health beliefs regarding pesticide exposure

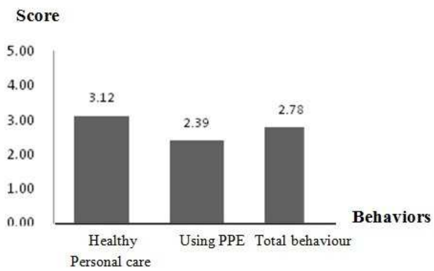

Figure 2. Level of behaviours regarding pesticide uses