Research article

The Application of Intervention Mapping in Developing a Parental Behavior Modification Program for Pesticide Exposure Prevention Among Children in Agricultural Areas for a Sub-District Health Promotion Hospital, Thailand

SATINEE SIRIWAT
Faculty of Public Health, Kasetsart University Chalermphrakiat Sakon Nakhon Province Campus, Sakon Nakhon, Thailand

APIRADEE WANGKAHARD
Faculty of Public Health, Kasetsart University Chalermphrakiat Sakon Nakhon Province Campus, Sakon Nakhon, Thailand

SRIWIPA CHUANGCHAIYA
Faculty of Public Health, Kasetsart University Chalermphrakiat Sakon Nakhon Province Campus, Sakon Nakhon, Thailand

CHAKKRIT PONRACHOM*
Faculty of Education, Kasetsart University, Bangkok, Thailand
Email: ponrachom@hotmail.com

Received 30 December 2020 Accepted 9 July 2021 (*Corresponding Author)

Abstract Child health problems in agricultural areas of Thailand are still a problem and must be addressed urgently. This study used a research and development (R&D) design consisting of two phases. Phase 1 aimed to understand parental behavior regarding pesticide exposure among children in agricultural areas. Data were collected by key informants with purposive sampling that used focus group discussion (8 informants/group) from 5 groups of parents of 1-3 years old children living in agricultural areas in Sakon Nakhon Province, totaling 40 people. Data were collected by multiple parent focus group in Sakon Nakhon Province. Data collected was then analyzed using content analysis. Phase 2 aimed to develop and study the quality of a parental behavior modification program for pesticide exposure prevention among children in agricultural areas. The results in phase 1 were used as input factors to develop the foreside program by the Intervention Mapping (IM). The developed program was then tests and reviewed by nine experts. Data were analyzed with mean and standard deviation. We found that parent's behavior in preventing pesticide exposure in their children was influenced by a least three factors, namely: attitudes toward pesticide exposure in their children, social norms and perceived behavioral control about pesticides exposure in their children. This meets the basic structure of Theory of Planned Behavior. The second phase involved developing a parental behavior modification program for pesticide exposure prevention in children in agricultural areas for a Sub-District Health Promotion Hospital. The components of the developed program were:1) background and significance; 2) objective; 3) organization; 4) role of involved people; 5) guidelines for organizing four learning activities for the parent behavior modification program; 6) monitoring and evaluation and 7) program management. The results of the program's quality assessment found that the overall quality of the program is in a very good level. When considered each aspect, it was found that all aspects; accuracy standard, utility standard, appropriateness standard, feasibility standard and generalizability standard were in very good quality as well. The findings of this study suggest that the developed program should be implemented with parents who had desirable pesticide exposure prevention behaviors.

Keywords theory of planned behavior, pesticide exposure, prevention behavior, health program modification, intervention mapping (IM)

INTRODUCTION

44.36 percent of land in Thailand is agricultural. The Northeast of the country has the most agricultural land, up to 63.86 percent of the entire country (OAE, 2020). Pesticides are used in agricultural societies for pest, insect and disease control (U.S. EPA, 2015). In 2011-2017, Thailand imported more than one hundred thousand tons of pesticides (OAE, 2020). While pesticides are widely used in agriculture society and households, the exposure to pesticides in large quantities affects human health and the environment (Snelder et al., 2008). Symptoms of pesticide exposure can include skin irritation, nausea, vomiting, loss of appetite, cough, runny nose, etc. When ingested, organophosphate and carbamate pesticides will inhibit the activity of choline esterase in red blood cells, which can result in both acute and chronic health problems (Suarez-Lopez et al., 2012). Especially, in children, very sensitive to chemicals more than adults because of ages, development, behavior and hygiene that may lead to a greater risk of exposure to environmental contaminants than adults (WHO, 2019; Curwin et al, 2007). Children living in agricultural societies are exposed to pesticides at a much higher rate than those living in other areas (Panuwet et al., 2008; Petchuay et al., 2006; Lu et al., 2000). They may be at high risk from exposure to pesticides both from agricultural activities and farmer families (Suarez-Lopez et al., 2012). Young children (1-3 years old) living in an agricultural areas are likely to have play activities on the ground in contact with the soil, both indoors and outdoors. This puts them greatly at risk of being exposed to agricultural pesticides (Curwin et al, 2007; U.S. EPA, 2008). Studies on pesticide exposure in 1-3 years old children living in agricultural areas in Sakon Nakhon Province found pesticides on children' hands skin up to 60 percent of the children surveyed (Siriwat et al., 2019). This is consistent with the annual report of cases of pesticide poisoning in 2014-2016 of the Department of Disease Control, Ministry of Public Health, which found that Sakon Nakhon Province is the top 10 provinces of the country with highest number of cases of chemical poisoning and residues by pesticides on health symptoms may include contact dermatitis, nausea, sweating, diaphoresis, lacrimation, diarrhea, salivation and headache in children under the age of 5 years.

Although various departments involved in managing diseases from poisoning and pesticides in children have been looking for solutions, previous studies show that the problem is not truly solved (Siriwat et al., 2019). One reason may due to pesticide prevention behavior in the individual or parents. There are multiple factors, mostly related to parent's internal issue and external factors in the environment, consisting of physical environment and social environment. However, when analyzing the causal factors leading to real and sustainable behavior change, causal factors from individuals seem more important as external factors are constantly changing due to a dynamic society. Therefore, finding causal factors of pesticide prevention behavior in children' patients (as opposed to factors unique to the individual) might result in the design of behavior change program for the target group that is sustainable.

After reviewing the literature of effective and efficient parental behavior modification programs in the prevention of pesticides exposure in children living in agricultural areas, we found that there is no such program in Thailand that focuses on solving the problem using an individual model. Meanwhile, Intervention Mapping (IM), a model that integrates theory and empirical evidence for planning and designing health promotion and health education (Bartholomew et al., 2006), has been successfully applied in many countries (Voogt, et al., 2014; Kwak et al., 2006; Tortelo et al., 2005). IM as an alternative way for health educators and health promoters to plan and design health behavior development leading to effective health promotion and health education program. The research team aimed to apply IM as a basis for planning, designing and building a high quality and practical parental behavior modification program in the prevention of pesticides exposure among children living in agricultural areas to result in the prevention of pesticide exposure among children living in agricultural areas.

OBJECTIVE

This study, therefore, aims to develop and study the quality of a parental behavior modification program for pesticide exposure prevention among children in agricultural areas for a Sub-District Health Promotion Hospital in Sakon Nakhon Province, Thailand.

METHODOLOGY

Research Design

This research was conducted as a research and development (R&D) by dividing into two phases. Phase 1 was the search for the internal causal factors of parents with children aged 1-3 years in agricultural areas. The research results were input and applied as data in Phase 2 for the development and study of the quality of the developed program by applying IM as a base for development because IM is a systematic process in developing a program design that promotes health and health education. More importantly, its application based on the concept and the theory integrated with empirical data for designing health promotion and health education program used for planning before implementing with a blueprint., as follows:

Phase 1 began with the implementation of Step 1 of IM: conduct a needs assessment or problem analysis using a qualitative research process with focus group discussion. A group of key informants included 40 parents of 1-3 years old children who were selected by purposive sampling (Palys, 2008) with the following criteria: 1) parents of 1-3 years old children living in agricultural areas in Sakon Nakhon Province for more than 1 year, 2) parents who were taking care of their children closely and living in the same house, 3) residential area was within 50 meters radius away from the agricultural areas, and 4) being voluntary participants in the study by signing a consent form for human research ethics. Together, there were 5 groups of informants from 5 agricultural areas in Sakon Nakhon Province, grouped into 8 people each, resulting in 40 informants.

Phase 2 was conducted with the process of Step 2 - 6 of IM, including; Step 2: create matrices of change objectives based on the determinants of behavior, Step 3: Select theory-based intervention methods and practical strategies, Step 4: translate methods and strategies into an organized program, Step 5: Plan for adoption, implementation, and sustainability of the program, and Step 6: Generate an evaluation plan. The program was drafted by the research team and quality was evaluated by nine experts (3 experts of behavioral research scientist, 3 experts of environmental health research scientist, and 3 experts of children health).

Research Instruments

There are two separate instruments used in phase1 and phase 2 detailed as follows:

Phase 1: For the range of questions used in group discussion, the researchers applied a semi-structured interview based upon a review of the literature regarding parent behavior and causal factors for the prevention of pesticide exposure among 1-3 years old children (Adgate and Sexton, 2001). The interview guideline consisted of an open-ended questionnaire for informants to freely express their opinions and own feelings freely. Accuracy and comprehensiveness of the content as well as appropriateness of the question were reviewed by three experts.

Phase 2: The program quality assessment form assessed standards of accuracy, utility, appropriateness, feasibility and generalizability, as well as an overview of the program. The rating scale had five quality levels: very good, good, moderate, fair and needs improvement (Best, 1977).

Ethical Approval

Ethical approval was obtained from the Human Research Ethics Committee, Kasetsart University, Bangkok, Thailand. (COA No. COA62/046 approved dated 2019/December/2).

Data Analysis

Phase 1, content analysis with a three-stage process of data reduction, data display, and drawing conclusions/ verification (Miles et al., 2018). Phase 2, means, and standard deviation.

RESULTS AND DISCUSSION

Phase 1 Participants' characteristics. The majority of participants were female (95.0%), ages ranging from 20 to 60 years (Mean = 40.7), with educational levels ranging from elementary school to diploma level, All the informants worked as cantaloupe melon, chili, potato and tomato farmers. The relationship with children aged 1 - 3 years, mothers (52.5%). The important research findings are as follows: parents still had unwanted pesticide prevention behavior for children in agricultural areas reflected in three areas of parents' individual behavior:

1) Unpreventable exposure: Parents were aware that children living in the agricultural areas often cannot avoid being exposed to pesticides. Even though children might not be taken to agricultural areas where chemicals are applied, chemicals still might get to their bodies by unavoidable touching from someone else. This parental internal factors made parents sometimes unable to take care of their children to prevent pesticide exposure, even when they wanted to do so.

2) Everyone must accept the condition: Parents recognized that people who influences them are parents of other 1-3year old children living in the same community, village or agricultural areas, Most of their child care is no different. Parents often had expectations and decision making which followed their reference group.

3) Difficulty of parental duty: Parents believed it is difficult to control or take action for very young children in their care, even to prevent or reduce pesticide exposure. Particularly when parents were taking care of their children alone, they believed that they were unable to perform demanding pesticide prevention for their children.

In Phase 2, the research team applied the results of Phase 1 as input to develop a program, by following the Step 2-6 of IM.

Parental behavior modification program in the prevention of pesticide exposure in children living in agricultural areas was a program for Sub-District Health Promotion Hospital as it is a department close to farmers and children aged 1-3 years. The research team focused on the practical and integration principles in designing this program with the following elements of the program.

1) Background and significance: Principles of parental health behavior modification to care and protect 1-3 years old children from pesticides in agricultural areas.

2) Objective: Modify the internal behavior of the parents based on the findings, including (1) attitudes toward pesticide exposure in their children, (2) social norms and (3) perceived behavioral control about pesticides exposure in their children, in order to achieve desirable parental behavior in preventing exposure to pesticides in children aged 1 - 3 years.

3) Organization: Sub-District Health Promotion Hospital that operates the program in the future, and the District Public Health Office that controls, monitors and directs the effective use of the program.

4) Role of involved people: (1) Director of Sub-District Health Promotion Hospital who supports and drives the implementation of the program, (2) program users who are the Public Health Officer of Sub-District Health Promotion Hospital and Village Health Volunteer (VHV), and who are also responsible for studying the program, and (3) parents of 1-3 years old children who are responsible for participating in the program and implementing the program for their children in a concrete manner.

5) Guidelines for four learning activities for the parent behavior modification program: Learning Activity 1 - It can be prevented with understanding; Learning Activity 2 - Everyone can take good care of their children; Learning Activity 3 - Believe that you can do it; and, Learning Activity 4 - Visit and follow up "Can it be done?". The four learning activities took six hours to complete, divided into three learning activities integrated and organized by Public Health Officers over 4.5 hours and another learning activity organized by VHVs for 1.5 hours.

6) Monitoring and evaluation: The program was conducted in three phases with objective questionnaires, including the phase before using the program, the phrase right after using the program, and the follow-up phase 3 months the program.
7) Program management: District Public Health Office must have at least one responsible person for monitoring and evaluating the overall program. There was also the program server to implement the program by adapting it to the context of the organization, report the results of the program usage to the management team and then also delivery suggestions to improve and develop the program after completing it.

Quality assessment tools placed the overall quality of the program is the "very good" range. Each standard, individually, also fell in the "very good" quality range (Table 1).

Table 1 Number and percentage of program quality from the improvement

Program quality	Mean	SD.	Interpretation
Accuracy standard	4.56	.527	Very good
Utility standard	4.89	.333	Very good
Appropriateness standard	4.22	.972	Very good
Feasibility standard	4.56	.527	Very good
Generalizability standard	4.22	.441	Very good
Overall program quality	4.67	.500	Very good

** 9 experts were evaluated the quality of program.*

Parental behavior in the prevention of pesticide exposure among 1-3 years old children living in agricultural areas did not meet the desirable level due to at least three important individual causal factors. This could be explained by the Theory of Planned Behavior (TPB) (Ajzen, 1991), which holds that human behavior is guided by three beliefs, including behavioral beliefs, normative beliefs and control beliefs. Each belief influenced various variables, including attitude toward behavior, social norms and perceived behavioral control, respectively, which also affected behavioral intention leading to behavior as a result. The developed program applied IM as a model development in planning and designing this program, because IM was a model for integrating theory and empirical evidence for the design of health promotion and health education (Bartholomew et al., 2006). The design was essential to rely on behavioral science theory together with empirical evidence for co-design (Kok, et al., 2004). The results of this research applied the findings from Phase 1 as an input for the design and development by applying all 6 steps of IM until the program achieved a very good level of quality that was also practical and possible to be integrated into the Sub-District Health Promotion Hospital.

CONCLUSION

This study described a parental behavior modification program for pesticide exposure prevention among children in agricultural areas for a Sub-District Health Promotion Hospital with the application of IM. The program was able to reach a "very good" quality level. This study suggests that public health agencies in agricultural areas where pesticide exposure is a problem might place such program into practice by integrating with the routine work of those agencies in such a way that they fit sustainably into the life context of local people and society.

ACKNOWLEDGEMENTS

This research is sponsored by Health System Research Institute (HSRI), Thailand. Appreciation is made to the Executive Director of Health System Research Institute; Sakon Nakhon Provincial Public Health Officers; Muang district, Tao Ngoi district and Phanna Nikhom district Public Health Office, who provided assistance and support for conducting the research. We would also like to thank all of the participants in this research who gave great attention to this work in order to help develop their community.

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