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A Community-Based Program for Promoting a Healthy Lifestyle Among Farmers in Indonesia: A Randomized Controlled Trial

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ABSTRACT

Aims Due to their jobs, farmers are exposed to a high risk of pesticide and organophosphate exposure, which can lead to chronic diseases. However, such a problem could be overcome by implementing a healthy lifestyle. This study aimed to analyze the effect of the community-based program on promoting a healthy lifestyle (CP2HL) among farmers in Indonesia.
Materials & Methods A randomized controlled trial was performed among 135 (intervention=68 and control=67) farmers in Indonesia. The CP2HL using transtheoretical model-lead (TTM) lasted for 24 weeks and included education, training, and follow-up sessions for the intervention group. Meanwhile, those in the control group attended a regular program at the local public health center to get their health measured. The modified healthy lifestyle among farmers was measured using six structured questionnaires. The inter- and intra-group differences were evaluated using paired t-test, and analysis of covariance (ANCOVA) was used to assess the effect of intervention.
Findings There was a significant difference in the modified healthy lifestyle after CP2HL ($p<0.05$), including in the areas of organophosphate pesticide exposure, farmers' knowledge, attitudes, and behavior, nutrition knowledge, musculoskeletal symptoms, upper respiratory infection symptoms, and farmer burnout. During the follow-up period, the intervention group showed a healthier lifestyle than the control group.
Conclusion TCP2HL can significantly promote a healthy lifestyle among farmers after the intervention.

Keywords Farmers; Healthy Lifestyle; Organophosphates; Pesticides

CITATION LINKS

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Introduction

The development of biotechnology in agriculture has had many impacts on farmers' lives, both positive impacts on agricultural output and negative impacts on farmers' health. Negative impacts that can arise on the health of farmers are related to the use of biotechnology products to increase productivity, such as pesticides, chemical fertilizers, and other chemicals in supporting agricultural productivity. Exposure to chemicals with frequent intensity to farmers certainly affects the health status of the farmers, their family members, and the community. In addition, this condition is supported by the inadequate knowledge, attitudes, and behavior patterns of Indonesian farmers in safely use of biotechnology in the agricultural sector [1-7].

Using chemicals, such as organophosphates in the long term will have a direct poisoning effect and cause chronic diseases in farmers [8, 9]. These health problems are not limited to one kind of chronic disease but also include cardiovascular problems [10], chronic obstructive pulmonary disease [11], as well as negative effects on pregnancy that can eventually cause congenital defects [12]. Research conducted on farmers in the agricultural area of Jember Indonesia shows that most farmers experience chronic diseases, such as hypertension, vascular problems, heart problems, respiratory problems, muscle and spinal disorders, and anemia [13, 14]. Some of the factors that have been analyzed and become the cause of this health problem include ignorance of prevention, lack of motivation, and the inability of farmers to control exposure to the agrochemicals they use. Chronic diseases that have been suffered by farmers require changes in appropriate healthcare so that farmers' quality of life can be enhanced by addressing risk factors for exposure to controllable chemicals [15].

Through the Ministry of Health, the Indonesian government has made efforts to facilitate treatment for people with chronic diseases through the Posbindu PTM (Integrated Non-Communicable Disease Development Program) program in all parts of Indonesia. The program has been implemented in 50.6% of villages throughout Indonesia, but the prevalence of chronic disease risk factors is still increasing [16]. Evaluating the inhibiting factors contributing to this problem includes the lack of follow-up by the health team conducted by medical/paramedical personnel for Posbindu PTM participants so that participants only receive treatment when the program is implemented once a month. Treatment in this way will less impact changes in health problems experienced by people with chronic diseases in the community [17]. A specific intervention is needed to change the behavior of people with chronic diseases in carrying out healthcare independently and reduce the risk of exposure to agents that can exacerbate their illness. Therefore, it is necessary to make a change to obtain maximum results in influencing the health behavior of farmers who suffer from chronic diseases to live optimally.

Strategies that can be devised to change farmers' knowledge and behavior so that they can adopt a healthy lifestyle are integrating health education activities, supervision, follow-up, assistance in achieving the main goal of healthy living and strengthening skills to implement a healthy lifestyle [18].

The transtheoretical model (TTM) is a strategy that meets the activity criteria. TM is one of the activity methods that is widely used in changing the behavior of an individual or the behavior of a group. TTM has been proven to be able to change the behavior of a person or group of people based on an adaptation process that allows progressive change to occur [18, 19]. Five steps can be done in this process, including pre-contemplation, contemplation, preparation, action, and maintenance [20]. This study aimed to analyze the effect of the community-based program in promoting a healthy lifestyle (CP2HL) using the TTM approach to Indonesian farmers.

Materials and Methods

Design

This study employed a randomized control trial (RCT) based on community program interventions and was conducted From May to November 2022. We conducted this research in four public health centers in Indonesia (Panti, Sukorambi, Banjarsengon, and Pakusari).

Participants

The population of this study was active farmers suffering from chronic non-communicable diseases at four public health centers in Indonesia. The sample size was calculated using G*Power with a statistical significance level 0.05. Using an effect size of 0.25 and a power of 0.80, 130 farmers were selected, and considering a 10% increase in the number of samples, 143 participants were recruited to prevent a significant dropout.

The research sample was divided into two groups: The intervention group (INT; CP2HL; n=72) and the control group (CON; receiving the intervention according to the community health center service program; n=71). The inclusion criteria were: (1) working as a farmer (owning land or being a farmworker), (2) being in a designated Posbindu area, (3) suffering from a chronic cardiovascular disease and/or kidney disease, and (4) willing to sign a consent form to participate in our research. After 24 weeks of intervention, four participants in each group did not continue the intervention due to health and personal reasons. At the end of the intervention, the number of participants was 135: (CON: n=67 and INT: n=68; Figure 1).

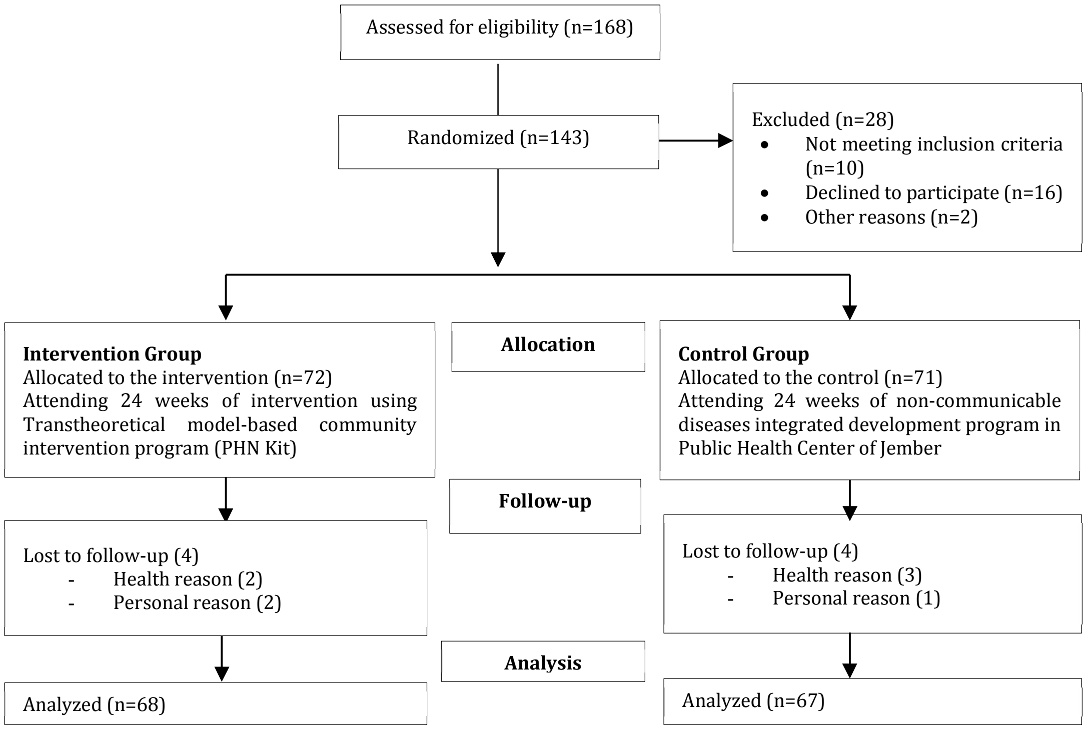

Figure 1. Consort flow diagram

Intervention

This study was conducted for 24 weeks, with the intervention performed at weeks 1-4 and follow-ups performed at weeks 5-24 in four public health centers in Jember (Sukorambi, Panti, Banjarsengon, and Pakusari). The INT group received a farmer's health service program to influence their behavior with a transtheoretical model-based community intervention program approach. TTM consists of several stages: (1) pre-contemplation; (2) contemplation; (3) preparations; (4) action, and (5) maintenance. We conducted a series of outreaches and training for respondents on the topics compiled in a guidebook (Table 1).

Table 1. The intervention topics

Session	Topic
1	Recognizing chronic diseases in farmers
2	Exposure to agricultural chemicals in chronic diseases
3	Risks of work position & physical injury to farmer's chronic pain
4	Treatment of hypertension in farmers
5	Treatment of diabetes mellitus in farmers
6	Treatment of back pain in farmers
7	Treatment of anemia in farmers
8	Treatment of kidney disorders in farmers
9	Healthy lifestyle behavior in farmers

The outreaches and training were carried out in nine sessions over four weeks. Each session lasted for 180 minutes under the direct supervision of the researchers and the team. After training, the respondents directly practiced healthcare for chronic diseases while being assisted for 19 weeks. We assessed the respondents at the beginning and the end of the intervention. The CON group received regular care from the non-communicable diseases integrated development program in the Public Health Center in Jember.

Measurement

The outcome measure was assessed at baseline (pre-test) and week 24 (post-test). The measurement instrument had two sections. The first section assessed the participants' demographic information (age, gender, ethnic group, history of diseases of the cardiovascular or urinary systems, hypertension status, education, allergy history, body weight, body height, abdominal circumference, and waist circumference). Physical indicators, such as weight (kg), height (centimeter), waist (WC), and hip circumference (HC) were measured according to standards. Meanwhile, the second part consisted of six questionnaires: (1) an organophosphate pesticide exposure questionnaire; (2) a questionnaire on knowledge, attitude, and behavior of general health conditions of farmers; (3) a nutrition knowledge questionnaire; (4) a Nordic Musculoskeletal Questionnaire (NMQ); (5) a Wisconsin Upper Respiratory Symptom Survey (WRUSS-21) questionnaire; and (6) a Maslach Burnout Inventory-General Survey (MBI-GS) questionnaire.

The organophosphate pesticide exposure questionnaire was used to assess the characteristics of pesticide exposure in agricultural workers. This questionnaire consists of 37 questions to explore (1) labor conditions during the application of organophosphates; (2) use of personal protective equipment (PPE); (3) workplace conditions related to organophosphate exposure, and (4) home conditions related to organophosphate exposure. The maximum score of each questionnaire was 54 points. A higher score indicates a greater risk of pesticide exposure and health effects. Questions answered as 'not applicable' scored zero (0) [21].

The knowledge, attitudes, and practices regarding farmers' general health conditions were measured using a structured questionnaire from previous research. This questionnaire consisted of three parts: (1) knowledge about pesticides (15 items); (2) attitude in using pesticides (13 items); and (3) practice regarding farmers' general health conditions (13 items). For the knowledge about pesticides, farmers were asked to answer all 15 questions. Each correct answer was given a score of one, while incorrect and missing values were given a score of zero. Attitude to using pesticides was scored on a four-point Likert scale from one (totally disagree) to four (totally agree). Meanwhile, practice regarding farmers' general health condition was scored on a five-point Likert scale from one (never) to five (always). This questionnaire has been tested for validity and reliability with a Cronbach's alpha of >0.6. The total scores of the three parts of the questionnaire are then summed, and the maximum potential score obtained is 132 [22].

The nutritional knowledge of farmers was assessed using a validated General Nutrition Knowledge Questionnaire. This questionnaire consists of four domains: (1) advice from health experts (11 items), (2) food groups and food sources (71 items), (3) food choices (12 items), and (4) diet-disease (22 items). Farmers were asked to answer all questions. Each correct answer is given a score of one, while incorrect and missing values are given a score of zero. Subscale scores are calculated for each domain. The total scores of the four domains are then summed, and the maximum potential score obtained is 116 [23].

The NMQ is a simple, standardized questionnaire used to detect and analyze individuals' musculoskeletal symptoms in various body parts. It has 28 items covering the body regions from top to bottom, such as "Have you at any time during the last 12 months had trouble (ache, pain, discomfort) in: ...", followed by a list and body diagram. The respondent then filled in each part of the body that felt sick. The score is from zero to three, depending on the farmer's pain intensity. The total scores of the NMQ are then summed, ranging from 0-81. The higher the score obtained, the higher the musculoskeletal problems experienced by farmers [24].

The WRUSS-21 questionnaire was used to assess respiratory symptoms in farmers. Its 19 items are valid and reliable. This questionnaire measures ten specific symptoms, including runny nose, stuffy nose, sneezing, sore throat, scratchy throat, cough, hoarseness, stuffy head, chest congestion, and fatigue. Nine functional items are also covered to assess the ability to think clearly, sleep well, breathe easily, exercise, work inside and outside the home, complete daily activities, interact with others, and lead a personal life. All items are scored on an eight-point Likert scale: zero (no or no impairment), one (very mild), three (mild), five (moderate), and seven (severe) [25, 26].

The MBI-GS questionnaire was used to measure the burnout syndrome experienced by farmers. This questionnaire was developed with items of emotional exhaustion (nine questions), depersonalization (five questions), and decreased personal achievement (eight questions). It consisted of 22 items scored on a seven-point Likert scale (0=never, 1=several times a year, 2=once a month or less, 3=several times a month, 4=once a week, 5=several times a week, and 6=every day). This questionnaire was proven to be valid and reliable based on the results of the previous studies (r>0.05) [27, 28].

Data analysis

The collected data were analyzed using SPSS 23 software, and the raw data were screened for accuracy and normality. A descriptive statistic was used for the characteristics of the respondents (age, gender, ethnic group, history of cardiovascular or urinary systems diseases, hypertension status, education, allergy history, body weight, body height, abdominal circumference, and waist size). The Kolmogorov-Smirnov test was used to evaluate the distribution of variables. Normally distributed variables are presented as the mean and standard deviation (SD), and those with no normal distribution are presented as the median and interquartile range (P25-P75).

An intra-group comparison using the paired t-test was carried out on the organophosphate pesticide exposure, knowledge, attitudes, and behavior of farmers about general health conditions of farmers, nutrition knowledge, musculoskeletal symptoms, upper respiratory symptoms, and burnout of farmers to test the effectiveness of the CP2HL program performed before and after follow-up. Analysis of covariance (ANCOVA) was used to assess the effectiveness of CP2HL intervention adjusted for education, duration of hypertension, and baseline measurement. Based on a literature review, adjustment measures were determined considering the important factors related to the results. The comparison results were corrected using the Bonferroni test.

Ethical considerations

This study considered ethical feasibility as an important aspect of research. The researchers guarantee that in carrying out the research process, research respondents had the right to either participate or object to participating in the research process. They provided verbal and/or written consent, and the principle of respondents' information confidentiality was observed. This research was carried out after the Health Research Ethics Commission of the Faculty of Dentistry, University of Jember, approved the research proposal under 1753/UN25.8/KEPK/DL/2022.

Findings

The CON (n=67) and INT (n=68) group participants were all Muslim and mostly middle-aged female farmers. Most participants were Madurese (CON: 67.2% and INT: 57.4%). Furthermore, most respondents had hypertension (CON: 52.2% and INT: 54.4%) for less than five years (31.3% and 26.5%). Most respondents only finished elementary school (59.7% and 58.8%). Participants in the CON and INT groups had a mean body weight of 51.6 and 54.7kg, a height of 151.7 and 152.6cm, abdominal circumference of 84.4 and 86.7cm, and waist circumference of 92.5 and 92.6cm, respectively (Table 2).

Table 2. Baseline participants' characteristics

Parameter	**Control** (n=67)		**Intervention** (n=68)	
	No./Mean	%/SD	No./Mean	%/SD
Age (year)				
25-44	6	9.0	18	27.9
44-46	38	56.7	28	41.2
60-75	19	28.4	20	29.4
75-90	3	4.5	1	1.5
90<	1	1.6	0	0
Gender				
Male	16	23.9	20	29.4
Female	51	76.2	48	70.6
Ethnic group				
Javanese	21	31,3	29	42.6
Madurese	45	67,2	39	57.4
Mix	1	1,5	0	0
History of diseases of the cardiovascular or urinary systems				
None	25	37,3	25	36.8
Hypertension	35	52,2	37	54.4
Diabetes mellitus	1	1,5	2	2.9
Chronic kidney disease	0	0	1	1.5
Low back pain	6	9,0	1	1.5
High cholesterol levels	0	0	2	2.9
Having hypertension for a long time				
None	31	46,3	36	52.9
<5 years	21	31,3	18	26.5
>5 years	15	22,4	10	14.7
Not know	0	0	4	5.9
Education				
Not attending school	16	23,9	20	29.4
Elementary	40	59,7	40	58.8
Junior high school	7	10.4	4	5.9
Senior high school	3	4.5	4	5.9
Allergy history				
Food	8	11.9	9	13.2
Medicine	0	0	1	1.5
Weather	2	3.0	0	0
None	57	85.1	58	85.3
Body weight	51.6	10.3	54.7	10.8
Body height	151.7	9.6	152.6	6.9
Abdominal circumference	84.4	10.9	86.7	10.8
Waist circumference	92.5	11.1	92.6	9.6

There was no significant difference in organophosphate pesticide exposure in the CON group before and after the procedure (p=0.09). However, there was a significant difference before and after the procedure in the INT group (p=0.036). There was no significant difference between the CON and INT groups in farmers' knowledge, attitudes, and behavior about their general health conditions before and after the procedure (Table 3).

Table 3. Comparison (paired T-test) of baseline and follow-up mean in the control and intervention group after 24 weeks of intervention

Parameter	Baseline	Follow-up	p Value
Control group			
Organophosphate pesticide exposure	22.9±8.4	22.7±8.7	0.09
Knowledge, attitudes, and behavior	92.9±22.6	92.53±23.1	0.862
Nutrition knowledge	84.7±6.8	85.2±6.9	0.128
Musculoskeletal symptoms	10.4±1.9	10.06±2.2	0.129
Upper Respiratory Symptom	5.6±0.4	4.47±0.3	0.46
Burnout of farmers	86.2±17.1	86.7±17.4	0.265
Intervention group			
Organophosphate pesticide exposure	23.8±10.4	20.7±8.8	0.036
Knowledge, attitudes, and behavior	82.2±30.4	97.9±28.1	0.04
Nutrition knowledge	88.1±10.5	92.8±9.4	0.027
Musculoskeletal symptoms	11.8±1.6	7.3±1.8	<0.001
Upper Respiratory Symptom	5.7±0.9	3.3±0.5	0.019
Burnout of farmers	86.8±17.9	81.1±14.7	0.038

Analyses of the intervention effectiveness after adjusting for education, duration of hypertension, and baseline measurement by ANCOVA, revealed significant differences between the CON and INT groups in organophosphate pesticide exposure (p=0.024), knowledge, attitudes, and behavior of farmers about their general health condition (p=0.042), nutrition knowledge (p<0.001), musculoskeletal symptoms (p=0.039), upper respiratory symptoms (p<0.001), and burnout of farmers (p=0.018).

Discussion

The current study concluded that CP2HL effectively modifies farmers' healthy lifestyles. The CP2HL carried out to promote a healthy lifestyle among farmers provided significant changes in farmers' organophosphate pesticide exposure, knowledge, attitudes, behavior, nutrition knowledge, musculoskeletal symptoms, upper respiratory infection symptoms, and farmers' burnout, respectively. During the 20-week follow-up period, the improvement rate of farmers' healthy lifestyles in the intervention group was greater than in the control group.

Farmers' exposure to organophosphate pesticides experienced better improvement after the intervention. On the other hand, the exposure to organophosphate pesticides in the intervention group was lower than in the control group. This change shows that the CP2HL implemented on farmers significantly promoted farmers' safe behavior in using pesticides. Implementing the CP2HL intervention for farmers for 24 weeks was effective, as evidenced by a reduction in post-test scores, indicating a reduction in pesticide exposure for farmers. Some previous studies conducted among

Egyptian pesticide users with a focus on behavior change have shown an increase in awareness of the dangers of pesticides and using PPE after the intervention [29]. Other studies have also stated that implementing interventions to reduce pesticide exposure could be generally effective if focusing on participants' education or behavior [30]. This shows that community-based program interventions to promote a healthy lifestyle (CP2HL) can be used to reduce pesticide exposure experienced by farmers.

The knowledge, attitudes, and behavior of farmers about their general health conditions also improved. Farmers' knowledge, attitudes, and behavior in the intervention group were higher than in the control group. Thus, the implementation of the CP2HL intervention was effective, as evidenced by the increase in the post-test scores, showing that the farmer's knowledge, attitudes, and behavior regarding health increased. Previous research revealed that the intervention impacted increasing farmers' knowledge. Meanwhile, the greatest increase in behavior due to the intervention was targeted at farmers who faced many farm health problems [31]. Other studies have also conducted interventions regarding general health and pre- and post-tests indicating significant changes in farmers' basic health knowledge [32]. This shows that community-based program interventions for promoting a healthy lifestyle (CP2HL) can improve farmers' general knowledge, attitudes, and behavior regarding health.

Farmers' nutrition knowledge after CP2HL also improved. Based on the results, nutrition knowledge in the intervention group was higher than in the control group. Therefore, the implementation of the CP2HL intervention was effective, as proven by an increase in the post-test scores.t. Previous studies have shown that nutritional knowledge interventions are effective in improving farmers' nutritional knowledge, as seen in the increased percentage of correct answers after nutrition education [33]. This shows that the community-based program interventions to promote a healthy lifestyle (CP2HL) are effective and can be used to increase farmers' nutrition knowledge.

Musculoskeletal symptoms felt by farmers after CP2HL also decreased. Musculoskeletal symptoms of farmers in the intervention group were lower than in the control group. This is because the CP2HL intervention was effective, as evidenced by the decrease in the post-test scores, which means that the muscle pain experienced by farmers subsided. There was a decrease in musculoskeletal complaints after farmers received interventions, such as stretching activities accompanied by ergonomic-based health education [34, 14]. Other studies have also found that interventions are effective in physical conditions and in preventing pain and injury [35]. This shows that community-based program interventions to promote a healthy lifestyle (CP2HL) can reduce musculoskeletal symptoms in farmers.

CP2HL also positively affected the upper respiratory infection symptoms in farmers. Based on these results, upper respiratory disorders among farmers in the intervention group were lower than those in the control group. This is because the CP2HL intervention was effective, as evidenced by a decrease in the post-test scores, indicating that the farmers' upper respiratory problems had subsided. Farmers easily experience upper respiratory infection symptoms due to pesticide exposure. The interventions effectively reduced upper respiratory infection symptoms by providing ongoing outreaches and training programs about potential health risks and hygienic and safety behaviors [36]. This shows that community-based program interventions to promote a healthy lifestyle (CP2HL) can be used to reduce farmers' upper respiratory infection symptoms.

Farmers' burnout also decreased after CP2HL. CP2HL can be said to be effective, as evidenced by a decrease in the post-test scores, which means that burnout experienced by farmers subsided. Mental health interventions carried out among farmers by combining physical and mental health education resulted in significant changes in farmers' physical and mental health and lifestyles that could reduce burnout [32]. Earlier interventions by educating people on mental health literacy and social-related activities reduced farmers' burnout [37, 38]. This shows that community-based program interventions to promote a healthy lifestyle (CP2HL) can be used to reduce farmers' burnout.

Conclusion

The CP2HL carried out to promote a healthy lifestyle among farmers significantly influenced organophosphate pesticide exposure, farmers' knowledge, attitudes, and behavior, nutrition knowledge, musculoskeletal symptoms, upper respiratory infection symptoms, and farmers' burnout. It can be concluded that CP2HL interventions can promote and significantly improve farmers' healthy lifestyles.

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Ethical Permissions: This research was approved by the Health Research Ethics Commission of the Faculty of Dentistry, University of Jember (1753/UN25.8/KEPK/DL/2022).

Conflicts of Interests: The authors declared no conflicts of interest.

Authors' Contribution: Yunanto RA (First Author), Introduction Writer/Methodologist/Main Researcher/Discussion Writer/Statistical Analyst (35%); Susanto T (Second Author), Methodologist/Main Researcher/Discussion Writer (20%); Hairrudin H (Third Author), Assistant Researcher/Discussion Writer (10%); Indriana T (Fourth Author), Methodologist/ Assistant Researcher (10%); Rahmawati I (Fifth Author), Assistant Researcher/Discussion Writer/Statistical Analyst (15%); Nistiandani A (Sixth Author), Assistant Researcher/Discussion Writer/Statistical Analyst (10%)

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