



# Protective Behavior among Indonesian People in the Transmission of COVID-19 after Vaccination: Influencing Factor using Health Belief Model

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**Abstract.** Vaccination is one of the health interventions carried out by the government, as an effort to deal with the spread of COVID-19. Indonesia has started a vaccination program since the beginning of 2021 and has successfully injected 321,258,956 doses of COVID-19 vaccine in both the first, second, and third doses. This study aimed to observe the protective behavior among Indonesian people after vaccination by using health belief model, to provide an overview of the implementation of health protocols after getting the COVID-19 vaccine. The study used a purposive sampling method with 326 respondents. The questionnaire was distributed online consisting of 12 HBM constructs statement and 9 demographic questions. The results of this study showed more than 70% had good protective behavior after vaccination, both using a mask, doing social distancing, avoiding touching the face, and washing hands. The empirical model shows that perceived severity, perceived benefit, and perceived self-efficacy significantly affect protective behavior. In addition to the results of this study, it is expected that the government considers several constructs that should be a focus for protective behavior campaigns after vaccination, such as perceived severity, self-efficacy, and benefits. For further research, investigations related to protective behavior after intervention is given need to be investigated. Interventions are expected to include some constructs, such as perceived severity of COVID-19, perceived self-efficacy, and perceived benefit of COVID-19 vaccine.

**Keywords:** COVID19, Health belief model, Protective behavior, Vaccine, HBM.

## 1 INTRODUCTION

Until early 2022, the COVID-19 pandemic still shows no signs of being over. It has been more than 1 year that this virus was discovered in Indonesia, until now the number of confirmed cases reached 4.5 million people with 144,554 deaths based on data from February 7, 2022. Various efforts have been made, most notably vaccination, and WHO has required every country to vaccinate its population of at least 70-90% of its population to achieve public immunity [1]. In Indonesia, the vaccination process began in early 2021 with the main targets are medical personnel, government, and public

personnel. The program continues, targeting people aged 17 years and above, and by the beginning of 2022 the government through the Ministry of Health has succeeded in injecting 321,258,956 doses of COVID-19 vaccine both the first, second, and third doses based on data from February 7, 2022.

Vaccination is one of the health interventions carried out by the government and considered as the most effective way to deal with various infectious diseases including COVID-19. Based on the evaluation of the Ministry of Health, the vaccine reduces the risk of infected by COVID-19, as well as reduce death for health workers [2]. Previous research has shown that the prevalence of COVID-19 vaccine acceptance in Indonesia reaches 78% [3]. However, in fact, Indonesia showed an increase in the confirmed status of COVID-19. This is because the public is starting to decrease its attention to health behaviors in preventing the spread of the COVID-19 virus. Thus, it is an important issue that the preventive behavior of the general population may change after getting vaccinated [4].

In the case of the spread of COVID-19 in the community, a person's protective behaviors have an important role to prevent the spread, such as using masks and physical distancing [5] [6] [7]. Tsai et al. assess the COVID-19

vaccine acceptance and the impact of risk perception on vaccine acceptance and health protective behaviors in Taiwan [8]. Goldszmidt et al. report the protective behavior by individual vaccination status [9]. Yuan et al. assess the COVID-19 vaccination effect on mental health status and protective behaviors of the population in Guangzhou, China [10].

Health Belief Model (HBM) is well known as a model that defines and predicts public health behavior [11], which can be influenced by perceived health risk (consist of perceived susceptibility and perceived severity), perceived benefit, perceived barrier, and perceived self-efficacy. Perceived susceptibility defined as a person's perception of their susceptibility to the risk of contracting a disease [12]. Perception of the extent to which a person feels at risk of exposure to a disease or health condition [13]. Perceived severity is a person's perception of the consequences if contracting a disease and leaving it untreated, the consequences in question can be medical and social consequences [12]. Perceived severity has the same concern as perceived severity, which is a person's perception of negative health outcomes [14].

Perceived benefit is a person's belief in the effectiveness of health measures taken in reducing the threat of disease [12]. Perceived barrier is the perception of the negative aspects if performing health actions, so it becomes an obstacle for a person to perform recommended health behaviors [12]. Perceived self-efficacy is an additional factor in the original HBM, which is interpreted as a person's belief in himself to be able to perform the recommended action [15][16]. The concept of perceived self-efficacy indicates a person's internal confidence to be able to perform particular behavior or task [17].

HBM was formerly used to evaluate public health beliefs and perceived effectiveness in averting the spread of COVID-19 in Indonesia [18]. Before that, Yastica et al. stated the literature review about the application HBM in COVID-19 prevention [19]. HBM also used to predict the acceptance of COVID-19 vaccination in some countries [20][21]. Yuan et al. explained the difference of HBM and protective behavior before and after COVID-19 vaccine [10]. The used of HBM to predict the protective behavior after vaccination has not been widely applied, especially in

Indonesia. Seeing the increase in COVID-19 cases in Indonesia, this shows if there may be a change in protective behavior after the vaccine is available COVID-19. Salma et al. stated that more than 90% of Indonesian students reported having carried out good actual prevention behavior before vaccination has been given [22].

This study aimed to observe the protective behavior among Indonesian people after vaccination by using health belief model. This research is expected to provide a little overview related to the implementation of health protocols in Indonesia after the COVID-19 vaccine. And furthermore, it is expected to be considered by the government in relation to future actions to continue to press and even liberate themselves against the COVID-19 pandemic. The conceptual model used in this study can be seen in the following Figure 1.

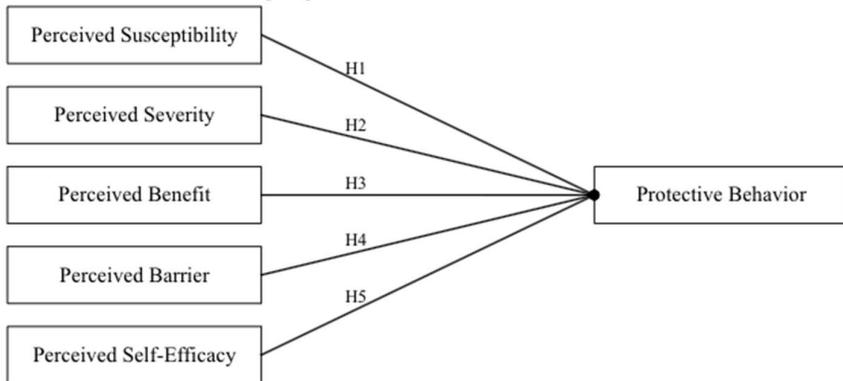


Fig. 1. The conceptual model [10]

## 2 METHOD

### 2.1 Respondents

Three hundred and twenty-six Indonesian respondents (mean age = 25.15 years, SD = 5.63 years, 148 males, 178 females) were voluntary in this study. The number of respondents has reached a minimum number which the sample size must be at least five times the number of indicators or questionnaire items [23]. They were selected based on sampling on several major cities on the islands of Java, Bali, and Sumatera. In addition, purposive sampling is used because it draws a sample based on certain considerations so that it can represent that of a population [24].

### 2.2 Questionnaire

The online survey was conducted during January-February 2022. The questionnaire begins with the demographic data of the respondents, including age, gender, occupation, education level, salary per month, vaccination status, domestic travel, overseas travel, and health assurance. The constructs of the questionnaire were based on health belief

model (HBM) and items regarding preventive behaviors against COVID-19 by Yuan et al. [10].

In this study, HBM contained six dimensions and 22 items. The questionnaire included perceived susceptibility of COVID-19 (four items), perceived the severity of COVID-19 (five items), perceived the benefits of receiving the COVID-19 vaccine (three items), perceived barrier to access the vaccine (three items), perceived self-efficacy to get vaccination (three items), and protective behavior (four items). The statement on the questionnaire has gone through the back translation process first [25][26]. Questionnaire responses used a five-point Likert scale, including a range from 1 (strongly agree) to 5 (strongly disagree). As a preliminary research, pilot study is conducted by surveying 32 respondents to see the validity and reliability of the items on the questionnaire. Then, items that are already valid and reliable are used as question items to be filled out by respondents. The items of the questionnaire are shown in Table 1.

**Table 1.** The items of the questionnaire.

Construct(s)	Code	Item(s)	Ref.
Perceived Susceptibility	Psus1	I think that I have a high chance of being infected with Covid-19 in the next 12 months	[10]
	Psus2	I think that the children have a high chance of being infected with Covid-19 in the next 12 months	
	Psus3	I think that the elderly has a high chance of being infected with Covid-19 in the next 12 months	
	Psus4	I cannot live a normal life as I did before Pandemic Covid-19	
Perceived Severity	Psev1	If I was infected with Covid-19, I would think that the consequences would be very serious	
	Psev2	If I was infected with Covid-19, I thought that it would cause prolonged residual symptoms	
	Psev3	If a child is infected with Covid-19, I would think that the consequences would be very serious	
	Psev4	If an elderly is infected with Covid-19, I would think that the consequences would be very serious	
Perceived Benefit	Pben1	Covid-19 virus has strong ability to spread	
	Pben2	Covid-19 Vaccination can prevent Covid-19 disease	
	Pben3	Coronavirus vaccine can reduce the severity of complications for Covid-19 infected people	
Perceived Barrier	Pbar1	Getting a Covid-19 vaccine can prevent someone from transmitting Covid-19 to others	
	Pbar2	Overall, it is difficult to get the Covid-19 vaccine in a public health center or a designated vaccination place	
	Pbar3	Overall, I think that getting the Covid-19 vaccine will cause healthy people to be infected with Covid-19	
Perceived Self Efficacy	Pself1	Overall, I think there might be a strong side effect after the Covid-19 vaccination	
	Pself2	I have been vaccinated by Covid-19 on recommendations from the Ministry of Health (Government)	
	Pself3	I have been vaccinated by Covid-19 over recommendations from people around me	
Protective Behavior	PB1	I have been vaccinated Covid-19 over recommendations from doctors, community workers and other professional workers	
	PB2	I will use a mask as often as possible when I leave my house	
	PB3	I am aware to keep the distance with others	
	PB4	When I left my house, I would not touch my eyes, nose, and mouth with my bare hands	
		I will wash my hands with soap or use a hand-sanitizer after I touch something outside	

### 2.3 Data Analysis

The validity and reliability tests used statistical software IBM SPSS 20 by looking at Cronbach’s alpha value. This study used 22 of items questionnaire. In addition, the percentage of good actual protective behavior after vaccination are presented based on

demographic data of the respondents. The  $p$ -value  $< 0.05$  was considered to indicate the statistical significance.

For developing the model, the Partial Least Square-Structural Equation Modeling (PLS-SEM) with the SMART-PLS 3.29 software was used. PLS-SEM was carried out to analyze the relationship between variables. In the PLS-SEM method, the evaluation of the outer model is accomplished through convergent validity with the loading factor value, construct reliability and Average Variance Extracted (AVE). Besides that, the fit of the model is measured by Root Mean Squared Error of Approximation (RMSEA).

The ideal loading factor value is greater than 0.7, means that the indicator is considered valid for the construct. Meanwhile, if the loading factor value is greater than 0.5, considered acceptable. Furthermore, the accepted limit value of the construct reliability test is above 0.7. For the average variance extracted, the greater the AVE value, the greater the diversity of indicators can be accommodated in the latent construct, and the greater the representation of indicator in the construct [23]. AVE value should be higher or equal to 0.5 [27]. For the fit of the model, measured by RMSEA, a value less than 0.1 are considered a good fit [28].

The first stage carried out in this research was starting from determining the object for the fast freezing machine, namely 5 kg of mango puree. Next, make a custom cabin with dimensions of 0.70 m long, 0.50 m high and 0.50 m wide. The cabin is equipped with armax insulation with a thickness of around 3cm. The compressor used for the two stage system uses 2 compressors measuring  $\frac{1}{4}$  PK for the low stage (first) and  $\frac{1}{2}$  PK for the high stage (second) and uses 1 evaporator. The condenser used is an air cooled condenser type with an additional fan and a capacity that is adjusted to the capacity of the compressor, while for the expansion device it uses 2 capillary pipes made of copper pipe with a diameter and length adjusted to the capacity of the compressor.

In a two-stage refrigeration system, an intercooler is needed to further cool (subcool) the condenser output refrigerant with the aim of increasing the COP of the refrigeration machine. There are several types of intercoolers commonly used in two-stage refrigeration systems, including: flash intercooler, flash chamber intercooler and dry intercooler. The intercooler used in this system is a dry intercooler type, considering that its design and installation is relatively easy to do. Meanwhile, the construction of the dry intercooler is designed with a double pipe type. This is also intended to make it easy to manufacture and also so that it is not too complicated in analyzing the heat transfer that occurs in the intercooler. Figure 1 is images of the piping system and its cycles in the pressure-enthalpy (P-h) diagram of a two-stage refrigeration system.

### 3 RESULTS AND DISCUSSIONS

From 326 respondents, on average, more than 70% have had good protective behavior after vaccination, both using masks, doing social distancing, avoiding touching the face, and washing hands. This suggests that they still maintain protective behavior after the vaccine, as previous studies have done [9]. The percentage of good actual protective behavior after vaccination are shown in Table 2.

**Table 2.** Descriptive statistics of respondents.

Personal Attribute	Category	N (%)	Percentage of good protective behavior after vaccination			
			Using masker	Social distancing	Not touching face	Washing hand
Gender	Male	148 (45%)	75%	74%	70%	79%
	Female	178 (55%)	79%	78%	70%	81%
Age	< 20 years	72 (22%)	96%	85%	61%	88%
	20 – 25 years	104 (32%)	78%	69%	72%	83%
	26 – 30 years	85 (26%)	66%	78%	68%	72%
	31 – 35 years	55 (17%)	67%	71%	76%	82%
	> 35 years	10 (3%)	80%	90%	90%	70%
Education level	Non-university graduate	167 (51%)	75%	69%	68%	78%
	Technical diploma	40 (12%)	63%	85%	80%	83%
	University graduate	105 (32%)	85%	82%	69%	82%
	Post-graduate university	14 (4%)	79%	86%	79%	93%
Occupation	Student	125 (38%)	91%	78%	66%	88%
	Government employee	28 (9%)	68%	75%	82%	64%
	Private employee	106 (33%)	66%	73%	71%	74%
	Health worker	25 (8%)	80%	76%	68%	92%
	Housewife	40 (12%)	65%	78%	70%	78%
Monthly salary (in million IDR)	Un-employee	2 (1%)	100%	100%	100%	100%
	< 2.5	126 (39%)	90%	78%	64%	87%
	2.5 – 5	101 (31%)	74%	72%	75%	79%
	5 – 7.5	73 (22%)	59%	77%	68%	71%
	7.5 – 10	19 (6%)	63%	79%	79%	84%
Vaccination status	> 10	7 (2%)	100%	71%	86%	57%
	First vaccination	60 (18%)	68%	53%	63%	72%
	Second vaccination	258 (79%)	78%	81%	72%	82%
Domestic trip frequency (nearly 6 months)	Third vaccination	8 (2%)	100%	75%	63%	100%
	Never	43 (13%)	98%	91%	63%	88%
	1 – 2	125 (38%)	78%	71%	67%	79%
Overseas trip frequency (nearly 6 months)	3 – 5	114 (35%)	74%	76%	76%	78%
	More than 6	44 (13%)	64%	73%	68%	82%
	1 – 2	151 (46%)	65%	68%	74%	74%
Health assurance	3 – 5	28 (9%)	61%	86%	79%	75%
	More than 6	1 (1%)	100%	100%	100%	100%
	Yes	288 (88%)	75%	75%	71%	80%
Health assurance	No	38 (12%)	95%	82%	63%	84%

Based on gender, women tend to have good protective behavior after vaccination than men. This suggests that women are more in the habit of carrying out health protocols just as they were when they had not received the vaccine [22]. Based on age, the age of 20-35 years tends to good protective behavior compared to other age groups. It can be explained that in this group is a productive age group which tends to have great mobility compared to other groups. This allows for decreased vigilance related to protective behavior after receiving the vaccine. An interesting discovery, Wong et al. said if that age group is a group that has a high acceptance of vaccines, but on the other hand, looking at the results in this study, the group will feel that after vaccine, they will be immune to COVID-19 [21].

Based on educational level, the higher the educational level, the higher the good protective behavior. As expected, this finding is in line with considerations regarding knowledge and behavior point of view. Highly educated people are assumed to have greater knowledge and to have better understanding about health [29]. Based on occupation, students (college students) have a tendency for high good protective behavior. College students are observed to have substantial knowledge, preventive behavior, and a positive attitude towards COVID-19 [30], [31]. This is because students spend a lot of their time on social networks and get a lot of information related to COVID- 19 [32], both through media, internet, TV, university, and friends. Thus,

student groups can convey and provide examples of this positive behavior in their respective community groups, so that the prevention of COVID-19 transmission can be done effectively.

Based on monthly salary, low monthly income has a tendency for high good protective behavior. As expected, they are more willing to take care of their health because when they are sick, they cannot work and earn, or they do not expect their income to be used for their negligence because they do not maintain health protocols. Based on vaccination status, the more vaccines they get the higher the good protective behavior. This finding can be understood by considering the knowledge and behavior point of view. When they get the opportunity to receive the vaccine, people with higher levels of knowledge will tend to immediately take the opportunity. It is one of the images of people who have good health behaviors as well. Based on domestic and oversea trip frequency, those who do not do it tend to have high good protective behavior. Reducing mobility is one of the health protocols that needs to be adhered to.

We used PLS-SEM to see the relation between variable in HBM with the protective behavior. Table 3 shows the value of loading factor, construct reliability, and Average Variance Extracted (AVE). The loading factor value must be greater than 0.5, but Pbar2 is lower than 0.5. It means that the indicator is not valid for the construct. Even though some construct did not meet the criteria of construct reliability and AVE, based on the fit of model, the RMSEA value is below 0.1. It means that the empirical model is considered a good fit.

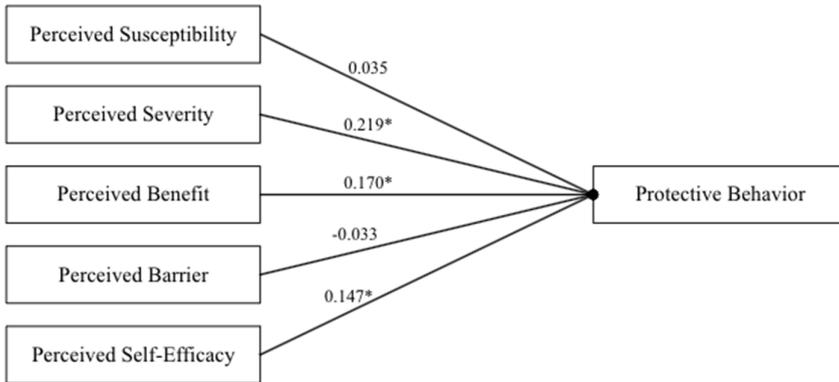
**Table 3.** The value of loading factor, construct reliability and AVE.

Construct(s)	Code	Loading Factor	Construct Reliability	AVE
Perceived Susceptibility	Psus1	0.860	0.853	0.663
	Psus2	0.911		
	Psus3	0.648		
Perceived Severity	Psev1	0.708	0.757	0.440
	Psev2	0.568		
	Psev3	0.676		
	Psev4	0.691		
Perceived Benefit	Pben1	0.687	0.741	0.489
	Pben2	0.668		
	Pben3	0.740		
Perceived Barrier	Pbar3	0.968	0.377	0.484
	Pbar2	0.487		
Perceived Self Efficacy	Pself1	0.739	0.727	0.571
	Pself2	0.772		
Protective Behavior	PB2	0.728	0.757	0.517
	PB3	0.847		
	PB4	0.550		

\*Psus4, Psev5, Pbar1, Pbar2, Pself3 and PB1 were deleted from the model because the loading factor is under 0.5

\*RMSEA = 0.089

The empirical model representing Indonesian people's protective behavior, which was analyzed using PLS-SEM, can be seen in Figure 2. The model shows that perceived severity, perceived benefit, and perceived self-efficacy significantly affect protective behavior.



**Fig. 2.** The empirical model (\*p value < 0.05).

First, the result states that the perceived severity has positive effect on protective behavior. The severity of COVID-19 itself has been felt by more than 50% of participants with them considering that COVID-19 is a very serious disease [33]. The higher the severity of the perceived risk the higher the person performs protective behavior. It is accordance with Li et al., that stated perceived severity elicits negative emotions, such as perceptions about mortality rates and the risk of transmission, affects a person's psychological response and encourages the prevention of COVID-19 transmission because as much fear as possible, the more motivating people to protect themselves [34]. Not only as a predictor protective behavior, Shmueli showed that perceived severity is also a predictor in the acceptance of the COVID-19 vaccine [35]. This shows that perceived severity of COVID-19 is an important factor in the prevention of COVID-19 transmission.

Second, perceived benefit has positive effect on protective behavior. The benefits of the vaccine itself are already felt for most participants, both the effectiveness of vaccines or vaccines that can protect them and their families [20]. The higher the perception of the usefulness of the vaccine they get, making them more encouraged to do protective behavior. In other words, individuals perform better by increasing perceived benefits. As is the case with Shahnazi et al., such as the impact of regular hand washing, the use of personal protective equipment such as masks, and disposable gloves can cause high perceived benefits, and thus become a strong motivation to take precautions against COVID-19 [36].

Third, perceived self-efficacy has positive effect on protective behavior. The higher their confidence in others who recommend implementing the vaccine, the higher their drive to protective behavior. The interesting finding was found, vaccine recommendations from the government (ministry of health) and people around (family, friends, co-workers) both have a big influence on protective behavior after vaccines. Therefore, it is quite effective if decisive action taken by the government and people around can affect a person's protective behavior. The recommendations of the government [21] and closest associates also [35] have a high influence on the acceptance of the COVID-19 vaccine.

From this study, perceived susceptibility and perceived barrier don't affect protective behavior. Perceived susceptibility is defined as an individual's perception of their susceptibility to the risk of contracting a disease. This observation can be explained by the fact that after getting the COVID-19 vaccine they consider no longer susceptible to COVID-19 infection. This can be explained in the Yuan et al research, which states that perceived susceptibility of COVID-19 decreases in groups who have received the vaccine, illustrates that participants believe that getting vaccinated COVID-19 can reduce the risk of COVID-19 infectiveness [10]. Besides that, perceived barrier is defined as perception of negative aspects if performing health actions. The study found that perceived barriers associated with getting the vaccine were not one of the factors that predicted their preventive behavior. This is contrary to the research of Shahnazi et al. that stated perceived barriers is an important HBM construct because individuals must overcome behavioral barriers despite their inner desire to engage in preventive behavior [36]. Indonesians tend not to take the serious side effect of the vaccine they have received and do not consider it an obstacle.

Comparison with Caesaron et al., several factors found no change in predicting protective behavior [18]. First, perceived severity affected actual preventive behavior. There is positive effect between perceived severity and actual preventive behavior. This illustrates both before and after, the perceived severity related to COVID-19 will affect Indonesian people's protective behavior. Second, perceived self-efficacy affected actual preventive behavior. There is positive effect between perceived severity and actual preventive behavior. This shows that, both before and after the vaccine, Indonesians' confidence in others can affect their protective behavior. Third, perceived susceptibility didn't affect actual preventive behavior. This suggests that, both before and after the vaccine, the perceived vulnerability associated with COVID-19 did not affect their protective behavior. The development of information through mass media and advances in science regarding the treatment of COVID-19 has changed the perception of public vulnerability to COVID-19. So, they tend to ignore and feel safe, especially after the vaccine is given. In addition, it can also be caused by economic demands that require people to keep working despite high levels of insecurity.

In addition, there are several factors that change. First, in previous research perceived barrier affected actual preventive behavior. This is reasonable because the indicators are different. Previous research discussed perceived barriers to perception of obstacles in preventing the transmission of COVID-19, while this study refers to perceived barriers to the side effect of vaccines. Second, perceived benefit in the previous research didn't affect actual preventive behavior. Like perceived barriers, previous studies discussed perceived benefits of preventive behavior, while this study refers to perceived benefits of vaccines.

Furthermore, we conclude that the HBM is useful in predicting protective behavior after vaccination. From the results obtained in this study, perceived severity of COVID-19 and perceived self-efficacy should be a focus for protective behavior campaigns after vaccination. In relation to perceived severity, one of the things the government can do is convey the existence of cases of death as many as 35 people due to COVID-19 even though the patient has received the vaccine [37]. Not only in Indonesia, but similar cases are also experienced by the Indian state where one-third of patients die from COVID-19 despite getting the vaccine [38]. In relation to perceived self-efficacy, the government must continue to take decisive action regarding the implementation of

health protocols, by using mass media such as television, billboards, to the use of social media. In addition, the government should also continue to strongly encourage the provision of education to the community related to healthy lifestyles and the importance of protective behavior after vaccines. Based on the results obtained, the education should be given through groups not individually (offices, schools, campuses, to villages). Because they see how the influence of closest colleagues affects protective behavior.

In addition, perceived benefit of vaccine should also be considered. This is related to motivation for people to continue to do good behavior because of the benefits they receive. The government should continuously convey the benefits of vaccines, especially related to how the COVID-19 vaccine can prevent someone from transmitting COVID-19 to others. With the perception of these benefits, it is expected that people are motivated to do protective behavior, especially related to social distance every time they are in the crowd.

This study had several limitations. First, the study was unable to see how protective behavior after the intervention was performed. Second, data collection is done using questionnaires to allow for subjectivity from participants. Third, sample is dominated by the age group under 35 years old.

## 4 CONCLUSION

This study shows that more than 70% have had good protective behavior after vaccination, including using masks, doing social distancing, avoiding touching the face, and washing hands. In addition, from the results of this study, it is expected that the government considers several constructs that should be a focus for protective behavior campaigns after vaccination, such as perceived severity, self-efficacy, and benefits. For further research, investigations related to protective behavior after intervention is given need to be investigated. Interventions are expected to include some constructs, such as perceived severity of COVID-19, perceived self-efficacy, and perceived benefit of COVID-19 vaccine. The focus on public health behaviors that are reinfecting to COVID-19 and their protective behavior may also be highlighted in future studies.

**Acknowledgments.** We would like to thank PPM Telkom University who funds this research.

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