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Uyen Thi To Nguyen
Dong Thap Medical College, Vietnam

Charuai Suwanbamrung
School of Public Health, Walailak University, Nakhon Si Thammarat Province, Thailand

Cua Ngoc Le
School of Public Health, Walailak University, Nakhon Si Thammarat Province, Thailand

Wichaya Janhom
School of Public Health, Walailak University, Nakhon Si Thammarat Province, Thailand

Yanika Ratjaran
School of Public Health, Walailak University, Nakhon Si Thammarat Province, Thailand

Alisara Khwansri
School of Public Health, Walailak University, Nakhon Si Thammarat Province, Thailand

ORIGINAL STUDY

Public Health Officers' Capability, Opportunity, Motivation, and Behavior after the COVID-19 Vaccination in Thailand

Uyen T. To Nguyen [c], Charuai Suwanbamrung [a,b,*], Cua N. Le [a,b], Wichaya Janhom [a], Yanika Ratjaran [a], Alisara Khwansri [a]

[a] School of Public Health, Walailak University, 222 Thaiburi Sub-district, Thasala District, Nakhon Si Thammarat Province, +6680160, Thailand
[b] Excellent Center for Dengue and Community Public Health (EC for DACH), Walailak University, Thailand
[c] Dong Thap Medical College, 312, Nguyen Thai Hoc Street, Cao Lanh City, Dong Thap province, Viet Nam

Abstract

Background: **Public health officers (PHOs) are the frontline health workforce against the Coronavirus disease 2019 (COVID-19) and therefore need high immunity for protection. The application of the capability, opportunity, motivation, and behavior (COM-B) model aimed to 1) explore the level of COM-B for prevention and control of COVID-19, and 2) analyze the association between factors and behaviors for prevention and control of COVID-19 among PHOs at primary care units (PCUs) of seven provinces in southern Thailand.**

Methods: **The study design performed an analytical cross-sectional study using information from primary care units from July to September 2021. Data collection used multi-stage sampling techniques to construct the online questionnaire based on the relationship of the COM-B model. Data analysis used descriptive statistics, and Chi-squared and Fisher's exact tests to find out the association among factors.**

Results: **The overall COM-B scores of the 203 PHOs were high, but the motivation was low. Almost all characteristics were associated with behavior. Work experience was significantly associated with capability, opportunity, and behavior ($P < 0.05$). The relationships between capability and behavior, and opportunity and motivation were statistically significant ($P < 0.05$ and $P < 0.001$ respectively).**

Conclusions: **This is the first report applying the COM-B model to explore behavior changes relating to the COVID-19 vaccination among PHOs at PCUs. The association between factors and individual behavior of health providers can be applied to design interventions for promoting effective preventive and controlling behavior after the COVID-19 vaccination.**

Keywords: Behavior, COVID-19, COM-B, Primary care unit, Public health officers, Vaccination, Thailand

1. Introduction

Coronavirus disease 2019 (COVID-19), an infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus, can be found in both animals and humans [1]. The most common symptoms are fever, dry cough, and loss of taste or smell. After the coronavirus enters the body, the incubation period lasts 1–14 days and symptoms manifest within 5–6 days [1]. Currently, patients are treated symptomatically because there is no specific treatment for the disease [2]. As of July 2021, there have been 181, 323, 906 confirmed COVID-19 cases worldwide, including 3,930,118 deaths, 119, 105, 080 recoveries, and 58, 288, 708 hospitalizations [3].

In previous studies, changing behaviors have been explained by several models, such as the Health Belief Model [4], which informed public opinion about the COVID-19 vaccination so health

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* Corresponding author.
E-mail address: yincharuai@gmail.com (C. Suwanbamrung).

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policymakers and healthcare providers could improve compliance regarding when the COVID-19 vaccine would be available to the public [5]. New methods have been developed to explain behavioral changes, including the model for evaluating internal and external factors: the capability, opportunity, motivation, and behavior (COM-B) model, which was promoted for the development of guidelines for the COVID-19 vaccination. Additionally, the COM-B model has been applied to design behavior change wheel-based interventions [6]. Moreover, it has been reported that the COM-B model significantly predicted good hygienic practices during COVID-19 outbreaks and that motivation had the greatest influence on behavior [7]. Findings from another descriptive study showed that capability, opportunity, and motivation were more likely to indicate negative behavioral intention toward COVID-19 vaccination such as not considering the vaccine to be effective. However, most behavioral intentions of prevention from COVID-19 were related to the motivation construction [8]. However, these studies did not evaluate the change in behavior of health providers after the COVID-19 vaccination based on the COM-B model.

In Thailand, as of July 17, 2021, there were 228,539 confirmed cumulative cases, 5126 severe cases, and 1744 deaths. Among seven provinces in the upper southern area of Thailand, there were 19,880 confirmed cumulative cases, 8632 hospitalization, 6802 recoveries, and 57 deaths [9]. Government measures to manage COVID-19 included locking down at-risk areas, limiting overcrowding in public places, and supporting the needs of internet access [10]. Additionally, quarantine guidelines were applied to people arriving from high-risk areas to monitor signs and symptoms for 14 days, as well as social distancing, and personal behaviors to prevent COVID-19 [10]. Moreover, COVID-19 vaccination management was carried out to prevent infections as the first phase [11]. However, the coverage rate of COVID-19 vaccination has not yet achieved herd immunity. Therefore, individual behavior changes are important for the prevention and control of COVID-19 in the community after they have had the COVID-19 vaccination. Vaccination is an important factor for effectively controlling communicable diseases and may be related to the changes in people's behavior or the prevention and control of COVID-19, especially in health providers, who are the main workers for promoting and supporting the change in people's behavior in Thailand.

Public health officers (PHOs) are local government representatives who provide health services, such as infection detection, screening, surveillance, prevention and control, investigation, health promotion, community health work, treatment and rehabilitation, and health education, including accurate communication of diseases to the population [12,13]. PHOs' behaviors to prevent the risk of infection, both while on duty and in their normal lives after COVID-19 vaccination are unknown. Therefore, this study aimed to explore the level of capability, opportunity, motivation, and behavior for the prevention and control of COVID-19 and to analyze the association between factors and behavior for the prevention and control of COVID-19 among primary health offices in the primary care units of seven provinces in southern Thailand.

2. Methodology

We performed an analytic, cross-sectional study in seven provinces of the upper southern region that included 700 primary care units (PCUs) and totaling 700 PHOs [9]. The sample size was calculated by the G*Power 3.1.9.4 program using the following parameters: the effect size to 0.30 with medium effect resulting in a medium-sized sample, the significance level was 0.05 with a 95% confidence level, the test power (1-β err prob) was equal to 0.99 where the test power should not be lower than 0.80, indicating the confidence of the results obtained from the research. The formula df = (r-1) (c-1) yields a degree of freedom (df) = 1. The sample size was calculated for 205 PHOs and all participants had received the COVID-19 vaccination.

2.1. Questionnaires

Questionnaires on the COVID-19 vaccination were constructed from a literature review based on the COM-B model. Three experts verified the content validity index to be 0.88, and a reliability test among 30 PHOs in different areas found Cronbach's alpha to be 0.91. The questionnaires included 52 items divided into 5 parts. For items in the questionnaires about capability, opportunity, motivation, and behaviors, the measurement was performed with a 5-point Likert scale (strongly agree = 5, agree = 4, neutral = 3, disagree = 2, and strongly disagree = 1). The cut-off point for high- and low-level values was set at 80% of the total score. The values of capability and opportunity with 40−50 points and 10−39 points were considered high and low, respectively. Regarding motivation, the high- and low-level values included 32−40 and 8−31 points, respectively. Finally, preventive behavior was high-level at 56−70 points and low-level at 14−55 points.

2.2. Data collection

Multi-stage sampling was used to ensure that the sample was representative of PHOs from 700 PCUs among seven provinces of the upper southern region of Thailand. At the PCU level, we used simple random sampling to select 205 of the 700 PHOs. The selection criterion for PHOs was anyone who assumed a role in the prevention and control of COVID-19. The questionnaires were administered through a Google Form to collect online data, which communicated objectives, risks and benefits, and confidentiality of the questionnaire to the participants before proceeding to complete the questionnaire.

2.3. Data analysis

Descriptive statistics were evaluated to generate summary tables for study variables such as capability, opportunity, motivation, and behavior prevention. Cross-tabulation analysis was performed to examine the association between characteristics, capability, opportunity, motivation, and preventative behavior with COVID-19 vaccination using Chi-squared and Fisher's exact tests. All data analyses were considered statistically significant at a p-value < 0.05.

2.4. Ethical issue

This study protocol was approved by the Human Research Ethics Committee of our institution (No: WUEC-21-207-01).

3. Results

Of the 205 PHOs, 203 (99%) were retained. Most were female (62.1%), 22–35 years old (51.2%) ($x = 36.7$, SD = 11.4), single (86.2%), with a monthly family income of 10,000–30,000 Baht/month (56.7%) ($x = 33,551.8$, SD = 18,168.3), working time >10 years (50.7%) ($x = 13.9$, SD = 11.6), public health practitioner position (59.1%), with a history of having the influenza vaccination in the past year (82.8%), Sinovac vaccination (81.3%), three full doses of COVID-19 vaccination (78.8%), no history of travel to or from another province (89.7%) or contact with a COVID-19 patient and/or exposure to SARS-CoV2 in the past 14 days (52.2%).

The overall score of 10 PHO's capability items was low-level (13.3%) and high-level (86.7%). Item numbers 2, 3, and 5 were the highest score of the high level at 96.6%, 96.6%, and 96.1%, respectively (Table 1).

The overall score of 10 PHO's opportunity items was low-level (27.1%), and high-level (72.9%). The score of item number 2 was at a low-level (59.1%). Whereas the score of nine items was at a high level, and item number 4, 6, and 5 were the highest scores at 98.5%, 96.1%, and 95.1%, respectively (Table 2).

The PHO's motivation items were at low-level (70.9%) and high-level (29.1%). Item numbers 2, 1, and 5 were the highest scores of high-level at 98.0%, 94.1%, and 88.7%, respectively. Whereas, the score of item numbers 7, 8, and 6 were low-level at 78.8%, 74.4%, and 61.1%, respectively (Table 3).

Overall scores of behaviors for prevention and control of COVID-19 items were low-level (27.1%), and high-level (72.9%). The score of 14 items was high-level, and items number 2, 6, and 1 were highest score of high-level at 98.5%, 96.1%, and 1 94.6% respectively (Table 4).

Education, work experience, history of influenza vaccination in the past one year, and COVID-19 vaccination dose were significantly associated with

Table 1. PHO capability level.

Item	PHO's capability n (%)	
	Low-level	High-level
1. There are different types of vaccines in Thailand.	13 (6.4)	190 (93.6)
2. Receiving the COVID-19 vaccination reduces the severity of the symptoms of the disease.	7 (3.4)	196 (96.6)
3. Preparing your body for the COVID-19 vaccine requires you to rest enough. No exercise, no tea, coffee, caffeinated beverages, or alcoholic beverages.	7 (3.4)	196 (96.6)
4. The most common side effects after vaccination are fever, headache, nausea, and pain at the injection site.	9 (4.4)	194 (95.6)
5. After receiving the COVID-19 vaccine, side effects must be observed for at least 30 min.	8 (3.9)	195 (96.1)
6. A mask or N95 can be put on or taken off following the steps of removal and replacement after the COVID-19 vaccination.	25 (12.3)	178 (87.7)
7. PPE clothing can be put on and taken off in accordance with the procedure after receiving the COVID-19 vaccine.	25 (12.3)	178 (12.3)
8. Wash hands with alcohol gel or soap for at least 20 s after receiving the COVID-19 vaccine.	19 (9.4)	184 (90.6)
9. Can perform duties with confidence after receiving the COVID-19 vaccine because of immunity.	22 (10.8)	181 (89.2)
10. After receiving the COVID-19 vaccine, you are ready to act in an emergency.	21 (10.3)	182 (89.7)
Overall capability score	**24 (13.3)**	**176 (86.7)**

Note: Cut-off point: 80%; Low-level capability: 10–39 points; High-level: 40–50 points.

Table 2. PHO opportunity level.

Item	PHO's opportunity n (%)	
	Low-level	High-level
1. Receiving the COVID-19 vaccination quickly, timely, and effectively is the best preventive measure.	31 (15.3)	172 (84.7)
2. Receiving the COVID-19 vaccination is easy and accessible.	120(59.1)	83 (40.9)
3. Receiving the COVID-19 vaccination has several steps that take a long time. Time should be allocated appropriately.	58 (28.6)	145 (71.4)
4. All public health officers should receive the COVID-19 vaccination at no cost.	3 (1.5)	200 (98.5)
5. Proper advice: if you have a fever after receiving the COVID-19 vaccination, take paracetamol.	10 (4.9)	193 (95.1)
6. The government should allocate enough COVID-19 vaccines to public health officers.	8 (3.9)	195 (96.1)
7. The provincial public health officials should issue regulations requiring all public health officers to receive the COVID-19 vaccine.	18 (8.9)	185 (91.1)
8. Public health officers in high-risk areas should receive the COVID-19 vaccine before public health officers in low-risk areas.	29 (14.3)	174 (85.7)
9. COVID-19 vaccine allocation to all public health officers reduces the risk of infection while working.	31 (15.3)	172 (84.7)
10. Public health officers have the opportunity to choose the type of COVID-19 vaccine before vaccination.	63 (31.0)	140 (69.0)
Overall opportunity score	**55 (27.1)**	**148 (72.9)**

Note: Cut-off point: 80%; Low-level: 10−39 points; High-level: 40−50 points.

Table 3. PHO motivation level.

Item	PHO's motivation n (%)	
	Low-level	High-level
1. Receiving the COVID-19 vaccination helps build immunity and reduce the severity of the disease.	12 (5.9)	191 (94.1)
2. Receiving the COVID-19 vaccine is necessary.	4 (2.0)	199 (98.0)
3. Public health officers should be given the first group of COVID-19 vaccines as it is a front line of disease prevention.	26 (12.8)	177 (87.2)
4. The COVID-19 vaccine currently available is safe and effective.	59 (29.1)	144 (70.9)
5. From current situation, intends to receive the COVID-19 vaccine.	23 (11.3)	180 (88.7)
6. Worries about side effects including fever, aches, and pains after receiving the COVID-19 vaccination.	124 (61.1)	79 (38.9)
7. Fear of death after receiving the COVID-19 vaccination.	160 (78.8)	43 (21.2)
8. Stressed about safety at work after receiving the COVID-19 vaccination.	151 (74.4)	52 (25.6)
Overall motivation score	144 (70.9)	**59 (29.1)**

Note: Cut-off point: 80%; Low-level: 8−31 points; High-level: 32−40 points.

Table 4. PHO behavior level.

Item	PHO's behavior n (%)	
	Low-level	High-level
1. Wear and take off a mask or N95 before, during, and after work for efficiency in controlling the disease epidemic.	11 (5.4)	192 (94.6)
2. Wash hands with alcohol gel or soap for at least 20 s/time when in contact with people at risk of infection.	3 (1.5)	200 (98.5)
3. Always wear and take off a full PPE suit, when screening people who are at risk of infection.	37 (18.2)	166 (81.8)
4. Wear and remove gloves before, during, and after touching people who are at risk of infection.	15 (7.4)	188 (92.6)
5. Clean and disinfect medical instruments with a disinfectant and place in the autoclave.	31 (15.3)	172 (84.7)
6. Keep a distance of at least 2 m between people in the performance of duties.	8 (3.9)	195 (96.1)
7. The performance of duties is proactive in area accountability by providing accurate information about preventing and controlling the epidemic of COVID-19 to the public.	32 (15.8)	171 (84.2)
8. Screen for COVID-19 in your area after being notified by the district health office when a new cluster is found.	17 (8.4)	186 (91.6)
9. Investigate people who are at risk of contracting COVID-19 after being notified by the district health office when a new group is found.	20 (9.9)	183 (90.1)
10. Spray alcohol disinfectant when there is an outbreak of COVID-19 in the area.	73 (36.0)	130 (64.0)
11. Visit the homes of people who have recovered from COVID-19 for physical and mental rehabilitation.	58 (28.6)	145 (71.4)
12. Plan to work with network partners in the prevention and control of COVID-19 after being notified by the district health office when a new cluster has been found.	26 (12.8)	177 (87.2)
13. Establish special teams to prevent and control an epidemic of COVID-19 in the area.	37 (18.2)	166 (81.8)
14. Report information about the COVID-19 situation in the area via the website of the District Public Health Office.	21 (10.3)	182 (89.7)
Overall behavior score	**55 (27.1)**	**148 (72.9)**

Note: Cut-off point: 80%; Low-level: 0−43 points; High-level: 44−56 points.

Table 5. Association between PHO's characteristics, capability, opportunity, motivation, and behavior for COVID-19 prevention and control.

Characteristics (n = 203)	Capability n (%)		χ^2	Opportunity n (%)		χ^2	Motivation n (%)		χ^2	Behavior n (%)		χ^2
	Low- level	High-level		Low-level	High-level		Low-level	High-level		Low-level	High-level	
Sex												
Male	8 (3.9)	69 (34.0)	*0.912*	21 (10.3)	56 (27.6)	*0.002*	49 (24.1)	28 (13.8)	*3.206*	22 (10.8)	55 (27.1)	*0.137*
Female	19 (9.4)	107 52.7)		34 (16.7)	92 (45.3)		95 (46.8)	31 (15.3)		33 (16.3)	93 (45.8)	
Age (Years)												
≤35	15 (7.4)	89 (43.8)	*0.233*	24 (11.8)	80 (39.4)	*1.742*	71 (35.0)	33 (16.3)	*0.736*	21 (10.3)	83 (40.9)	*5.142**
>35	12 (5.9)	87 (42.9)		31 (15.3)	68 (33.5)		73 (36.0)	26 (12.8)		34 (16.7)	65 (32.0)	
Education (Degree)												
Undergraduate	25 (12.3)	150 (73.9)	*1.068*[a]	46 (22.7)	129 (63.5)	*0.419*	123 (60.6)	52 (25.6)	*0.260*	36 (17.7)	139 (68.5)	*27.323****
Graduate	2 (1.0)	26 (12.8)		9 (4.4)	19 (9.4)		21 (10.3)	7 (3.4)		19 (9.4)	9 (4.4)	
Monthly income (Baht)												
≤50,000	23 (11.3)	153 (75.4)	*0.062*[a]	46 (22.7)	130 (64.0)	*0.614*	123 (60.6)	53 (26.1)	*0.707*	49 (24.1)	127 (62.6)	*0.374*
>50,000	4 (2.0)	23 (11.3)		9 (4.4)	18 (8.9)		21 (10.3)	6 (3.0)		6 (3.0)	21 (10.3)	
Working experience (Years)												
≤10	18 (8.9)	82 (40.4)	*3.775**	20 (9.9)	80 (39.4)	*5.021**	66 (32.5)	34 (16.7)	*2.329*	20 (9.9)	80 (39.4)	*5.021**
>10	9 (4.4)	94 (46.3)		35 (17.2)	68 (33.5)		78 (38.4)	25 (12.3)		35 (17.2)	68 (33.5)	
Working positions												
Less than or equal to operational	21 (10.3)	119 (58.6)	*1.130*	38 (18.7)	102 (50.2)	*0.001*	100 (49.3)	40 (19.7)	*0.053*	41 (20.2)	99 (48.8)	*1.097*
Higher than operational	6 (3.0)	57 (28.1)		17 (8.4)	46 (22.7)		44 (21.7)	19 (9.4)		14 (6.9)	49 (24.1)	
History of influenza vaccination in the past 1 year												
Not received	5 (2.5)	30 (14.8)	*0.036*[a]	11 (5.4)	24 (11.8)	*0.402*	26 (12.8)	9 (4.4)	*0.230*	18 (8.9)	17 (8.4)	*12.679****
Received	22 (10.8)	146 (71.9)		44 (21.7)	124 (61.1)		118 (58.1)	50 (24.6)		37 (18.2)	131 (64.5)	
History of AstraZeneca vaccination												
Not received	20 (9.9)	107 (52.7)	*1.762*	36 (17.7)	91 (44.8)	*0.270*	91 (44.8)	36 (17.7)	*0.085*	31 (15.3)	96 (47.3)	*1.237*
Received	7 (3.4)	69 (34.0)		19 (9.4)	57 (28.1)		53 (26.1)	23 (11.3)		24 (11.8)	52 (25.6)	
History of Sinovac vaccination												
Not received	1 (0.5)	37 (18.2)	*4.615*[a]*	13 (6.4)	25 (12.3)	*1.199*	26 (12.8)	12 (5.9)	*0.143*	23 (11.3)	15 (7.4)	*26.455****
Received	26 (12.8)	139 (68.5)		42 (20.7)	123 (60.6)		118 (58.1)	47 (23.2)		32 (15.8)	133 (65.5)	
History of Pfizer vaccination												
Not received	9 (4.4)	67 (33.0)	*0.224*	18 (8.9)	58 (28.6)	*0.715*	57 (28.1)	19 (9.4)	*0.973*	19 (9.4)	57 (28.1)	*0.270*
Received	18 (8.9)	109 (53.7)		37 (18.2)	90 (44.3)		87 (42.9)	40 (19.7)		36 (17.7)	91 (44.8)	
Dose of COVID-19 vaccinations												
≤2 dose	4 (2.0)	39 (19.2)	*0.756*[a]	12 (5.9)	31 (15.3)	*0.018*	33 (16.3)	10 (4.9)	*0.893*	21 (10.3)	22 (10.8)	*13.058****
>2 dose	23 (11.3)	137 (67.5)		43 (21.2)	117 (57.6)		111 (54.7)	49 (24.1)		34 (16.7)	126 (62.1)	
History of travel to or from another province in the last 14 days												
No	25 (12.3)	157 (77.3)	*0.290*[a]	48 (23.6)	134 (66.0)	*0.462*	129 (63.5)	53 (26.1)	*0.003*	45 (22.2)	137 (67.5)	*4.996**
Yes	2 (1.0)	19 (9.4)		7 (3.4)	14 (6.9)		15 (7.4)	6 (3.0)		10 (4.9)	11 (5.4)	

History of contact with SARS-CoV2 and/or COVID-19 patient in the past 14 days												
No	15 (7.4)	91 (44.8)	0.139	28 (13.8)	78 (38.4)	0.052	77 (37.9)	29 (14.3)	0.313	28 (13.8)	78 (38.4)	0.052
Yes	12 (5.9)	85 (41.9)		27 (13.3)	70 (34.5)		67 (33.0)	30 (47.8)		27 (13.3)	70 (34.5)	
Capability												
Low-level				10 (4.9)	17 (8.4)	1.559	19 (9.4)	8 (3.9)	0.005	3 (1.5)	24 (11.8)	4.027[a]*
High-level				45 (22.2)	131 (64.5)		125 (61.6)	51 (25.1)		52 (25.6)	124 (61.1)	
Opportunity												
Low-level							51 (25.1)	4 (2.0)	17.376[a]***	18 (8.9)	37 (18.2)	1.212
High-level							93 (45.8)	55 (27.1)		37 (18.2)	111 (54.7)	
Motivation												
Low-level										35 (17.2)	109 (53.7)	1.950
High-level										20 (9.9)	39 (19.2)	

Note: Chi-squared statistics: [a] Fisher's Exact Test, *P < 0.05, **P < 0.01, ***P < 0.001.
Cut-off point: 80%; Low-level capability: 10–39 points, High-level: 40–50 points.
Low-level opportunity: 10–39 points; High-level 40–50 points.
Low-level motivation: 8–31 points; High-level 32–40 points.
Low-level prevention behavior: 0–43 points; High-level: 44–56 points.

behavior for prevention and control (P < 0.001). Age and history of caring for or coming into contact with a patient or someone at risk of COVID-19 in the past 14 days were also significantly associated with preventive behavior (P < 0.05). Additionally, work experience was significantly associated with capability, opportunity, and behavior (P < 0.05, P < 0.05, and P < 0.001, respectively). Moreover, a history of Sinovac vaccination was significantly associated with capability and preventive behavior (P < 0.05, P < 0.001, respectively). However, sex, monthly income, working position, history of AstraZeneca or Pfizer vaccination; travel abroad in the last 14 days; and travel to or from another province in the last 14 days were not associated with capability, opportunity, motivation, or behavior for disease prevention. Additionally, no significant association was observed between capability and behavior (P < 0.05). However, the opportunity was significantly associated with motivation (P < 0.001) (Table 5).

4. Discussion

After the COVID-19 vaccination, 203 PHOs from 203 PCUs who were sampled showed that the type of COVID-19 vaccination they received was associated with their capability. This could be because the Sinovac vaccine was the first type of vaccine in Thailand, which allowed PHOs to learn about its properties, qualities, and side effects [9]. Moreover, work experience of ≤10 years was related to opportunity. Most PHOs held positions at the operational level in which they played roles in the community. Thus, more time spent in the community increased the opportunity as PHOs gained more knowledge and experience [14]. This was in accordance with a study on the impact of the COVID-19 crisis on work and private life, mental well-being, and self-rated health among employees. Their opportunities directly increased duty on work and private life in a COVID-19 crisis [15]. However, no PHO characteristics were associated with motivation. This could be because the Thai government prioritized the COVID-19 vaccination for all frontline health care workers [14].

The association of behavior with an age of 22–35 years after COVID-19 vaccination was high. This may be because PHOs at this age range held positions at the practitioner level, in which their work area is at risk of COVID-19 infection [14]. Other findings on acceptance and attitudes toward COVID-19 vaccination of people >35 years-old showed that they were less likely to accept

The COVID-19 vaccination [16]. However, a report on attitudes, behaviors, and barriers to public health

measures for COVID-19 with a population aged ≥18 years indicated that age was irrelevant in the assessment of public health measures [17].

Education was associated with behavioral prevention after the COVID-19 vaccination. This is in agreement with the previous findings that an undergraduate or postgraduate education was associated with preventive behaviors [16]. Our findings are also consistent with the study on the association between capability, opportunity, and motivation to enact hygienic practices in the early stages of the COVID-19 outbreak in the United Kingdom [7]. However, another report showed that the level of education was irrelevant to behavior [8]. This is likely because the enactment of COVID-19 prevention behaviors depends not only on the level of education but also on other external factors.

Work experience was associated with capability, opportunity, and behavior for disease prevention. We found that ≤10 years of work experience was associated with an increasing level of preventive behavior. It is possible that most PHOs hold positions at the practitioner level. Results consistent with those of previous studies found that duration of work experience plays an important role in determining disease prevention behaviors [14,15].

A history of influenza vaccination was associated with COVID-19 vaccination. This could be because most PHOs who had an influenza vaccination before COVID-19 infection had reduced severity or shorter hospitalizations than individuals who had never received an influenza vaccination before infection [10]. A history of the Sinovac vaccination was associated with preventive behavior because the vaccine was the first type to enter Thailand. Furthermore, it is essential for health providers and PHOs, who are at the front line, to be vaccinated and boost their immune systems as they are at greater risk of exposure to infections [10]. This is consistent with the research on the safety of an inactivated SARS-CoV-2 vaccine among healthcare workers in China that were found to cause fatigue, muscle pain, headache, and dizziness, which were considered the most common adverse effects and acceptable safety profile among healthcare workers [18]. When PHOs received three doses, the level of preventive behavior for COVID-19 was high. It is possible that the first vaccination dose was unable to boost immunity enough to prevent disease. Therefore, the second and third vaccination doses were administered to stimulate the immune system, and they were able to reduce the severity of the disease [10]. It has been reported that the rate of COVID-19 confirmation and serious illness was significantly reduced among those that received the booster vaccine [19]. History of traveling to or from other provinces in the last 14 days was associated with preventive behavior. We found that PHOs did not travel with the medical team in the provinces where COVID-19 was widespread. This is in agreement with the finding that the majority of healthcare workers were significantly more worried about traveling and were deeply concerned about traveling to affected countries [20].

Opportunity was associated with motivation. For example, the Thai Ministry of Public Health had a policy on the allocation of COVID-19 vaccines. Specifically, medical and public health personnel, including PHOs, at the front lines, both public and private, were to be the first group to access vaccines. The government allocated only one type of vaccine and set a policy for all public health officers to receive that vaccine [10]. Therefore, there was no need to appeal for a COVID-19 vaccination or incentive to choose the type of vaccine. This is consistent with the findings on attitudes towards the COVID-19 vaccine and willingness to get vaccinated among healthcare workers in French Guiana. It indicated that participants were less likely to be vaccinated if they were registered nurses or other non-medical professionals [21].

Additionally, preventive behavior was associated with motivation. This was represented by the low level of motivation among PHOs concerned with the side effects, fear of death, and stress about safety at the workplace. This is consistent with previous findings on capability, opportunity, and motivation to enact hygienic practices in the early stages of the COVID-19 outbreak in the United Kingdom, as the study reported that all three COM-B factors were significant predictors of good hygiene practices ($P < 0.01$) and motivation had the greatest influence on behavior [7]. Behavior regarding COVID-19 prevention practices was associated with the capability of PHOs. Thus, PHOs should be trained and skilled in disease prevention practices to reduce the risk of illness in the community [12]. This is supported by the research on the behavior change wheel that showed that capability was defined by knowledge and skills, and was necessary to engage the specific behavior of PHOs to promote preventive behavior after COVID-19 vaccination [6]. Additionally, another study confirmed that cognitive capability increased the understanding of the COVID-19 vaccine [8]. This is consistent with the study on capability, opportunity, and motivation to enact hygienic practices in the early stages of the COVID-19 outbreak in the United Kingdom, as it reported the contribution of cognitive capability to increasing hygiene practices [11]. Our study limitation

included purposively selecting a PHO as the representative health provider of the primary care units in southern Thailand. In the future, the study should survey other health professionals or people who received the COVID-19 vaccine because their behavior may be related to the COVID-19 pandemic and management. Another limitation was that 99% of the response rate was retained during the COVID-19 pandemic because data collection was performed via Google Forms and monitored by directly telephoning the researcher. In the future, E-mail and Web-based survey studies would increase the number for data collection errors by 70−80%, whilst collecting data face-to-face would also help.

5. Conclusion

PHOs accounted for high levels of the overall score in capacity, opportunity, and behavior, but motivation was at a low level. The association between factors and individual behavior of health providers could be used to design interventions for promoting the effective preventive behavior after COVID-19 vaccination among PHOs. The capability of PHOs is a determinant of individual behavior that promotes changes for best practices and mitigates the severity and progress of the COVID-19 pandemic. To enhance preventive behavior, provincial public health offices and primary care units should assess the level of capability among health providers and provide training workshops regarding capability according to age, education, work experience, and history of COVID-19 vaccination.

6. Recommendations

The unpredictable situation of the COVID-19 pandemic caused increasing uncertainty around COVID-19 vaccination, then a longitudinal study of the COM-B model would be more significant after the administration of COVID-19 vaccination or receiving the booster dose that cover all PHOs in a primary care unit. Moreover, the policymakers should be involved in PHOs' performance and enablement in making the decision of the types of COVID-19 vaccine and in facilitating hygienic practices.

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Conflict of interest

The authors declare that there is no conflict of interest.

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