THE EFFECTIVENESS OF ONLINE SOCIAL MARKETING COMMUNICATION ON PROMOTING SELF-PROTECTIVE BEHAVIORS FROM PM 2.5 AMONG RESIDENTS IN BANGKOK

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ABSTRACT

This study aims1) to investigate self-protective behaviorsfrom PM2.5 among Residents in Bangkok, Thailand and 2) to examine the effectiveness of online social marketing communication on promoting self-protective behaviors from PM2.5 among Thai residents in Bangkok. The effectiveness indicatorsof online social marketing communication used in this study compose of five variables based on the theory of planned behavior [TPB] (attitude toward the behavior, subjective norm, perceived behavioral control, intention to perform the behavior, and actual behaviors). The findings show that 1) self-protective behaviorsfrom PM2.5 among Thai Residents in Bangkok were in the high level (Mean = 9.05, SD. = 2.97, Max = 15, Min = 0), and2) Twitter (Beta = .134) and Facebook (Beta = .142) affect attitude toward the behavior. Moreover, Twitter (Beta = .122) and Facebook (Beta = .196) also affect subjective norm as well. Facebook (Beta = .341) and Line (Beta = .204) affect perceived behavioral control. Twitter (Beta = .155) and Facebook (Beta = .221) affect intention to perform the behavior. Lastly, Twitter (Beta= .222) and Facebook (Beta = .304) also affectactual behaviors. The contribution of this research is to increase and expand knowledge ofonline social marketing communicationand to recommend its implications for promotingself-protective behaviorsfrom PM2.5 both in the national and the international level.

INTRODUCTION

Nowadays, air pollution with small particulate matter (PM2.5) has become a major public health concern in Thailand. This was because PM2.5 could cause

the negative impacts on human health in several conditions (Phupong, 2019;
Cho& Kim,2019).These negative impacts on human health could include
respiratory illness, heart and blood vessel diseases affecting cardiovascular
system, brain malfunction, lung cancer, depression, and even death (Cho&
Kim,2019;Sahanavin, Tantrakarnapa, &Prueksasit, 2016; He et
al.,2020).Long term exposure to PM2.5 might be a significant risk factor of
hypertension and could also deteriorate the reproductive system. PM2.5 dusts
were particulate matters with diameter averaging less than 2.5microns that
were suspended in the air (Qian et al., 2016; Xiong et al., 2018).The sources of
PM2.5 were mostly from the diesel engine combustion, the burning of
biomass both in open and enclosed areas, dusts from combining of pollutant
gases, and the industrial activities in factories and electrical generator plants
(Phupong, 2019; Qian et al., 2016; Chen et al., 2017). Therefore, it was
urgently necessary for Thailand to recognize and find the ways to solve this
problem sustainably. Countermeasures to handle with this problem by the
government sectors could be implemented in many ways such as controlling
the vehicles emitting black smoke on the roads, preventing people from
lighting a fire outdoors and indoors, asking people to reduce their use of
private vehicles, spraying water in the areas with high traffic, collecting
environment tax or fees, replacing all types of public transport vehicles with
electric vehicles, online social marketing communication campaigns to
promote self-protective behaviors from PM2.5,and even giving away N95
masks to the public (Chulalongkorn University, 2020; Phupong, 2019; Song et
al., 2019).Apart from those ways in the government level, preventions in the
individual level andlearning how to protect ourselves from PM2.5 were also
inevitably needed. Hence, promoting self-protective behaviors from PM2.5
among Thai population should be proceeded.As mentioned above, online
social marketing communication campaigns to promote self-protective
behaviors from PM2.5 were considered as an important intervention to deal
with this problem (Xiong et al., 2018; Chulalongkorn University, 2020).With
the effectiveness of online media that can rapidly disseminate health
information into the public, health organizations both public and private
sectors in several countries use these media in social marketing
communication campaign to promote health behaviors (Vantamay, 2015,
2017, 2019; Celik, 2016; Cole & Fieselman, 2013; Green et al., 2019; Goedel
et al., 2021).The types of using online media in social marketing
communication campaign to promote self-protective behaviors from
PM2.5have several platforms from website to social networking sites (SNS)
such as Facebook, Instagram, Youtube, Line, and even Twitter.In Thailand,
these new media received exposure and attention among youths and working-
aged people (15-60 years) more than traditional media including television,
radio, movie, newspaper, and magazine(Vantamay, 2015, 2017,
2019;Kennedy,2010). Consequently, they were increasingly used in social
marketing communication campaign to promote self-protective behaviors
from PM2.5 in Thailand (Vantamay, 2015). However, study ineffectiveness of
online social marketing communication to promote health behaviors in
Thailand is still needed, especially for study in the effectiveness of online
social marketing communicationon promoting self-protective behaviors from
PM2.5.For evaluating the effectiveness indicators, 5 variables from theory of
planned behavior (attitude towards the behavior, subjective norm, perceived

behavioral control, intention, and actual behavior) (Ajzen, 1988)were used as the effectiveness indicators in this study because these indicators were suggested from past studies as appropriate indicators for evaluating the effectiveness of social marketing campaign (McKenzie-Mohr, 2000a, 2000b, 2008; Tabanico, 2007; Borden, 2017;Potts& Henderson, 2021).The contribution of this research is to increase and expand knowledge ofonline social marketing communicationand to recommend its implications for promoting self-protective behaviorsfrom PM2.5. The important motivation of this study for the author is to explore new knowledge in the field of social marketing communication in Thailand. Especially, the author is strongly interested in applying social marketing communication to promote health behaviors for better well-beingamong Thai population. Additionally, the author also believes that online media is very powerful for changing behaviors. Therefore, from this research, if online social marketing communication is effective, this will become the significantly valuable communication strategy to promote health behaviors among populations both in the national and the international level as well.

RESEARCH OBJECTIVES

This study aims

1) to investigate self-protective behaviorsfrom PM2.5 among Thai Residents in Bangkok, Thailand.
2) to examine the effectiveness of online social marketing communication on promoting self-protective behaviors from PM2.5 among Thai residents in Bangkok.

Hypothesis

This study proposes five hypotheses and the model of the study is demonstrated in
Figure 1.

H1: Online social marketing communications affect attitude toward self-protective behaviors
from PM2.5
H2: Online social marketing communications affect subjective norm in self-protective behaviors
from PM2.5
H3: Online social marketing communications affect perceived behavioral control
in self-protective behaviors from PM2.5
H4: Online social marketing communications affect intention to perform self-protective behaviors from PM2.5
H5: Online social marketing communications affect self-protective behaviors from PM2.5
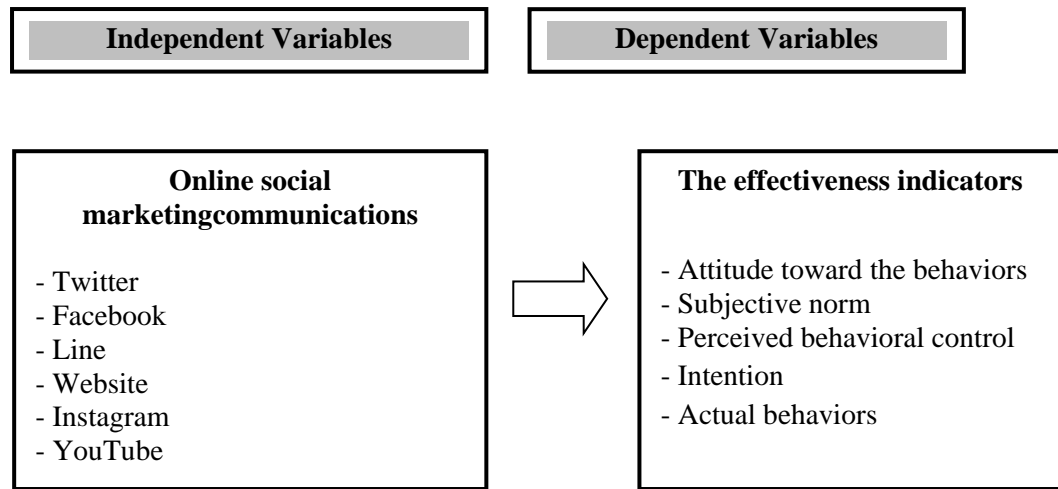
Independent Variables	Dependent Variables
Online social marketingcommunications - Twitter - Facebook - Line - Website - Instagram - YouTube	**The effectiveness indicators** - Attitude toward the behaviors - Subjective norm - Perceived behavioral control - Intention - Actual behaviors

Figure 1. Model of the study

REVIEWED LITERATURES

PM2.5 dusts were particulate matters with diameter averaging less than 2.5microns that were suspended in the air. PM2.5 could cause the negative impacts on human health in several conditionsincluding respiratory illness, heart and blood vessel diseases, cardiovascular diseases, brain malfunction, lung cancer, and even death (Phupong, 2019; Cho& Kim, 2019; Sahanavin et al., 2016).Long term exposure to PM2.5 might be a significant risk factor of hypertension and could also deteriorate the reproductive system(Qian et al., 2016; Xiong et al., 2018).Nowadays, air pollution with small particulate matter (PM2.5) has become a major public health concern in Thailand because this phenomenon occurs every year in Thailand, especially in Bangkok and metropolitan area, upper northern regions, northeastern regions, and some central region areas.The sources of PM2.5 were mostly from the diesel engine combustion, the burning of biomass both in open and enclosed areas, dusts from combining of pollutant gases, and the industrial activities in factories and electrical generator plants.In 2005, WHO (World Health Organization) sets the appropriate average level of PM2.5 in 24-hour round. It should not exceed 25 milligrams per m^3. And in one-year-round, the appropriate average level of PM2.5 should not exceed 10 milligram per m^3. However, Thailand's standard is different from WHO. Thailand sets the appropriate average level of PM2.5 in 24-hour round at 50 milligram per m^3 while the appropriate average level of PM2.5 in one-year roundshould not exceed 25 milligram per m^3(Ministry of Public health, 2021). This is still another questionamong Thai pro-environmentalists whether Thailand should consider and adjust that standard level of PM2.5 according to WHO or not. Besides, to cope with this problem, the Pollution Control Department of Thailand develops "AIR4THAI", an online application for checking the air quality in Thailand. People can download this application for free to check Air Quality Index (AQI) and can also monitor the level of each matter in the air including PM2.5, PM10, Ozone (O3), Nitrogen Dioxide (NO2), Carbon Monoxide (CO), and Sulfur Dioxide (SO2). Furthermore, Thailand's Air Quality Index use 5 colors to indicate the 5 levels of the air quality; blue (Very Good), green (Good), yellow (Moderate), orange (Unhealthy), and red (Very Unhealthy), in the increasing

order of the severity of health warnings (Pollution Control Department of Thailand, 2021). The general public are at risk when AQI turns orange (Unhealthy) and the individual sensitive to air pollution, such as the elderly, children, pregnant woman, and people with heart diseases, lung diseases or asthma, might be at risk when the AQI turns yellow (Moderate)(Pollution Control Department of Thailand, 2021). The example of information showing AQI and graph of PM2.5 in an area of Bangkok (Lat Phrao Rd., Khet Wang Thonglang, Bangkok) in this application (Pollution Control Department of Thailand, 2021) were shown in Figure 2.

Figure 2. The example of information in AIR4THAI application

Source: http://air4thai.pcd.go.th

Besides, Thailand has other ways to solve this problem sustainably as well. Countermeasures to handle with this problem by the government sectors could be launched in many ways both in national and regional level such as controlling the vehicles emitting black smoke on the roads, preventing people from lighting a fire outdoors and indoors, asking people to reduce their use of private vehicles, spraying water in the areas with high traffic, collecting environment tax or fees, replacing all types of public transport vehicles with electric vehicles, online social marketing communication campaigns to promote self-protective behaviors from PM2.5,and even giving away N95 masks to the public (Phupong, 2019; Chulalongkorn University, 2020). Apart from those ways in the government level, preventions in the individual level and learning how to protect ourselves from PM2.5 were also inevitably needed. Hence, promoting self-protective behaviors from PM2.5 among Thai

population should be proceeded in all levels. As mentioned above, online social marketing communication campaigns to promote self-protective behaviors from PM2.5 were considered as an important intervention to deal with this problem. Social marketing communication is defined as using integrated marketing communication tools such as advertising, public relations, direct marketing, personal media, sales promotion, or event marketing to promote and change a desired social behavior (Vantamay, 2015, 2017, 2019; Kotler & Lee, 2008; Potts& Henderson, 2021; Fergus, 2021). In the past, social marketing communication campaign was used in traditional mass media, often called offline media, such as television, radio, newspaper, and magazine (Kennedy,2010; Celik, 2016). However, nowadays with growth of online media in era of internet of thing, social marketing communication practitioners around the world turns to use online media in their social marketing campaign to reach their target population increasingly (Vantamay, 2015, 2017, Celik, 2016). There were several social marketing communication campaigns using online media in promoting social behaviors, especially in health behaviors (Cho& Kim, 2019; Sahanavin et al., 2016; Qian et al., 2016; Xiong et al., 2018; Liuet al., 2018). With the effectiveness of online media that can rapidly disseminate health information into the public, health organizations both public and private sectors in several countries use these media in social marketing communication campaign to promote health behaviors(Kotler& Lee, 2008).The types of using online media in social marketing communication campaign to promote self-protective behaviors from PM2.5 have several platforms from website to Social Networking Sites (SNS) such as Facebook, Instagram, YouTube, Line, and even Twitter. In Thailand, these social media received exposure and attention among youths and working-aged people increasingly and continuously (We are social, 2021), as shown in Table 1. However, study in the aspect of the effectiveness of using online media in social marketing communication campaignto promote self-protective behaviors from PM2.5is still needed in Thailand.

Table 1. Percentage of social media users in Thailand

Social Media	Percent
YouTube	94.20
Facebook	93.30
Line	86.20
Instagram (IG)	64.20
Twitter	57.80

Source: https://datareportal.com/reports/digital-2021-thailand

From reviewing the literatures on the effectiveness indicators of social marketing communication, the author found that all related studies suggested that the variables in the theory of planned behavior can be the appropriate effectiveness indicators (Vantamay, 2015, 2017, 2019; McCabe et al., 2013; Scholl et al., 2010; Staniskis et al., 2012; Thøgersen& Schrader, 2012).Therefore, in this research, the variables in the theory of planned behavior (TPB) was used as the effectiveness indicators of online social marketing communication on promoting self-protective behaviors from PM2.5

among Thai residents in Bangkok.The theory of planned behavior is a theory developed to explain variables affecting actual behavior. It was developed by Ajzen (1988). According to the theory of planned behavior (TPB), actual behavior was affected by intention to perform a behavior (INT) which was the individual's perceived level of intent to practice behavior. At the same time, the intention to perform a behavior was also affected by three factors: the attitude towards the behavior (ATT), the subjective norm (SN), and perceived behavioral control (PBC). The attitude towards the behavior is an individual's feeling towards that behavior while the subjective norms are the beliefs that his or her reference groups think the individual ought to perform and how significant their notions are to his or her behavior. Lastly, perceived behavioral control is the individual's perceived self-efficacy to perform a behavior. It was based from past experiences together with present competencies to determine the perceived self-efficacy to perform a behavior. This framework is very beneficial to explain a complicated behavior more accurately. Therefore, these variables can be taken to evaluate the effectiveness of social marketing communication campaign, not only in traditional media but also in online media as well (Vantamay, 2015, 2017, 2019; McCabe et al., 2013).

METHODOLOGY
Survey research by self-reporting questionnaires was employed to study self-protective behaviors from PM2.5 among Thai Residents in Bangkok and to examine the effectiveness of online social marketing communication on promoting self-protective behaviors from PM2.5. In this study, Thai Residents in Bangkok are defined as people aged 15-60 years old who are living in Bangkok during October- December 2020. Multistage sampling was used to select 400 samples in 10districts in Bangkok. The size of samples in this study was calculated by using formulation of Yamane (1973) at the 95% confidence level. Yamane (1973) suggested that if the total population is more than 100,000, the 400 samples are enough to represent that population. In sampling, multistage random sampling was employed. First, simple random sampling by drawing was used in selecting 10 districts in Bangkok: CHATUCHAK, BANGKHEN, LAT KRABANG, BANG KAPI, BANGNA, BANG RAK, DUSIT, KLONG SAM WA, BANG SUE, and PHAYA THAI. Second, convenience sampling around parks, shopping mall, and convenience stores in each selected area was used for collecting data (40 samples per area). All samples in each area received an explanation in the details of the study and then were invited to participate. The samples were asked to complete the questionnaire after they were informed that their participation was voluntary, that their responses were anonymous and confidential. The results would be reported only in a group format. All participants signed informed consent forms that were then separated from their questionnaires to maintain confidentiality.
There were six independent variables in this study: 1) Online social marketing communication exposure to promote self-protective behaviors from PM2.5 in Twitter, 2) Online social marketing communication exposure to promote self-protective behaviors from PM2.5 in Facebook, 3) Online social marketing communication exposure to promote self-protective behaviors from PM2.5 in Line, 4) Online social marketing communication exposure to promote self-

protective behaviors from PM2.5 in Website, 5) Online social marketing communication exposure in Instagram (IG), and 6) Online social marketing communication exposure in YouTube. They were measured using a 5-point frequency rating scale within 1 month. There were 5 items per one variable, ranging from "always" (5), "usually" (4), "sometimes" (3), "seldom" (2) to "never" (1).

For dependent variables called the effectiveness indicators, there were five variables in this study: 1) Attitude toward the behavior, 2) Subjective norms, 3) Perceived behavioral control, 4) Intention, and 5) Actual behavior. Attitude toward the behavior was defined as an individual's positive or negative evaluation of self-protective behaviors from PM2.5. It was measured using a 5-point Likert scale for five items. Subjective norms was defined as beliefs about what his or her friends, family member, and influencers think the person should perform regarding self-protective behaviors from PM2.5 and how important their opinions are to his or herself-protective behaviors from PM2.5. It was measured in nine items. Perceived behavioral control was defined asthe person's perceived ease or difficulty to perform self-protective behaviors from PM2.5. It was measured in six items. Intention was defined as the perceived level of tendency to perform self-protective behaviors from PM2.5. It was measured in fifteen items. All above-mentioned variables were measure using a 5-point Likert scale, ranging from "strongly disagree" (1), "disagree" (2), "neutral" (3), "agree" (4) to "strongly agree" (5). Lastly, actual behavior was defined as performing self-protective behaviors from PM2.5 within 1 month. It was measured in 15 items using dichotomous question, yes (1) or no (0), therefore sum score in this variable will range from 0 (minimum) to 15 (maximum). These questions were adapted from past studies (Cho& Kim, 2019; Sahanavin et al., 2016; Qian et al., 2016; Xiong et al., 2018; Liu et al., 2018; Zhang et al., 2016).A pretest was conducted with 30 university students in Bangkok. Cronbach's alpha to evaluate the internal consistency of the summed scale was used for analyzing reliability of several variables (Online social marketing communication exposure to promote self-protective behaviors from PM2.5 in all platforms, Attitude toward the behavior, Subjective norms, Perceived behavioral control, and Intention). Besides, Kuder Richardson-21 (KR-21) to evaluate reliability of the dichotomous question (0 and 1) was also used for analyzing reliability of actual behavior measurement. The results showed that the alpha levels ranged from 0.71 to 0.95 (Twitter = 0.93, Facebook = 0.92, Line = 0.92, Website = 0.95, IG = 0.95, YouTube = 0.94, Attitude toward the behavior = 0.93; Subjective norm = 0.94; Perceived behavioral control= 0.93) and the KR-21 score was 0.71. Scores within this range (more than 0.70) are considered as an adequate indication of internal consistency (Cottrell& McKenzie, 2005; Hair et al., 1992). For statistical analyses, the mean, standard deviation, percentage, and multiple regression analysis (MRA) at the .05 level of significance was used in this research.

RESULTS and DISCUSSION

Characteristics Of the Study Sample

The samples included 400residents in Bangkok, aged 15-60 yearsold. Most samples were female (61.3%) and graduated in the bachelor degree (59.5%). The average age was 29.57 years, (SD = 8.40). The median of income per month was THB 19,500. Besides, theyare governmental officers in the highest proportion (34.3%).

Descriptions Of the Studied Variables

Mean and standard deviation (SD) were used in describing the studied variables. For independent variables, the exposuremean of online social marketingcommunicationto promote self-protective behaviors from PM2.5 among samples were the following: Twitter (Mean = 2.55, SD = 1.13), Facebook was (Mean =2.61, SD = 1.02), Line (Mean = 2.28, SD = 1.04), Website (Mean =2.43, SD = 1.10), Instagram (Mean = 2.22, SD = 1.09), and YouTube (Mean =2.38, SD = 1.08). The overall exposuremean of online social marketingcommunicationto promote self-protective behaviors from PM2.5 among samples were 2.41 (SD = 0.86)

For dependent variables, the mean of attitude toward the behavior was 4.56 (SD = 0.57) (Max = 5, Min = 0). The mean of the subjective norm from friends, family members, and influencerswas 3.62 (SD = 0.84) (Max = 5, Min = 0). The mean of perceived behavioral control was 3.86 (SD = 0.72) (Max = 5, Min = 0). The mean of intention to perform the behavior was 3.83 (SD = 0.68) (Max = 5, Min = 0). The mean of self-protective behaviors from PM2.5 (actual behavior) was 9.05(SD = 2.97) (Max = 15, Min = 0) as shown in Table 3.

Table 2 Mean and standard deviation among the studied variables

Variable	$\overline{X}$*	SD
Twitter	2.55	1.13
Facebook	2.61	1.02
Line	2.28	1.04
Website	2.43	1.10
Instagram	2.22	1.09
YouTube	2.38	1.08
Attitude toward the behavior	4.56	0.57
Subjective norm (Friends, Family members, and Influencers)	3.62	0.84
Perceived behavioral control	3.86	0.72
Intention to perform the behavior	3.83	0.68
Self-protective behaviors from PM2.5 (actual behavior)	9.05**	2.97

*5-point scale
**Max = 15, Min = 0

Besides, when each item of self-protective behaviors from PM2.5 was considered by using percentage, the result found that eating fish oil or Omega3 supplements to strengthen immunity had the lowest percent (27.8) while smoking avoidance in househad the highest percent (93.3) as shown in Table 3.

Table 3 Percentage among 15 items of Self-protective behaviors from PM2.5

Items	Percent
Outdoor activity avoidance	81.5
Air-purifier usage	42.3
Tree planting	50.7
Indoor Exercising	84.3
Travelling avoidance	63.2
Window opening avoidance	76.0
Studying Air Quality Index (AQI)	57.3
Wearing a normal face mask when going outdoor	92.0
Wearing a N-95 face mask when going outdoor	38.3
Smoking avoidance in house	93.3
Installing air-quality monitor applications	55.0
Cleaning nose and mouth	52.5
Use clean energy in vehicles such as E85	37.5
Taking antioxidants such as Vitamin C and E	53.3
Eating fish oil or Omega3 supplements	27.8

The effectiveness of online social marketing communication on promoting self-protective behaviors from PM2.5 among Thai residents in Bangkok

Multiple regression analysis (MRA) was performed to examine the effectiveness of online social marketing communication on promoting self-protective behaviors from PM2.5 among Thai residents in Bangkok.The effectiveness indicatorsof online social marketing communication used in this study compose of five variables based on the theory of planned behavior[TPB] (attitude toward the behavior,subjective norm, perceived behavioral control, intention to perform behavior, and actual self-protective behaviors).The standardized regression coefficients (β) and*t*-statisticwere used for this analysis.Before analysis, checking the problem of multicollinearity was performed by considering all correlations among independent variables. The results found that all correlations in this study were less than 0.60. This range of correlation coefficients was considered an acceptable level without the problem of multicollinearity (Cooper and Schindler, 2001; Hair *et al*, 1992).

H1: Online social marketingcommunications affect attitude toward self-protectivebehaviors from PM2.5

After multiple regression analysis had been performed, the results found that there were 2 independent variables affecting attitude toward self-protective behaviors from PM2.5 significantly. They are Twitter (Beta = .134) and Facebook (Beta = .142). Besides, all online social marketingcommunicationscan significantly co-predict attitude toward self-

protective behaviors from PM2.5 at3.9 percent (Adjusted R^2 = 0.039) as shown in Table 4.

Table 4 Multiple regression analysis of attitude toward self-protective behaviors from PM2.5

Independent Variable	Beta	t
1. Twitter	.134	2.067*
2. Facebook	.142	1.912*
3. Line	.047	.710
4. Website	.028	.371
5. IG	.138	1.656
6. YouTube	.122	1.495
Adjusted R^2 = 0.039, F = 3.738, *p< .01*		

Statistically significant at .05 significance level.

H2: Online social marketing communications affect subjective norm in self-protective behaviors from PM2.5

After multiple regression analysis had been performed, the results found that there were 2 independent variables affecting subjective norm (from friends, family member, and influencers) in self-protective behaviors from PM2.5significantly. They are Twitter (Beta = .122) and Facebook (Beta = .196). Besides, all online social marketingcommunicationscan significantly co-predict subjective normin self-protective behaviors from PM2.5at 21.8 percent (Adjusted R^2 = 0.218) as shown in Table 5.

Table5 Multiple regression analysis of subjective norm in self-protective behaviors from PM2.5

Independent Variable	Beta	t
1. Twitter	.122	2.076*
2. Facebook	.196	2.915*
3. Line	.022	.363
4. Website	.095	1.374
5. IG	.140	1.852
6. YouTube	.042	.564
Adjusted R^2 = 0.218, F = 19.568, *p< .01*		

Statistically significant at .05 significance level.

H3: Online social marketingcommunications affect perceived behavioral control in self-protective behaviors from PM2.5

After multiple regression analysis had been performed, the results found that there were 2 independent variables affecting perceived behavioral control in self-protective behaviors from PM2.5significantly. They are Facebook (Beta = .341) and Line (Beta = .204). Besides, all online social marketingcommunicationscan significantly co-predict perceived behavioral

control in self-protective behaviors from PM2.5at 21.9 percent (Adjusted R^2 = 0.219) as shown in Table 6.

Table6 Multiple regression analysis of perceived behavioral control in self-protective behaviors from PM2.5

Independent Variable	Beta	*t*
1. Twitter	.088	1.496
2. Facebook	.341	5.081*
3. Line	.204	5.394*
4. Website	.125	1.810
5. IG	.113	1.501
6. YouTube	.141	1.915
Adjusted R^2 = 0.219, F = 19.595,*p< .01*		

Statistically significant at .05 significance level.

H4: Online social marketing communications affect intention to performself-protective behaviors from PM2.5

After multiple regression analysis had been performed, the results found that there were 2 independent variables affecting intention to performself-protective behaviors from PM2.5significantly. They are Twitter (Beta = .155) and Facebook (Beta = .221). Besides, all online social marketingcommunicationscan significantly co-predict intention to performself-protective behaviors from PM2.5 at13.1 percent (Adjusted R^2 = 0.131)as shown in Table 7.

Table7 Multiple regression analysis of intention to perform self-protective behaviors from PM2.5

Independent Variable	Beta	*t*
1. Twitter	.155	2.506*
2. Facebook	.221	3.476*
3. Line	.065	.921
4. Website	.105	1.445
5. IG	.079	.992
6. YouTube	.004	.053
Adjusted R^2 = 0.131, F = 11.044, *p< .01*		

Statistically significant at .05 significance level.

H5: Online social marketing communications affect self-protective behaviors from PM2.5

After multiple regression analysis had been performed, the results found that there were 2 independent variables affecting self-protective behaviors from PM2.5significantly. They are Twitter (Beta = .222) and Facebook (Beta = .304). Besides, all online social marketingcommunicationscan significantly co-

self-protective behaviors from PM2.5at 21.1percent (Adjusted $R^2 = 0.211$) as shown in Table 8.

Table8 Multiple regression analysis of self-protective behaviors from PM2.5

Independent Variable	Beta	*t*
1. Twitter	.222	3.666*
2. Facebook	.304	4.392*
3. Line	.114	1.932
4. Website	.047	.695
5. IG	.004	.051
6. YouTube	.027	.359
Adjusted $R^2 = 0.211$, F = 18.805, *p< .01*		

Statistically significant at .05 significance level.

From the findings in mean among the studied variables, the author found that self-protective behaviors from PM2.5 among samples in this research were in the high level (Mean = 9.05, Max = 15, Min = 0) when scores were divided into 5 ranges (very low, low, moderate, high, and very high). This result showed that people living in Bangkok were aware in PM2.5 problem because this problem affects everyday life and negative health conditions among them explicitly. This is a good signal for any health organizations in Thailand both local and national level. Furthermore, when each item of self-protective behaviors from PM2.5 was considered by using percentage, the result found that the three highest self-protective behaviors from PM2.5 were 1) Smoking avoidance in house (93.3%), 2) Wearing a normal face mask when going outdoor (92%), and 3) Indoor Exercising (84.3%). This might be a result of social marketing communication campaigns among several health organizations in Thailand that often picked these three practices to promote self-protective behaviors from PM2.5. However, the three lowest self-protective behaviors from PM2.5 were 1) Eating fish oil or Omega3 supplements to strengthen immunity (27.8%), 2) Using clean energy in vehicles such as E85 (37.5%), and 3) Wearing a N-95 face mask when going outdoor (38.3%). Therefore, governments and health organizations in Thailand should more promote these practices, especially in wearing a N-95 face mask when going outdoor. This is because wearing a N-95 face maskis considered as the most effective method in PM2.5 prevention (Phupong,2019; Chulalongkorn University, 2020; Liuet al., 2018; He et al., 2020; Chen, 2017; Song et al., 2019). The author believes that high market price of N-95 limit reach in this product. Hence, using price intervention to reduce cost of PM2.5 is urgently needed in Thailand so as to make people can reach N-95 face mask more increasingly(Qian et al., 2016; Xiong et al., 2018).Besides, when means of online social marketing communication exposure among residents in Bangkok were considered, the author found that Facebook is the highest online social media in exposing information about self-protective behaviors from PM2.5 (mean = 2.61), followed by Twitter (mean = 2.55), Website (mean = 2.43), YouTube (mean = 2.38), Line (mean = 2.28), and IG (mean = 2.22) respectively. Therefore, social marketer or health promotion practitioners should use Facebook more than any other social media because it

can most reach Thai residents in Bangkok. Next, from the findings of multiple regression analysis in each effectiveness indicator, the author found that most online social media affected effectiveness indicators were Facebook and Twitter. As shown in Table 4-8, Facebook and Twitter significantly affected attitude toward the behavior, subjective norm, intention to perform the behavior, and actual behaviors. Besides, Facebook and Line also affected perceived behavioral control. That is, if Thai residents in Bangkok more expose online social marketing communication campaign in promoting self-protective behaviors from PM2.5 through Facebook and Twitter, they will belikely to have attitude toward the behavior, subjective norm, intention to perform the behavior, and actual behaviors in self-protective behaviors from PM2.5 more increasingly. The findings are consistent with previous studies (Goedel et al., 2021; Vantamay,2015, 2017, 2019; Potts& Henderson, 2021; Celik, 2016; Cole&Fieselman, 2013; Green et al., 2019; Cho& Kim, 2019; Sahanavin et al., 2016; Qian et al., 2016; Xiong et al., 2018; Liuet al., 2018; Green et al., 2019) which supported using online media in social marketing communication campaigns.

Besides, the author also supports variables in the theory of planned behavior [TPB] by Ajzen (1988) as the effective indicators of online social marketing communication campaign. The results of this research also supported all related previous studies which suggested that the variables in the theory of planned behavior can be the appropriate effectiveness indicators of social marketing communication on promoting health behaviors(Vantamay, 2015, 2017, 2019; McCabe et al., 2013; Scholl et al., 2010; Staniskis et al., 2012; Thøgersen& Schrader, 2012).Finally, the author believes that if Thailand continuously promotes self-protective behaviors from PM2.5 by using online social marketing communication campaign in promoting self-protective behaviors from PM2.5 among Thai people, especially through Facebook, Twitter, and even Line, self-protective behaviors from PM2.5 among Thai peoplewill be better. However, this study had at least two limitations that need to be recognized. Firstly, this study focused on Bangkok area, only one group participating in the campaign. Therefore, it may need collecting data from more areas to expand the results. Another limitation to note was the self-reported questionnaire in evaluating the effectiveness of the campaign. This limitation might make the respondents over-report their behaviors, possibly because of any potential shame or guilt. Despite these limitations, the strength of this study was extending the existing body of knowledge of social marketing communication more broadly, especially within Thailand. For future research directions, the author suggested two possible paths to follow. First, groups of population vulnerable to PM 2.5 such as children, aging people, and pregnant women should be studied more deeply. Second, further studies about designing online contents on social media in social marketing communication campaign to promote self-protective behaviors from PM2.5, especially in Facebook, Twitter, or even Line, are still more needed in Thailand.

CONCLUSION
This study aims 1) to investigate self-protective behaviors from PM2.5 among Residents in Bangkok, Thailand and 2) to examine the effectiveness of online

social marketing communication on promoting self-protective behaviors from PM2.5 among Thai residents in Bangkok. The effectiveness indicators of online social marketing communication used in this study compose of five variables based on the theory of planned behavior [TPB] (attitude toward the behavior, subjective norm, perceived behavioral control, intention to perform the behavior, and actual behaviors). The findings show that 1) self-protective behaviors from PM2.5 among Thai Residents in Bangkok were in the high level (Mean = 9.05, SD. = 2.97, Max = 15, Min = 0), and 2) Twitter (Beta = .134) and Facebook (Beta = .142) affect attitude toward the behavior. Moreover, Twitter (Beta = .122) and Facebook (Beta = .196) also affect subjective norm as well. Facebook (Beta = .341) and Line (Beta = .204) affect perceived behavioral control. Twitter (Beta = .155) and Facebook (Beta = .221) affect intention to perform the behavior. Lastly, Twitter (Beta = .222) and Facebook (Beta = .304) also affect actual behaviors. The contribution of this research is to increase and expand knowledge of online social marketing communication and to recommend its implications for promoting self-protective behaviors from PM2.5 both in the national and the international level.

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