



# Factors affecting perceived effectiveness of COVID-19 prevention measures among Filipinos during Enhanced Community Quarantine in Luzon, Philippines: Integrating Protection Motivation Theory and extended Theory of Planned Behavior

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## ABSTRACT

**Objective:** The current study integrated Protection Motivation Theory (PMT) and extended Theory of Planned Behavior (TPB) to evaluate factors affecting the perceived effectiveness of COVID-19 prevention measures among Filipinos during Enhanced Community Quarantine (ECQ) in Luzon, Philippines.

**Methods:** A total of 649 Filipinos answered an online questionnaire, which contained 63 questions. Structural Equation Modeling (SEM) was utilized to derive the causal relationships of the latent variables construct.

**Results:** SEM showed that understanding of COVID-19 had significant direct effects on perceived vulnerability and perceived severity. Also, perceived vulnerability and perceived severity had significant indirect effects on intention to follow. Intention to follow had significant direct effects on actual behavior and adapted behavior, which subsequently led to perceived effectiveness. Of note, an understanding of COVID-19 was found to have a significant indirect effect on perceived effectiveness.

**Conclusions:** The current study is one of the first studies to analyze factors affecting the perceived effectiveness of COVID-19 prevention measures during the global pandemic. It is proposed that the integrated PMT and extended TPB of this study can be applied and extended to evaluate the perceived effectiveness of COVID-19 measures in other countries that are currently dealing with COVID-19 pandemic. © 2020 The Author(s). Published by Elsevier Ltd on behalf of International Society for Infectious Diseases. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Coronavirus (COVID-19), a highly transmittable disease that threatens the human population worldwide, is considered to be the third pandemic in the 21st century (Perlman, 2020). After the emergence of Middle East respiratory syndrome coronavirus (MERS-CoV) in Saudi Arabia and severe acute respiratory syndrome coronavirus (SARS-CoV) in China, a new SARS-like coronavirus was discovered last December 2019 (Zhou et al., 2020). The virus was linked to a wholesale seafood market in Wuhan, China, when an unknown pathogen was identified by the local hospitals in a group of patients who are

accustomed to pneumonia (Zhu et al., 2020; Fan et al., 2020). Adnan Shereen et al. (2020) initially mentioned that patients who have been infected by the coronavirus in China might have gone to Wuhan where live animals were being sold. Later, Chinese researchers determined a human to human transmission of the virus and initially named the novel virus Wuhan coronavirus or 2019 novel coronavirus (2019-nCoV) (Adam et al., 2020).

The International Committee on Taxonomy of Viruses (ICTV) recently named the novel coronavirus SARS coronavirus 2 (SARS-CoV-2), which is now generally called coronavirus disease 19 (COVID-19) (Gorbalenya et al., 2020a, b). Details about this epidemic were released by the National Health Commission of China on January 12, 2020 (Wang et al., 2020). This virus outbreak has grown extensively to infect 13,575,158 people worldwide and has led to 584,940 death cases as of July 17, 2020 (WHO, 2020a, b). On March 11, 2020, the World Health Organization listed COVID-19 as a global pandemic.

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Due to the global pandemic of COVID-19, several prevention measures were taken. A massive lockdown has been implemented by governments in several countries. In addition, “#StayAtHome” was promoted by the media to prevent the spread of COVID-19. Researchers are currently developing a vaccine; as yet, there is no effective medicine that has been invented for the treatment of COVID-19 infections (Paital et al., 2020). At the moment, the only remedial option is hospitalization and thorough care management. With few initial treatment medications, predicting the duration and final size of the virus in every country becomes critical for policymakers and public health authorities to prevent further spread of the outbreak.

Despite the availability of different studies about preventive measures in other countries, there is a significant lack of academic research addressing the COVID-19 situation in the Philippines. On March 17, 2020, the country was placed under community quarantine for six months (CSIS, 2020). However, on July 16, 2020, the Philippines was declared to have the highest number of active cases in Southeast Asia (Table 1). The Department of Health of the Philippines (DoH) reported 61,266 confirmed cases of the infection and 1643 deaths in the Philippines as of July 17, 2020 (Figure 1).

On March 16, 2020, The Philippine government imposed a total lockdown in Luzon, known as the Enhanced Community Quarantine (ECQ), as a preventive measure to minimize the COVID-19 outbreak. This ECQ is widely known as one of the longest lockdown in the world. Under the ECQ, all modes of domestic travel, including ground, air, and sea, were suspended. Residents were not allowed to leave their homes except in case of emergencies. Border closures and entry bans were also enforced. Thousands of police officers and military personnel were deployed at checkpoints to ensure that people complied with the lockdown. The administration also implemented, through several platforms as preventive measures, strict social distancing (Duddu, 2020; CSIS, 2020) and educated the community on healthy lifestyles.

The purpose of this study was to evaluate factors affecting the perceived effectiveness of COVID-19 prevention measures among Filipinos during ECQ in Luzon, Philippines, by integrating Protection Motivation Theory (PMT) and extended Theory of Planned Behavior (TPB). The current study is one of the first studies to have analyzed factors affecting the perceived effectiveness of COVID-19 prevention measures during the 2020 global pandemic. Finally, the integrated PMT and extended TPB of this study can be applied and extended to evaluate the perceived effectiveness of COVID-19 measures in other countries that are currently dealing with the COVID-19 pandemic.

## Theoretical Research Framework

Figure 2 represents the Theoretical Research Framework of the current study. Unlike a previous study that only utilized PMT

related to COVID-19 (Barati et al., 2020), we integrated the PMT and extended TPB to determine the causal relationships between determined variables and latent assemblies. The final goal was to evaluate factors affecting the perceived effectiveness of COVID-19 prevention measures among Filipinos during ECQ in Luzon.

Based on PMT, when individuals encounter a threatening event, they are primarily motivated to engage in protective behavior (Janmaimool, 2017). According to previous research, individuals believe that performing preventive behavior can reduce the threat that comes with a lack of action (Hung et al., 2014). During a global crisis, providing reliable and accurate information is essential. In 2009, the public believed that the H1N1 virus was more lethal than H5N1 human avian flu and SARS because various forms of new infectious diseases were merged together (Lau et al., 2009). Early knowledge of the outbreak can help to illustrate the public's risk behavior and how they perceived it (Balkhy et al., 2010). Moreover, Johnson and Hariharan (2017) highlighted that providing health education and creating awareness during an outbreak is an effective measure to help prevent the spread of the disease. Thus, we hypothesized the following:

**H1.** Understanding of COVID-19 had a significant direct effect on perceived vulnerability.

**H2.** Understanding of COVID-19 had a significant direct effect on perceived severity.

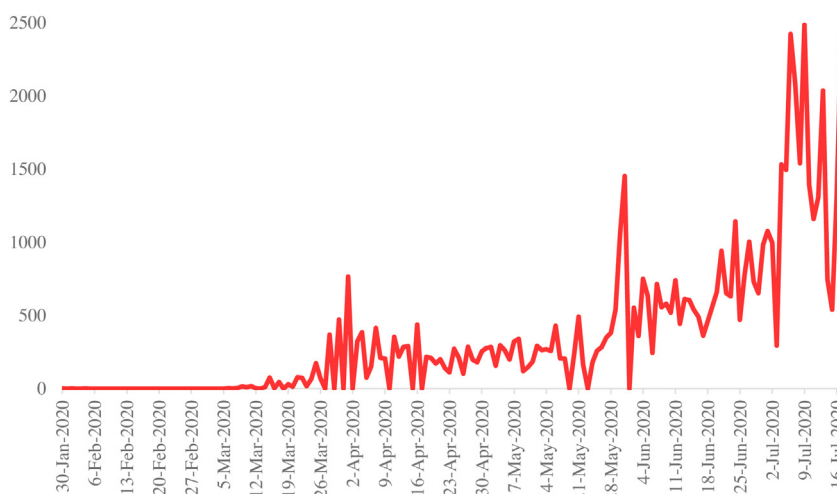
Health understanding and perceived behavioral control have been frequently identified as predictors of individuals' tendency to follow the prescribed prescription, and subsequently conform to treatment procedures (Davis et al., 2006). Bandura (1977) stated that the essential predictor of various medical behaviors, including medication adherence, is perceived behavioral control. However, Cameron et al. (2010) point out that taking medication as prescribed is the patient's responsibility. It is not an unusual occurrence if, due to inadequate knowledge, a patient fails to understand how to properly administer medication, either misuse, or non-adherence (Cameron et al., 2010). Moreover, this pivotal dispute of misconception and ignorance of directions for prescribed pharmaceutical products, particularly for people with poor health literacy (Cameron et al., 2010), is associated with avoidance of preventive care and worse outcomes in many chronic medical conditions (Berkman et al., 2011). Thus, we hypothesized the following:

**H3.** Understanding of COVID-19 had a significant direct effect on the perceived behavioral control of an individual.

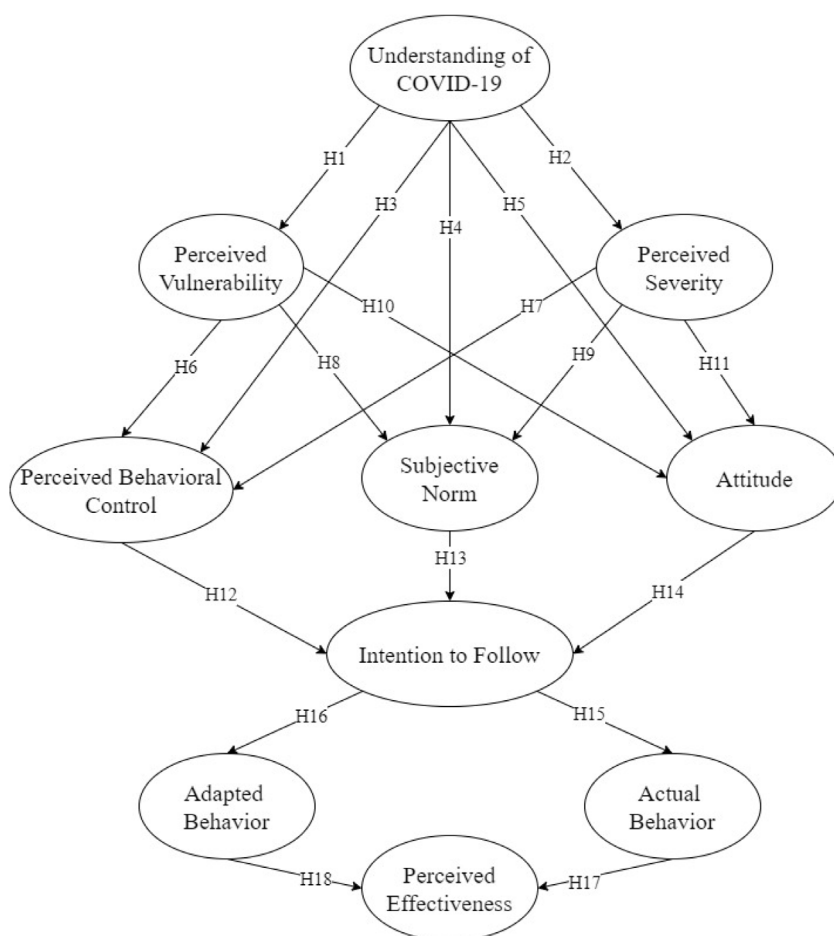
Based on the Theory of Planned Behavior, a person's behavioral intent is profoundly affected by the behavioral norms of his social community (Ajzen, 2011). A critical stage in this approach is a thorough exposition of the problem that was accomplished by intensive engagement with the various communities, leading to

**Table 1**  
COVID-19 cases in Southeast Asia as of July 17, 2020 (<https://www.worldometers.info/coronavirus/>).

| Rank | Country     | Total cases | New cases | Total deaths | New deaths | Total recovered | Active cases |
|------|-------------|-------------|-----------|--------------|------------|-----------------|--------------|
| 1    | Philippines | 63,001      | 1841      | 1660         | 17         | 21,748          | 39,593       |
| 2    | Indonesia   | 83,130      | 1462      | 3957         | 84         | 41,834          | 37,339       |
| 3    | Singapore   | 47,453      | 327       | 27           | 0          | 43,256          | 4170         |
| 4    | Malaysia    | 8755        | 18        | 122          | 0          | 8541            | 92           |
| 5    | Thailand    | 3239        | 3         | 58           | 0          | 3096            | 85           |
| 6    | Myanmar     | 339         | 0         | 6            | 0          | 270             | 63           |
| 7    | Cambodia    | 171         | 5         | 0            | 0          | 133             | 38           |
| 8    | Vietnam     | 382         | 1         | 0            | 0          | 356             | 26           |
| 9    | Brunei      | 141         | 0         | 3            | 0          | 138             | 0            |
| 10   | East Timor  | 24          | 0         | 0            | 0          | 24              | 0            |
| 11   | Laos        | 19          | 0         | 0            | 0          | 19              | 0            |



**Figure 1.** Confirmed COVID-19 cases in the Philippines as of July 17, 2020 (<https://covid19.who.int/>).



**Figure 2.** Theoretical research framework.

stronger cultural norms (Biglan and Taylor, 2000). Thus, it is logical to conclude that the stronger the group standards, the higher the level of understanding among the social community members. Hence, we proposed:

**H4.** Understanding of COVID-19 had a significant direct effect on subjective norms about the preventive measures implemented in the Philippines.

Mishra et al., (2016) mentioned that healthcare professionals exhibit a greater understanding of pandemic, optimistic attitudes towards the pandemic, and frequently exhibit low rates of anxiety. On the contrary, research from Ethiopia recommended intensive preparation for healthcare practitioners due to their inadequate knowledge and erroneous beliefs about the Ebola virus (Abebe et al., 2016). During the H1N1 pandemic in 2016, a study conducted

in Trinidad and Tobago reported that a substantial proportion of the general population was oblivious of the severity of, and the prevention measures for coping with the epidemic (Johnson and Hariharan, 2017). A related study found that most respondents among secondary school- children in Nigeria had insufficient awareness and had a negative approach to the Ebola virus (Ilesanmi and Alele, 2016). Along with hypotheses 1 and 2, we also hypothesized the following:

**H5.** Understanding of Covid-19 had a significant direct effect on an individual's attitude towards the ongoing global outbreak.

Most studies about health-related behaviors have utilized TPB (Gabriel et al., 2019; Hagger et al., 2016; Huang et al., 2020) or PMT separately (Barati et al., 2020). TPB specifies that attitudes, subjective norms, and perceived behavioral control are the essential components of behavioral intent and actual health-related behavior (Kam et al., 2008). However, there is little to no discussion of a relationship between TPB and PMT. Hence, the current model attempts to correlate factors associated with PMT to the key determinants of TPB. Thus, we hypothesized the following:

**H6.** Perceived vulnerability had a significant direct effect on perceived behavioral control.

**H7.** Perceived severity had a significant direct effect on perceived behavioral control.

**H8.** Perceived vulnerability had a significant direct effect on subjective norms.

**H9.** Perceived severity had a significant direct effect on subjective norms.

**H10.** Perceived vulnerability had a significant direct effect on an individual's attitude towards COVID-19.

**H11.** Perceived severity had a significant direct effect on an individual's attitude towards COVID-19.

Lau et al. (2010) mentioned that the variables of behavioral intention are directly correlated to the factors derived from the TPB. According to Ajzen (1991), self-efficacy is an element that is common to both TPB and PMT, which has the same concept of perceived behavioral control. It highlights the skills and competencies of a person handling the task or decision making (Bandura, 1998; Bandura, 1978). Workman et al. (2008) also showed that self-efficacy has a significant effect on the capability of a person to perform task behavior. Hence, we hypothesize the following:

**H12.** Perceived behavioral control had a significant direct effect on the intention to follow the preventive measures of COVID-19.

Subjective norm is defined as the normative rewards, values, and desires to adhere to a specific act, which is primarily expressed by observing others' behaviors (Ajzen, 1991; Aronson et al., 2020). Past study (Chan et al., 2005) has reported that the behavior of an individual is affected by the norm in their community. In the context of the individual's compliance in organizations, Chan et al. (2005) stated that when supervisors and employees confer, cooperate and follow the guidelines, employees are most likely to comply with the organization's guidelines. Also, most studies have proven that there is a strong relationship between subjective norms and compliance in organizations (Ho et al., 2017; Schepers and Wetzels, 2007; Grimes and Marquardson, 2019). However, some studies mentioned that the subjective norms construct is usually a poor indicator of behavioral intention since a person's behavior may be affected by societal influences and personal

choices (Armitage and Conner, 2001). Thus, we hypothesized the following:

**H13.** Subjective norms had a significant direct effect on an individual's behavioral intention to follow the preventive measures of COVID-19.

Attitude towards behavior refers to the perception of the individual performing a particular behavior. Most studies have confirmed that people will comply with rules, requirements, and guidelines when they have a positive attitude (Mcmillan and Conner, 2003; Sasse et al., 2020; Ng et al., 2009; Herath and Rao, 2009; Bulgurcu et al., 2010). On the other hand, people who disregard certain desirable habits do not adhere readily to the implemented guidelines (Pahnila et al., 2007; Myyry et al., 2009). Hence, we hypothesized that:

**H14.** Attitude had a significant direct effect on an individual's behavioral intention to follow the preventive measures of COVID-19.

Behavioral intent is defined as the subjective probability that an individual will execute a particular behavior (Mahardika et al., 2020). It is depicted as the best possible predictor of an individual's action, despite the many factors that may affect the effectiveness of the intention-behavior relationship (Bentler and Speckart, 1979). Previously, Bentler and Speckart (1979) proposed a model that complements the Hill et al. (1977) theory in predicting behavior. Thus, we hypothesized the following:

**H15.** Behavioral intention had a significant direct effect on the actual behavior of individuals.

**H16.** Behavioral intention had a significant direct effect on the adapted behavior of individuals.

Previous studies emphasized that the feeling that individuals can only have a negligible impact on a larger scale is a major barrier for socially responsible behavior (Ellen et al., 1991). According to Owens (2000), individuals may perceive their actions as irrelevant on a larger scale even if they have an awareness of the situation and desire to contribute to society. Consequently, in addition to maintaining prosocial values, the perception that one's actions will make a difference is a necessary precursor to socially responsible

**Table 2**  
Descriptive statistics of the respondents (n = 649).

| Characteristics               | Category                      | N   | %    |
|-------------------------------|-------------------------------|-----|------|
| Gender                        | Male                          | 279 | 43   |
|                               | Female                        | 370 | 57   |
| Age                           | 15–24                         | 395 | 60.9 |
|                               | 25–34                         | 118 | 18.2 |
|                               | 35–44                         | 70  | 10.8 |
|                               | 45–54                         | 43  | 6.6  |
|                               | 55–64                         | 19  | 2.9  |
|                               | More than 64                  | 4   | 0.6  |
| Educational Background        | Elementary graduate           | 8   | 1.2  |
|                               | High school graduate          | 118 | 18.2 |
|                               | Senior high school graduate   | 58  | 8.9  |
|                               | Technical-vocational graduate | 7   | 1.1  |
|                               | College graduate              | 427 | 65.8 |
|                               | Master graduate               | 27  | 4.2  |
|                               | PhD graduate                  | 4   | 0.6  |
| Monthly Salary/ Allowance     | <15,000 PHP                   | 265 | 40.8 |
|                               | 15,000–30,000 PHP             | 202 | 31.1 |
|                               | 30,000–45,000 PHP             | 49  | 7.6  |
|                               | 45,000–60,000 PHP             | 32  | 4.9  |
|                               | 60,000–75,000 PHP             | 18  | 2.8  |
|                               | >75,000 PHP                   | 83  | 12.8 |
| Enrolled in health insurance? | Yes                           | 369 | 56.9 |
|                               | No                            | 280 | 43.1 |

**Table 3**

The constructs and measurement items.

| Construct                    | Items | Measures                                                                                           | Supporting References                                                                     |
|------------------------------|-------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Understanding of COVID-19    | U1    | I do understand the transmission of COVID-19                                                       | Liu (2020); Shim et al. (2020); Nicola et al. (2020)<br>Coccia (2020)<br>Li et al. (2020) |
|                              | U2    | I do understand the incubation period of COVID -19                                                 |                                                                                           |
|                              | U3    | I do understand the symptoms of COVID -19                                                          |                                                                                           |
|                              | U4    | I do understand the protocol if I have symptoms that might lead to COVID-19                        |                                                                                           |
| Perceived Vulnerability      | U5    | I do understand which hospital can treat COVID -19 patients.                                       | Nicola et al. (2020)                                                                      |
|                              | PV1   | I think I am very vulnerable to COVID -19.                                                         | Díaz et al. (2016)                                                                        |
|                              | PV2   | I think my neighborhood is very vulnerable to COVID -19.                                           | Coccia (2020)                                                                             |
|                              | PV3   | My past experiences make me believe that I am likely to get sick when my friends are sick.         | Díaz et al. (2016)                                                                        |
| Perceived Severity           | PV4   | I have a history of susceptibility to infectious diseases.                                         | Díaz et al. (2016)                                                                        |
|                              | PV5   | I think there is a chance that my family will be infected by COVID -19                             | Nicola et al. (2020); Coccia (2020)                                                       |
|                              | PS1   | I find COVID -19 is a serious disease.                                                             | Paital et al. (2020); Basheti et al. (2020)                                               |
|                              | PS2   | I find COVID -19 can lead to death.                                                                | Barati et al. (2020)                                                                      |
|                              | PS3   | I find COVID -19 is more severe than any other disease.                                            | Barati et al. (2020)                                                                      |
|                              | PS4   | I find COVID -19 can affect mental health.                                                         | Burgelt et al. (2009); Tanoue et al. (2020); Grover et al. (2020)                         |
|                              | PS5   | I think it's very expensive to pay the medical expenses for COVID -19.                             |                                                                                           |
|                              | PS6   | I think the COVID -19 outbreak will continue at least until the following 3 months.                | Cássaro and Pires (2020)                                                                  |
| Attitude                     | PS7   | I think the COVID-19 outbreak in my country is more severe than in other countries.                |                                                                                           |
|                              | AT1   | I worry about the number of people infected by COVID -19.                                          | Sarkodie and Owusu (2020); Mi et al. (2020)                                               |
|                              | AT2   | I feel stressed during the COVID-19 outbreak.                                                      | Shader (2020)                                                                             |
|                              | AT3   | I am afraid that one of my family members will get infected.                                       | Dariya and Nagaraju (2020)                                                                |
|                              | AT4   | I feel anxious during COVID -19 outbreak.                                                          | Roy et al. (2020)                                                                         |
|                              | AT5   | I feel insecure if someone stands too close to me during COVID -19 outbreak.                       | Roy et al. (2020)                                                                         |
| Subjective Norm              | AT6   | I feel insecure if someone is not wearing a mask during the COVID-19 outbreak.                     | D'Amours (2020)                                                                           |
|                              | AT7   | I feel insecure if someone sneezes or coughs next to me.                                           | Centers for Diseases Control and Prevention (2020)                                        |
|                              | SN1   | Most people I know are following the preventive protocols given by the government.                 | Centers for Diseases Control and Prevention (2020)                                        |
|                              | SN2   | Most people I know are wearing face masks outside.                                                 | Conner (2020); Rubio-Romero et al. (2020)                                                 |
|                              | SN3   | Most people I know are staying at home and work from home.                                         | Yancey-Bragg and Bravo (2020)                                                             |
| Perceived Behavioral Control | SN4   | Most people I know are using hand sanitizer                                                        | USA Food and Drug Administration (2020)                                                   |
|                              | SN5   | Most people I know, are doing physical distancing.                                                 | Adam (2020)                                                                               |
|                              | PBC1  | The preventive protocols are completely up to me.                                                  | Sato (2018)                                                                               |
|                              | PBC2  | I think preventive protocols are easy to be implemented.                                           | Shen et al. (2020)                                                                        |
| Intention to Follow          | PBC3  | I am confident that I can prevent getting infected by COVID -19.                                   | Veldhuijzen et al. (2006)                                                                 |
|                              | PBC4  | I am confident that I have enough knowledge about COVID -19.                                       | Barati et al. (2020)                                                                      |
|                              | IF1   | I am willing to follow the recommended precautions until the end of the COVID-19 outbreak.         | Barati et al. (2020)                                                                      |
|                              | IF2   | I am willing to stay at home during COVID -19 outbreak.                                            | Sen-Crowe et al. (2020)                                                                   |
| Actual Behavior              | IF3   | I am willing to follow every rule made by my government during the COVID-19 outbreak.              | Oyeniran and Chia (2020)                                                                  |
|                              | IF4   | I am willing to reschedule my travel plans.                                                        | Lee et al. (2020); World Health Organization (2020a; World Health Organization (2020b)    |
|                              | IF5   | I am willing to follow my government to lock down the country, city, and community.                | University of Michigan School of Public Health (2020)                                     |
|                              | AB1   | I am practicing proper handwashing to prevent the spread of the virus.                             | UNICEF (2020); Luo et al. (2020)                                                          |
|                              | AB2   | I use hand sanitizer more often during the COVID-19 outbreak.                                      | Pradhan et al. (2020)                                                                     |
|                              | AB3   | I always wash my hands whenever I go outside.                                                      | New Zealand Government (2020)                                                             |
| Adapted Behavior             | AB4   | I practice 1-meter social distancing to reduce unnecessary infections.                             | Wu and Mcgoogan (2020)                                                                    |
|                              | AB5   | The company/school where I work/study implements work from home to prevent the spread of COVID-19. | Public Health of England (2020)                                                           |
|                              | AB6   | I always wear a face mask whenever I go outside during the COVID-19 outbreak.                      | Shaw et al. (2020)                                                                        |
|                              | AB7   | I always dispose of my face mask properly.                                                         | Feng et al. (2020)                                                                        |
|                              | AD1   | I maintain a healthy lifestyle during the COVID-19 outbreak.                                       | FAO (2020)                                                                                |
|                              | AD2   | I keep working from home during the COVID-19 outbreak.                                             | Gorlick (2020)                                                                            |
| Perceived Effectiveness      | AD3   | I don't smoke during the COVID-19 outbreak.                                                        | Taghizadeh-Hesary and Akbari (2020)                                                       |
|                              | AD4   | I don't drink alcohol during the COVID-19 outbreak.                                                | Feuer (2020)                                                                              |
|                              | AD5   | I sleep at least 7 h per day during the COVID-19 outbreak.                                         | Medalie (2020)                                                                            |
|                              | PE1   | I think the preventive protocols for the COVID-19 outbreak in my country are effective.            | WHO (2020a)                                                                               |
|                              | PE2   | I think the preventive protocols for the COVID-19 outbreak in my community are informative.        | WHO (2020b)                                                                               |
|                              | PE3   | I think a healthy lifestyle will enhance my immunity.                                              | Rula (2020)                                                                               |
|                              | PE4   | I think social distancing can prevent the transmission of COVID-19.                                | Matrajt and Leung (2020)                                                                  |
|                              | PE5   | I think a face mask can prevent the transmission of COVID-19.                                      | Geggel (2020)                                                                             |
|                              | PE6   | I think proper hygiene can prevent the transmission of COVID-19.                                   | Centers for Diseases Control and Prevention (2020)                                        |
|                              | PE7   | I think lockdown is an effective way to prevent COVID-19.                                          | Sasikumar (2020)                                                                          |

behavior. For example, in a study of social activism, only those who perceived their actions as effective, acted on their beliefs (Hinkle et al., 1996). Hence, we hypothesized the following:

**H17.** Actual behavior had a significant direct effect on the perceived effectiveness of COVID-19 preventive measures implemented in Luzon, Philippines.

**H18.** Adapted behavior had a significant direct effect on the perceived effectiveness of COVID-19 preventive measures implemented in Luzon, Philippines.

## Methodology

### Participants

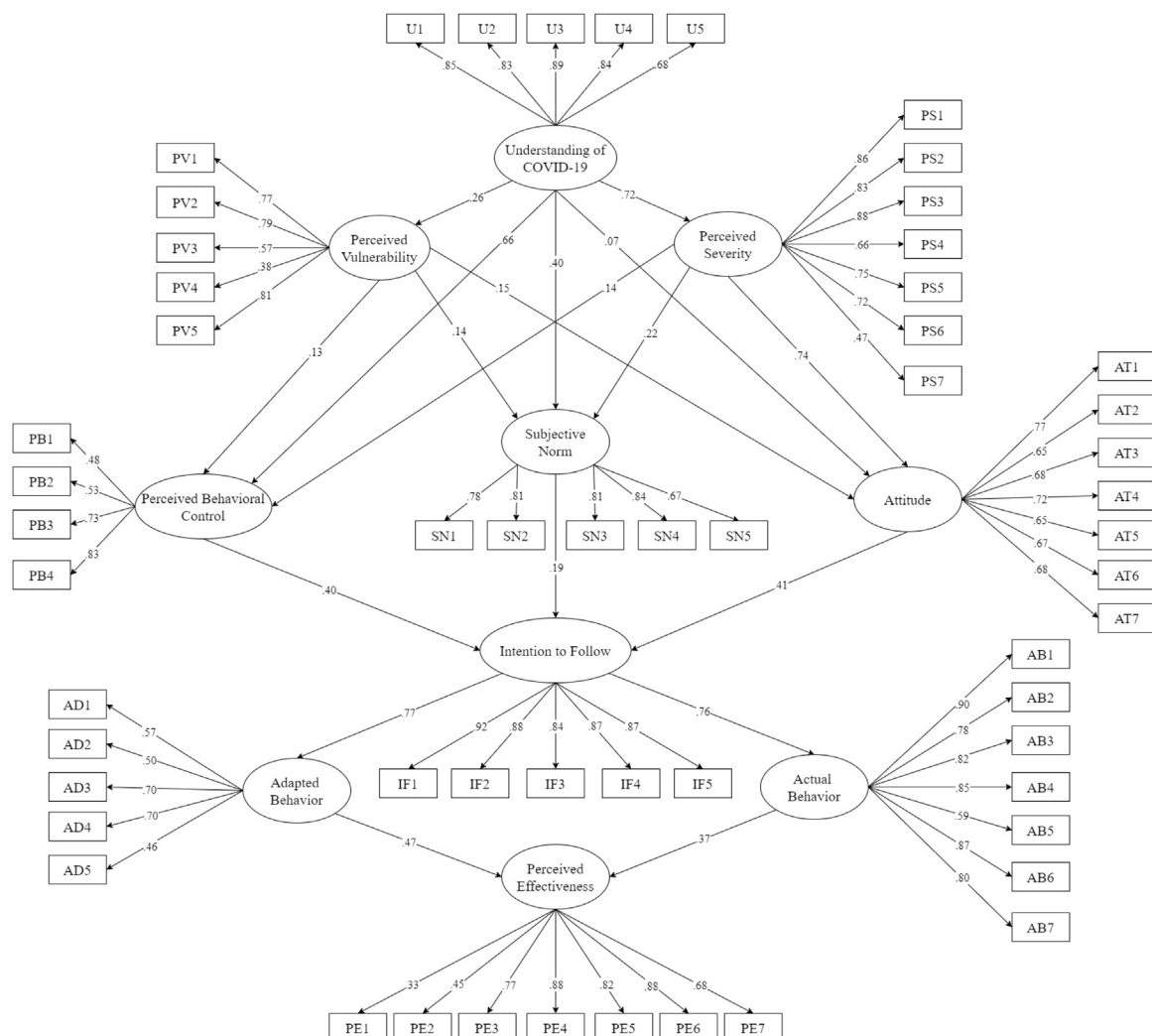
The current study utilized a cross-sectional design. An online questionnaire was distributed from May 7 to May 11, 2020, since it was not possible to do a community-based sampling during ECQ in Luzon, Philippines. A total of 649 Filipinos between 15–75 years old (mean: 27.76; standard deviation: 10.64) answered the online questionnaire, which contained 63 questions.

Table 2 represents the descriptive statistics of the respondents. Among the 649 respondents, 57% of them were female, and 43% were male. Most respondents were between 15–24 years of

age (60.9%). About 18.2% of the respondents were between the ages of 25 and 34, 10.8% were between 35 and 44 years, 6.6% were between 45 and 54 years, 2.9% were between 55 and 64 years, and only 0.6% were over 64 years. Approximately 1.2% of the respondents were elementary school graduates, 18.2% were high school graduates, 8.9% were college graduates, 4.2% were master graduates, and only 0.6% were doctoral graduates. Most of the respondents have a monthly salary/allowance of less than PHP15,000 (40.8%). About 31.1% of the respondents have a monthly salary/allowance of PHP15,000–PHP30,000, 7.6% of them have a monthly salary/allowance of PHP30,000–PHP45,000, 4.9% have a salary/allowance of PHP45,000–PHP60,000 monthly, 2.8% have a monthly salary/allowance of PHP60,000–PHP75,000, and 12.8% of the respondents have a salary/allowance of more than PHP75,000 monthly. Most respondents answered that they are currently enrolled in health insurance (56.9%), while only 43.1% were not.

### Questionnaire

Following our theoretical framework, a self-administered questionnaire was developed for this study to evaluate factors affecting the perceived effectiveness of COVID-19 prevention measures during the ECQ in Luzon, Philippines (Table 3). The questionnaire consists of eleven sections: (1) Demographic



**Figure 3.** Initial SEM with indicators for evaluating the perceived effectiveness of COVID-19 prevention measures during ECQ in Luzon, Philippines.

Information (gender, age, educational attainment, monthly income/allowance, and health insurance), (2) Perceived Vulnerability, (3) Perceived Severity, (4) Understanding of COVID-19, (5) Attitude, (6) Subjective Norm, (7) Perceived Behavioral Control, (8) Intention to Follow, (9) Actual Behavior, (10) Adapted behavior, and (11) Perceived Effectiveness. All latent constructs included in the SEM were measured by utilizing a 5-point Likert scale.

### Structural Equation Modeling

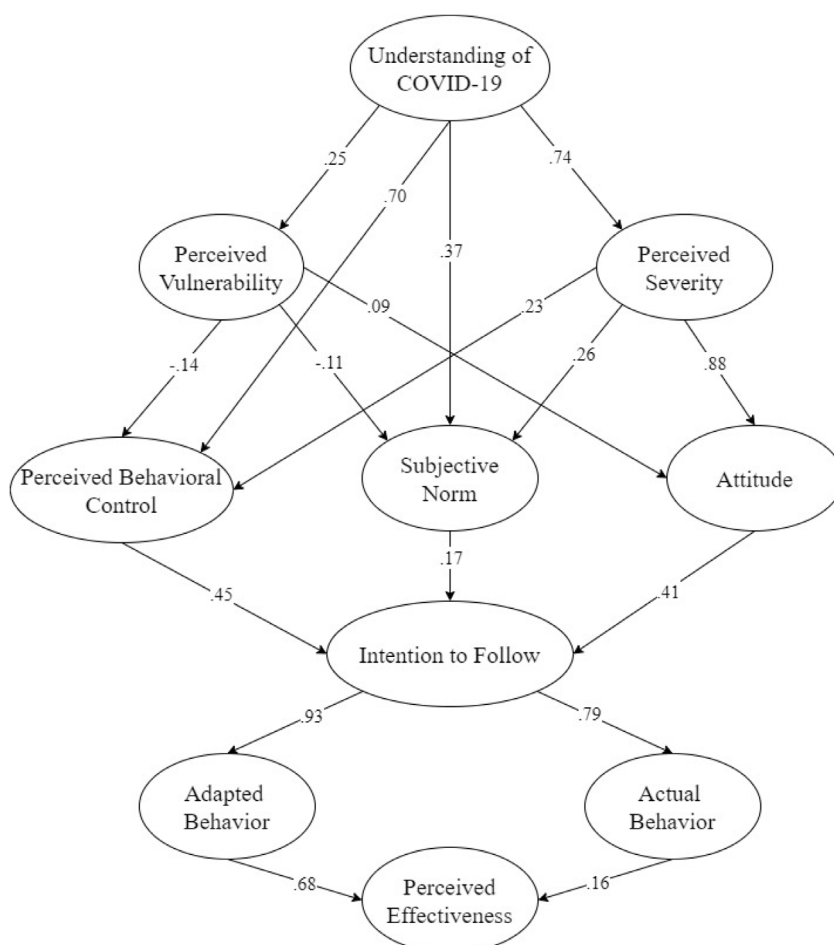
Structural Equation Modeling (SEM) is an advanced statistical approach mainly designed to describe causal relationships between the latent variables construct (Hair, 2010; Martinez et al., 2019; Torres et al., 2019). AMOS 22 with the Maximum Likelihood estimation approach was utilized to run the SEM. Figure 3 demonstrates that the SEM construct had ten latent variables with one exogenous latent variable (Understanding of COVID-19) and nine endogenous latent variables (Perceived Vulnerability, Perceived Severity, Perceived Behavioral Control, Subjective Norm, Intention to Follow, Adapted Behavior, Actual Behavior, and Perceived Effectiveness).

Following some previous studies (Chin et al., 2018; Lin et al., 2017; Nadlifatin et al., 2016), six sets of measurements were used to analyze the model's fit: Incremental Fit Index (IFI), Tucker Lewis Index (TLI), Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), and Root Mean Square Error of Approximation (RMSEA). For IFI, TLI, and CFI, a value greater than 0.90 indicates a good model fit (Hair, 2010; Hu and

Bentler, 1999). Similar to  $R^2$  in the multiple linear regression (Lin et al., 2019a), a value greater than 0.80 is the minimum indication of a good model fit for GFI and AGFI (Gefen et al., 2000). Finally, a value smaller than 0.07 is also an indication of a good model fit for RMSEA (Steiger, 2007).

### Results

Figure 3 demonstrates the initial SEM for evaluating the perceived effectiveness of COVID-19 prevention measures among Filipinos during ECQ in Luzon, Philippines. According to the figure below, one hypothesis was not significant: Understanding of COVID-19 to Attitude (Hypothesis 5). Therefore, a revised SEM was derived by removing this hypothesis. Following some of our previous studies that utilized the SEM approach (Lin et al., 2018, 2019b; Miraja et al., 2019), some modification indices were applied to enhance the model fit. Figure 4 demonstrates the final SEM for evaluating the perceived effectiveness of COVID-19 prevention measures during ECQ in Luzon, Philippines, and Table 4 demonstrates the descriptive statistic results of each indicator. As presented in Table 5, the IFI, TLI, and CFI values were greater than the suggested cutoff of 0.90, indicating that the specified model's hypothesized construct was an excellent representation of the observed data. In addition, the GFI and AGFI values were 0.842 and 0.820, respectively, indicating that the model was also good. The RMSEA value was 0.044, which is also lower than the recommended value. Finally, the direct, indirect, and total effects are presented in Table 6.



**Figure 4.** The Final SEM for evaluating the perceived effectiveness of COVID-19 prevention measures during ECQ in Luzon, Philippines.

**Table 4**  
Descriptive statistic results.

| Factor                       | Item | Mean | StDev | Factor Loading |             |
|------------------------------|------|------|-------|----------------|-------------|
|                              |      |      |       | Initial Model  | Final Model |
| Understanding of COVID-19    | U1   | 4.30 | 0.80  | 0.85           | 0.87        |
|                              | U2   | 4.20 | 0.81  | 0.83           | 0.80        |
|                              | U3   | 4.30 | 0.74  | 0.89           | 0.88        |
|                              | U4   | 4.28 | 0.75  | 0.84           | 0.86        |
|                              | U5   | 3.90 | 0.95  | 0.68           | 0.69        |
| Perceived Vulnerability      | PV1  | 3.08 | 1.05  | 0.77           | 0.68        |
|                              | PV2  | 3.28 | 1.03  | 0.79           | 0.64        |
|                              | PV3  | 2.89 | 1.13  | 0.57           | 0.58        |
|                              | PV4  | 2.23 | 1.09  | 0.38           | 0.41        |
|                              | PV5  | 2.85 | 1.15  | 0.81           | 0.67        |
| Perceived Severity           | PS1  | 4.60 | 0.73  | 0.86           | 0.87        |
|                              | PS2  | 4.42 | 0.79  | 0.83           | 0.80        |
|                              | PS3  | 3.84 | 1.00  | 0.88           | 0.55        |
|                              | PS4  | 4.14 | 0.90  | 0.66           | 0.64        |
|                              | PS5  | 4.38 | 0.88  | 0.75           | 0.72        |
| Attitude                     | PS6  | 4.26 | 0.85  | 0.72           | 0.71        |
|                              | PS7  | 3.66 | 1.12  | 0.47           | 0.42        |
|                              | AT1  | 4.34 | 0.84  | 0.77           | 0.84        |
|                              | AT2  | 3.81 | 0.94  | 0.65           | 0.57        |
|                              | AT3  | 4.16 | 0.98  | 0.68           | 0.66        |
| Subjective Norm              | AT4  | 3.88 | 0.96  | 0.72           | 0.62        |
|                              | AT5  | 3.85 | 0.97  | 0.65           | 0.52        |
|                              | AT6  | 4.03 | 0.94  | 0.67           | 0.57        |
|                              | AT7  | 4.20 | 0.91  | 0.68           | 0.62        |
|                              | SN1  | 3.91 | 0.91  | 0.78           | 0.79        |
| Perceived Behavioral Control | SN2  | 4.14 | 0.86  | 0.81           | 0.82        |
|                              | SN3  | 4.08 | 0.89  | 0.81           | 0.81        |
|                              | SN4  | 4.00 | 0.90  | 0.84           | 0.82        |
|                              | SN5  | 3.86 | 0.97  | 0.67           | 0.80        |
|                              | PBC1 | 3.79 | 1.15  | 0.48           | 0.45        |
| Intention to Follow          | PBC2 | 3.61 | 1.04  | 0.53           | 0.41        |
|                              | PBC3 | 3.87 | 0.93  | 0.73           | 0.56        |
|                              | PBC4 | 4.06 | 0.81  | 0.83           | 0.75        |
|                              | IF1  | 4.51 | 0.74  | 0.92           | 0.91        |
|                              | IF2  | 4.43 | 0.80  | 0.88           | 0.84        |
| Actual Behavior              | IF3  | 4.33 | 0.87  | 0.84           | 0.79        |
|                              | IF4  | 4.53 | 0.77  | 0.87           | 0.87        |
|                              | IF5  | 4.40 | 0.84  | 0.87           | 0.82        |
|                              | AB1  | 4.47 | 0.77  | 0.90           | 0.91        |
|                              | AB2  | 4.35 | 0.85  | 0.78           | 0.79        |
| Adapted Behavior             | AB3  | 4.51 | 0.75  | 0.82           | 0.92        |
|                              | AB4  | 4.39 | 0.79  | 0.85           | 0.84        |
|                              | AB5  | 4.31 | 1.01  | 0.59           | 0.61        |
|                              | AB6  | 4.55 | 0.77  | 0.87           | 0.90        |
|                              | AB7  | 4.39 | 0.83  | 0.80           | 0.79        |
| Perceived Effectiveness      | AD1  | 3.98 | 0.95  | 0.57           | 0.54        |
|                              | AD2  | 3.95 | 1.12  | 0.50           | 0.59        |
|                              | AD3  | 4.48 | 0.99  | 0.70           | 0.56        |
|                              | AD4  | 4.43 | 0.98  | 0.70           | 0.57        |
|                              | AD5  | 3.79 | 1.16  | 0.46           | 0.35        |
|                              | PE1  | 3.09 | 1.17  | 0.33           | 0.29        |
|                              | PE2  | 3.41 | 1.05  | 0.45           | 0.41        |
|                              | PE3  | 4.31 | 0.81  | 0.77           | 0.85        |
|                              | PE4  | 4.27 | 0.83  | 0.88           | 0.82        |
|                              | PE5  | 4.15 | 0.87  | 0.82           | 0.77        |
|                              | PE6  | 4.44 | 0.78  | 0.88           | 0.94        |
|                              | PE7  | 4.11 | 0.99  | 0.68           | 0.71        |

**Table 5**  
Model Fit.

| Goodness of fit measures of the SEM             | Parameter Estimates | Minimum cutoff | Suggested by          |
|-------------------------------------------------|---------------------|----------------|-----------------------|
| Incremental Fit Index (IFI)                     | 0.928               | >0.90          | Hair (2010)           |
| Tucker Lewis Index (TLI)                        | 0.920               | >0.90          | Hu and Bentler (1999) |
| Comparative Fit Index (CFI)                     | 0.927               | >0.90          | Hair (2010)           |
| Goodness of Fit Index (GFI)                     | 0.842               | >0.80          | Gefen et al. (2000)   |
| Adjusted Goodness of Fit Index (AGFI)           | 0.820               | >0.80          | Gefen et al. (2000)   |
| Root Mean Square Error of Approximation (RMSEA) | 0.044               | <0.07          | Steiger (2007)        |

## Discussion

The current study integrated Protection Motivation Theory (PMT) and extended Theory of Planned Behavior (TPB) to evaluate factors affecting the perceived effectiveness of COVID-19 prevention measures among Filipinos during Enhanced Community Quarantine (ECQ) in Luzon, Philippines. SEM was utilized to analyze the interrelationship among understanding of COVID-19 (U), perceived vulnerability (PV), perceived severity (PS), attitude (AT), subjective norm (SBN), perceived behavioral control (PBC), intention to follow (IF), actual behavior (AB), adapted behavior (AD), and perceived effectiveness (PE). An online questionnaire was utilized and a total of 649 data samples were collected.

SEM indicated that understanding of COVID-19 had significant direct effects on PV ( $\beta:0.247$ ,  $p = 0.001$ ) and PS ( $\beta:0.739$ ,  $p = 0.001$ ). [Khosravi \(2020\)](#) stated that the public's assessment of the disease's danger is influenced by their understanding of a specific health hazard by perceived severity and vulnerability. Understanding of COVID-19, which is related to the transmission and incubation periods of the virus, the protocol when they catch symptoms that may lead to COVID-19, and the hospitals which can treat COVID-19 patients, would positively affect the perceived vulnerability and perceived severity. However, [Reuben et al. \(2020\)](#) mentioned in their study that under-privileged people and vulnerable people, especially the older adults, unemployed, illiterates, farmers, rural and semi-urban residents, are more likely to have poor knowledge about the COVID-19 due to limited or no access to gadgets and the internet. Hence, policymakers have to make sure that the community fully understands the virus and its symptoms as it can also enhance the perceived vulnerability and perceived severity of the disease.

As discussed before, the current study integrated the extended TPB wherein it was classified into three elements, perceived behavioral control (PB), subjective norm (SN), and attitude (AT). Based on the results, it proved that understanding of COVID-19 had significant direct effects on SN ( $\beta:0.366$ ;  $p = 0.001$ ) and PBC ( $\beta:0.700$ ;  $p = 0.001$ ). It could be interpreted that people can understand the virus if they are surrounded by people who are following the preventive protocols given by the government, such as wearing face masks outside, staying and working from home, using a hand sanitizer frequently, and practicing social distancing during the outbreak. Moreover, people are more confident if they understand the symptoms of COVID-19. Apart from the significant direct effects, the current model surprisingly showed that understanding COVID-19 had no significant direct effect on attitude, but it was found to have a significant indirect effect.

Regarding the perceived vulnerability, SEM indicated that PV had significant negative effects on PBC ( $\beta:-0.136$ ;  $p = 0.009$ ) and SN ( $\beta:-0.111$ ;  $p = 0.033$ ). It could be considered that individuals who are confident with their knowledge about COVID-19 and are surrounded by a community that is aware of a healthy lifestyle are most likely to think they are not vulnerable to the disease. Meanwhile, PV had a significant effect on AT ( $\beta:0.092$ ,  $p = 0.018$ ), which supports the claim of [Prokop and Kubiattko \(2014\)](#) that

**Table 6**

Direct effect, indirect effect, and total effect.

| No | Variables | Direct effect | P-value | Indirect effect | P-value | Total effect | P-value |
|----|-----------|---------------|---------|-----------------|---------|--------------|---------|
| 1  | U → PS    | 0.739         | 0.001   | –               | –       | 0.739        | 0.001   |
| 2  | U → PV    | 0.247         | 0.001   | –               | –       | 0.247        | 0.001   |
| 3  | U → AT    | –             | –       | 0.670           | 0.001   | 0.670        | 0.001   |
| 4  | U → SN    | 0.366         | 0.001   | 0.165           | 0.003   | 0.531        | 0.001   |
| 5  | U → PBC   | 0.700         | 0.001   | 0.137           | 0.066   | 0.837        | 0.001   |
| 5  | U → IF    | –             | –       | 0.746           | 0.001   | 0.746        | 0.001   |
| 6  | U → AB    | –             | –       | 0.593           | 0.001   | 0.593        | 0.001   |
| 7  | U → AD    | –             | –       | 0.692           | 0.001   | 0.692        | 0.001   |
| 8  | U → PE    | –             | –       | 0.567           | 0.001   | 0.567        | 0.001   |
| 9  | PS → AT   | 0.876         | 0.001   | –               | –       | 0.876        | 0.001   |
| 10 | PS → SN   | 0.260         | 0.003   | –               | –       | 0.260        | 0.003   |
| 11 | PS → PBC  | 0.231         | 0.028   | –               | –       | 0.231        | 0.028   |
| 12 | PS → IF   | –             | –       | 0.510           | 0.001   | 0.510        | 0.001   |
| 13 | PS → AB   | –             | –       | 0.405           | 0.001   | 0.405        | 0.001   |
| 14 | PS → AD   | –             | –       | 0.473           | 0.001   | 0.473        | 0.001   |
| 15 | PS → PE   | –             | –       | 0.387           | 0.001   | 0.387        | 0.001   |
| 16 | PV → AT   | 0.092         | 0.018   | –               | –       | 0.092        | 0.018   |
| 17 | PV → SN   | –0.111        | 0.033   | –               | –       | –0.111       | 0.033   |
| 18 | PV → PBC  | –0.136        | 0.009   | –               | –       | –0.136       | 0.009   |
| 19 | PV → IF   | –             | –       | –0.043          | 0.255   | –0.043       | 0.255   |
| 20 | PV → AB   | –             | –       | –0.034          | 0.238   | –0.034       | 0.238   |
| 21 | PV → AD   | –             | –       | –0.040          | 0.248   | –0.040       | 0.248   |
| 22 | PV → PE   | –             | –       | –0.032          | 0.243   | –0.032       | 0.243   |
| 23 | AT → IF   | 0.413         | 0.001   | –               | –       | 0.413        | 0.001   |
| 24 | AT → AB   | –             | –       | 0.328           | 0.001   | 0.328        | 0.001   |
| 25 | AT → AD   | –             | –       | 0.383           | 0.001   | 0.383        | 0.001   |
| 26 | AT → PE   | –             | –       | 0.313           | 0.001   | 0.313        | 0.001   |
| 27 | SBN → IF  | 0.168         | 0.001   | –               | –       | 0.168        | 0.001   |
| 28 | SBN → IF  | –             | –       | 0.134           | 0.001   | 0.134        | 0.001   |
| 29 | SBN → AB  | –             | –       | 0.156           | 0.001   | 0.156        | 0.001   |
| 30 | SBN → AD  | –             | –       | 0.128           | 0.001   | 0.128        | 0.001   |
| 31 | PBC → IF  | 0.454         | 0.001   | –               | –       | 0.454        | 0.001   |
| 32 | PBC → AB  | –             | –       | 0.361           | 0.001   | 0.361        | 0.001   |
| 33 | PBC → AD  | –             | –       | 0.422           | 0.001   | 0.422        | 0.001   |
| 34 | PBC → PE  | –             | –       | 0.345           | 0.001   | 0.345        | 0.001   |
| 35 | IF → AB   | 0.794         | 0.001   | –               | –       | 0.794        | 0.001   |
| 36 | IF → AD   | 0.928         | 0.001   | –               | –       | 0.928        | 0.001   |
| 37 | IF → PE   | –             | –       | 0.759           | 0.001   | 0.759        | 0.001   |
| 38 | AB → PE   | 0.163         | 0.011   | –               | –       | 0.163        | 0.011   |
| 39 | AD → PE   | 0.679         | 0.001   | –               | –       | 0.679        | 0.001   |

perceived vulnerability to disease is positively correlated with attitude. Hence, people who are worried about the number of people infected by COVID-19 are most likely to think they are vulnerable to it. On the other hand, PS was found to have positive effects on PBC ( $\beta$ : 0.231,  $p$  = 0.028), SN ( $\beta$ : 0.260;  $p$  = 0.003), and AT ( $\beta$ : 0.876;  $p$  = 0.001). The result indicates that people who perceived the severity of COVID-19 are more likely to have enough knowledge about the virus. Moreover, an individual who is surrounded by a community that is aware of a healthy lifestyle will help them understand how severe COVID-19 is.

Regarding the intention to follow, the current model proved the Lau et al. (2010) statement that factors derived from the TPB were significantly associated with behavioral intention. The result showed that intention to follow was significantly affected by PBC ( $\beta$ : 0.454;  $p$  = 0.001), SBN ( $\beta$ : 0.168;  $p$  = 0.001), and AT ( $\beta$ : 0.413;  $p$  = 0.001) which has several implications. First, based on PBC, people with enough knowledge are more likely to stay at home and comply with the lockdown implementation of the country, city, and community. In a similar study by Seale et al. (2020), it was observed that strategies implemented by the government to subsidize the outbreak, such as social distancing and lowering the score if people do not fully understand the government strategy, could influence the wellbeing of the community. Second, based on SBN, individuals who are surrounded by people that are frequently using hand sanitizers are more likely to follow the recommended precautions during the COVID-19 outbreak. Lastly, based on AT, people who are worried about the number of infected people are

most likely to follow every rule implemented by the government during the outbreak.

Meanwhile, it was found that the intention to follow had significant effects on AB ( $\beta$ : 0.794;  $p$  = 0.001) and AD ( $\beta$ : 0.928;  $p$  = 0.001). The result implies that the people's willingness to follow leads to a healthy behavior towards the recommended precautions. In addition, intention to follow tends to affect a few implications, such as proper hygiene and a healthy lifestyle. People are more likely to wash their hands, wear face masks, and avoid activities that would affect their immunity during the COVID-19 outbreak.

Subsequently, the results showed that AB was found to have a significant effect on PE ( $\beta$ : 0.163;  $p$  = 0.001). These make an implication that proper hand washing, use of microbial solutions, and social distancing would enhance the PE. Policymakers should implement these to create awareness and to prevent panic within the community (Balkhy et al., 2010). On the other hand, the SEM showed that AD would have a significant effect on PE ( $\beta$ : 0.679;  $p$  = 0.001). The SEM indicated that a healthy lifestyle of people would help to achieve PE by increasing their immunity to avoid the transmission of the disease. Finally, the results imply that a healthy lifestyle, social distancing, face mask, proper hygiene, and lockdown would enhance the perceived effectiveness of COVID-19 preventive measures.

Surprisingly, the Understanding of COVID-19 had a significant indirect effect on perceived effectiveness ( $\beta$ : 0.567;  $p$  = 0.001). Educating the community, particularly concerning the transmission period, the incubation period, the symptoms, the protocol if

they have the symptoms, and the hospital that can treat COVID-19 would significantly lead to the perceived effectiveness of the prevention measures. Our results proved that the government and other stakeholders really need to educate the community about COVID-19, including the prevention measures.

In the Philippines, there are different quarantine levels that Inter-Agency Task Force for the Management of Emerging Infectious Diseases (IATF-EID) recommended; these are Enhanced Community Quarantine (ECQ), Modified Enhanced Community Quarantine (MECQ) for high-risk areas, and General Community Quarantine (GCQ) for moderate risk areas (Ranada, 2020). Cities such as Metro Manila, Laguna, and Cebu City were placed under MECQ from May 16 until May 31, 2020. MECQ, as defined by the IATF-EID, is the transition phase between ECQ and GCQ. During this phase, residents are still required to follow the government's implemented protocol, especially staying at home for people who are considered vulnerable and transmitters. Currently, some regions (e.g., Region II, Region III, Region IV, NCR) and provinces (e.g., Albay and Pangasinan) in Luzon are placed under GCQ, which has more relaxed measures compared to MECQ (GOVPH, 2020). The difference between GCQ and MECQ is that during the GCQ, transportation, excluding the jeepneys and buses, is now allowed but not at full capacity in compliance with strict social distancing. All industries and businesses are allowed to operate up to 75% and must follow strict protocols. Although our study was conducted during ECQ, our results are still valid during MECQ, and GCQ since the implemented preventive measures of the government are still in effect.

Despite the clear and substantial contributions, the authors would like to acknowledge several limitations of this study. First, the current study was mainly focused on perceived effectiveness rather than measuring the effectiveness of prevention measures themselves. A future study to correlate the perceived effectiveness and the number of cases would be a very promising topic. Second, our sample was collected through an online questionnaire. Future research to collect more samples in the community after ECQ would lead to more comprehensive results. Last but not least, we did not correlate the power of the media to the understanding of COVID-19. Future studies should also incorporate people's trust in information and outcome expectations as one of the essential predictors of behavioral intention to follow.

## Conclusion

The COVID-19 pandemic is a global crisis in 2020. It has grown extensively to infect 10,185,374 people worldwide, with 503,862 deaths as of June 30, 2020 (WHO, 2020a, b). In the Philippines, there have been 36,438 confirmed cases of the infection and 1255 deaths as of June 29, 2020, leading the government to enact several preventive measures such as ECQ in Luzon. The current study integrated Protection Motivation Theory (PMT) and extended Theory of Planned Behavior (TPB) to evaluate factors affecting the perceived effectiveness of COVID-19 prevention measures among Filipinos during Enhanced Community Quarantine (ECQ) in Luzon, Philippines. A total of 649 Filipinos answered the online questionnaire, which contained 63 questions. The results of Structural Equation Modeling (SEM) indicated that understanding of COVID-19 had significant direct effects on perceived vulnerability and perceived severity. In addition, perceived vulnerability and perceived severity had significant indirect effects on intention to follow. Intention to follow had significant direct effects on actual behavior and adapted behavior, which subsequently leads to perceived effectiveness.

Interestingly, an understanding of COVID-19 was found to have a significant indirect effect on perceived effectiveness. The current study is one of the first studies that analyzed factors affecting the

perceived effectiveness of COVID-19 prevention measures during the global pandemic. Finally, the integrated PMT and extended TPB of this study can be applied and extended to evaluate the perceived effectiveness of COVID-19 measures in other countries that currently dealing with COVID-19 pandemic.

## Conflict of interest

None declared.

## Authors' contributions

YTP, as the first and the corresponding author, was responsible for the paper's conceptualization as well as securing the funding from Mapúa University DRIVE, running SEM in AMOS, and finalizing the manuscript. AMC, LJS, JAS, and JAS designed the framework, collected data, and prepared the manuscript. All authors significantly contributed to the revisions of the manuscript.

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## Ethical approval

Approval was not required.

## Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.ijid.2020.07.074>.

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