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코로나-19 백신 수용의도에 관한 연구: 정서 중심적 대처와 문제 중심적 대처 관점을 중심으로

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Understanding COVID-19 Vaccine Acceptance Intention: An Emotion-focused and Problem-focused Coping Perspective

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ABSTRACT

Purpose: The purpose of this study was to understand an individuals' COVID-19 vaccine acceptance intention during the peak of the pandemic by utilizing the coping theory and technology threat avoidance theory (TTAT) as a framework. Specifically, we focused on understanding how inward and outward emotion-focused coping (EFC), such as psychological distancing and emotional support seeking, affect problem-focused behavior (PFC), which is vaccine acceptance. Furthermore, we investigate how the individuals' cognitive appraisal toward COVID-19, consisted of perceived threat and perceived avoidability act as an antecedent of EFC.

Methods: A PLS-SEM analysis was conducted to find the causal relation between the variables. An online survey was conducted targeting vaccination recipients on April, 2021. Participants were asked about their perception toward the virus, their coping strategy, and vaccine acceptance intention. A total of 186 valid samples were collected and used for the analysis. Furthermore, to analyze the out-of-sample predictive power of the research model and ensure the generalizability of the results, a PLSpredict analysis was conducted.

Results: The results of the PLS-SEM analysis show that perceived threat toward COVID-19 significantly affect an individuals' EFC strategy. Furthermore, both types of inward EFC (psychological distancing, wishful thinking) negatively affected vaccine acceptance intention. On the other hand, emotional support seeking, which is a type of outward EFC, positively affected vaccine acceptance. The result of the PLSpredict analysis confirms the generalizability of the PLS-SEM result.

Conclusion: The results of our study could be utilized to decrease vaccine hesitancy and prevent global pan-

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demics by accelerating and increasing vaccination. Our study provides several meaningful implications to researchers and practitioners regarding vaccine acceptance and threat coping behavior.

Key Words: COVID-19, Coping Theory, Technology Threat Avoidance Theory, Vaccine Hesitancy

1. Introduction

For the past couple years, the Coronavirus Disease 2019 (COVID-19) pandemic has caused global fear and concern due to its high infectivity and lethality. As of March 2023, over 670 million confirmed cases and 6.8 million deaths were reported globally (Johns Hopkins Coronavirus Resource Center, 2023). In order to contain the uncontrollable spread of the virus, the World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), and other public health related organizations developed guidelines providing public health measures, such as social distancing and the use of infected patient transport robots (Jeong et al., 2020; Choi et al., 2023). In the service industry, most firms are switching their service to channels that require no physical contact, also known as untact services (Lee et al., 2022). However, to ensure the safety of the public and put an end to the COVID-19 pandemic, worldwide distribution and acceptance of the COVID-19 vaccine is crucial.

Despite the timely development of vaccines and global efforts to increase vaccination, people were hesitant to take the vaccine, due to its short development time and limited number of clinical trials. This public resistance toward vaccine acceptance is referred to as “vaccine hesitancy” (Dror et al. 2020). According to Lazarus et al. (2021), while countries such as Italy (86.1%) or Brazil (85.4%) showed a relatively high vaccine acceptance rate, France (58.9%) and Russia (56.3%) show a high percentage of the population were reluctant about taking the vaccine.

Increasing vaccine acceptance is crucial in creating herd immunity, which is defined as the indirect protection of susceptible individuals from an infectious disease when a significantly large percentage of the population are immune (Randolph and Barreiro, 2020). While the COVID-19 pandemic has come to an end, efforts to understand vaccine hesitancy must be conducted to prevent similar threats in the future, considering the fact that global pandemics are getting more frequent and severe (Poorolajal, 2021).

Acknowledging the importance of vaccine acceptance, several studies attempted to investigate the factors affecting it. A high percentage of these studies utilized variables from the Protection Motivation Theory or Health Belief Model to identify which factors affect vaccine acceptance (Rogers and Prentice-Dunn, 1997; Strecher and Rosenstock, 1997). However, studies utilizing these theories show inconsistent results regarding the effects of response efficacy, self-efficacy, and perceived cost on health behavior (Liang et al., 2019). This could be because most studies do not consider the emotional coping process of people susceptible to diseases. According to Lazarus and Folkman (1984), how individuals cope with certain stressors could be categorized into two types, problem-focused coping (PFC) and emotion-focused coping (EFC). While PFC has been a topic of interest in vaccine acceptance studies, studies focusing

on the EFC of individuals are still limited. Therefore, this study utilizes the Technology Threat Avoidance Theory (TTAT) proposed by Liang et al. (2019) to consider both the emotional and cognitive aspect about how an individual's perception toward COVID-19 affects their vaccine acceptance intention.

2. Theoretical Background

2.1. Coping Theory

The coping theory was developed to explain how people deal with stressful situations (Lazarus and Folkman, 1984). According to Lazarus and Folkman (1984), people go through two main processes to resolve stressful situations, cognitive appraisal and coping. In the cognitive appraisal stage, individuals assess the amount of damage the stressor might cause to their well-being (Folkman et al., 1986). Assessment of potential damage is usually determined by the perceived threat and avoidability of the stressor (Chen and Liang, 2019).

After the assessment of the situation is complete, people go through the coping process in order to prevent or nullify the negative emotions and stress that may have formed (Ugli and Um, 2023). Coping is defined as the mental and physical effort individuals perform in order to deal with stressful events (Folkman et al., 1986; Huang et al., 2020). Specifically, the coping process is divided into two types: PFC and EFC. PFC is a function-oriented process focusing on identifying and resolving the cause of the stress (Folkman et al., 1986; Liang et al., 2019). For example, installing an antivirus software to prevent damage from security breaches or wearing masks to prevent COVID-19 are typical PFC behavior (Barceló and Sheen, 2020; Gurung et al., 2009). On the other hand, EFC focuses on resolving or controlling the undesirable emotions caused by the stressful situation (Folkman et al., 1986; Liang et al., 2019). Examples of EFC include self-control or positive reappraisal (Folkman et al., 1986). Studies show that both these coping processes are crucial when investigating an individual's coping behavior since they lead to different outcomes (Baker and Berenbaum, 2007; Herman and Tetrick, 2009).

However, although there are several studies dedicated to identifying the predictors of health behavior, only a few of them approach health threats as stressors (Lee-Baggley et al., 2004). Furthermore, studies focusing on how individuals cope with these health threats, especially their EFC, are still lacking (King et al., 2016; Lee-Baggley et al., 2004). Most studies focus only on how the people's appraisal of the situation affects the adoption of specific PFC behavior (e.g., taking medication, wearing masks). Focusing only on the PFC has led to highly inconsistent results across studies on the antecedents of protective health behavior (Liang et al., 2019). For example, while Farooq et al. (2020) concluded that only perceived severity, self-efficacy, and response cost have a significant effect on COVID-19 preventive behavior, Rad et al. (2021) concluded that perceived vulnerability and response cost also play a crucial role in predicting the behavior. This inconsistency has been pointed out by Liang et al. (2019), stating that "It is possible that the missing variable, EFC, has contributed to such inconsistency".

Taking into account the fact that emotions and how people cope with them play a critical role when people deal with health threats such as COVID-19, it is crucial to understand the role of EFC in vaccine acceptance behavior (Arteaga Pérez, 2020). While there are studies, such as Chou and Budenz (2020), that highlight the importance of emotion in COVID-19 vaccine acceptance, they focus on the specific emotion itself, such as fear or anxiety. Our study aims to focus not on the emotion itself, but on how people cope with these emotions and how this coping affects vaccine acceptance intention, thus, providing a more consistent and clear understanding on the antecedents of COVID-19 vaccine acceptance.

2.2. Inward and Outward Emotion-Focused Coping

After the EFC mechanism was first introduced by Folkman et al. (1986), several studies attempted to identify or categorize different types of EFC and its effect on PFC behavior. Some of the most studied types of EFC include psychological distancing, denial, wishful thinking, seeking emotional support, and venting (Austenfeld and Stanton, 2004). However, considering EFC as a single concept has led to inconsistent results across studies, some emphasizing the positive aspects of EFC while others point out the negative (Brown et al., 2005). For example, Rabinowitz and Peirson (2006), focusing on the patient's denial with cancer, claim that EFC has a negative effect on the patient's treatment behavior. On the other hand, Pourfallahi et al. (2020), focusing on emotional support as an EFC, claim that EFC has a positive effect on illness perception among cancer patients.

In this study, to consider both the negative and positive aspects of EFC and present a more consistent result on the effect of EFC on PFC, we categorize EFC into inward EFC and outward EFC as proposed by Liang et al. (2019) in TTAT. Inward EFC refers to emotional regulation aimed to stop negative emotions from being generated (Li and Huang, 2020). Including coping actions such as psychological distancing and wishful thinking, it occurs internally within oneself and is unobservable to others (Liang et al., 2019; Poudel-Tandukar et al., 2020).

Outward EFC, on the other hand, aims to adjust emotional response. Unlike inward EFC, it occurs after negative emotions have been generated and is observable to others. Outward EFC includes emotional support seeking and emotional venting (Mikal et al., 2020). The different nature of these two coping mechanisms could be the reason behind the mixed results on EFC's effect on PFC behavior. According to Liang et al. (2019), categorizing EFC into inward and outward EFC allows for a clearer explanation on the effect of EFC on PFC.

Based on earlier studies on the different types of EFC and its effect on PFC, investigating how an individual's cognitive appraisal of the COVID-19 affects both their inward and outward EFC and its effect on vaccine acceptance (PFC) could provide meaningful implications on increasing vaccine acceptance among the public. Especially, comparing the different effects of inward and outward EFC is crucial to provide a more consistent result and interpretation on the role of EFC. The specific inward and outward EFC strategies and their potential effect on vaccine acceptance intention are presented in the next section.

3. Research Model and Hypotheses

Based on the coping theory and the TTAT, our research model is presented in Figure 1. The research model aims to look at the process from cognitive appraisal to the emotional and problem focused coping behavior. PFC, which in our case is vaccine acceptance intention, is anticipated to be affected by the individual's inward and outward EFC. Furthermore, their appraisal of the COVID-19 is expected to affect the EFC of the individual.

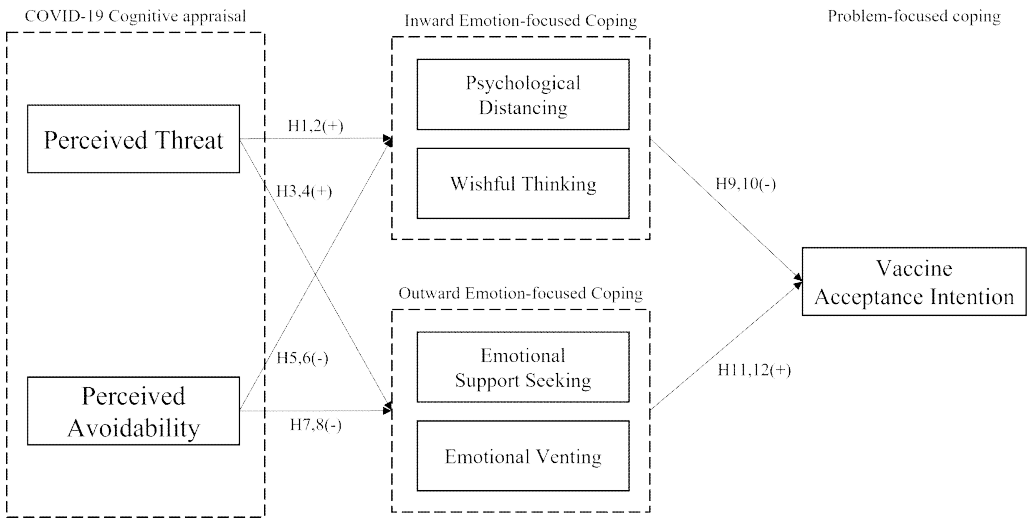

Figure 1. Proposed Research Model

3.1. Cognitive Appraisal and Emotion-Focused Coping

Derived from the protection motivation theory, the TTAT posits that perceived threat and perceived avoidability act as antecedents of EFC (Liang and Xue, 2009). Although it was developed to explain how individuals deal with technology related stresses, its main objective, explaining how individuals prevent or overcome stressful situations using both EFC and PFC, is still valid in the COVID-19 context.

Perceived threat, the first variable in the cognitive appraisal stage, is defined as the degree to which an individual perceives a certain threat, in our case COVID-19, to be harmful to their well-being (Liang and Xue, 2009; Zheng et al., 2021). It is determined by both the severity and susceptibility of the threat perceived by the individual (Ugli and Um, 2023). Prior studies show that higher levels of perceived threat result in negative emotions such as anxiety, anger, fear, or depression (Pérez-Fuentes et al., 2020; Rapee, 1997). This leads individuals to initiate inwards and outwards EFC mechanisms in order to prevent negative emotions from forming (inward EFC) or to adjust these emotions (outward EFC).

As Chou and Budenz (2020) mentioned, negative emotions raised from the pandemic has led to detached or dampened emotional responses to COVID-19. In other words, people emotionally cope with COVID-19

by psychologically distancing themselves from the pandemic or by wishful thinking, which are both examples of inward EFC.

Psychological distancing refers to efforts to psychologically detach oneself from the stressor (Carver et al., 1989). Past studies show that people who feel threatened by a stressor may tend to treat the event as irrelevant to them or to ignore the cause of the stress, preventing any negative emotions from forming (Leviston et al., 2014; Schimel et al., 2000). Wishful thinking refers to an individual's effort to escape from the stressful situation by thinking that some miraculous act will turn things around for the better (Liang et al., 2019). Studies show that for patients suffering from illnesses, such as cancer or AIDS, wishful thinking is one of the most widely adopted coping mechanism (Al-Azri et al., 2009; Varni et al., 2012).

At the same time, people experiencing negative emotions by the pandemic may also depend on outward EFC mechanisms to relieve their stress. Unlike inward EFC, outward EFC is a strategy used to express their feelings to others, vent out their emotions, and receive emotional support (Parlamis, 2012).

Prior studies confirm that emotional venting, which is defined as an individual's effort to emotionally express themselves, have beneficial outcomes, such as emotional recovery, social integration and distress reduction (Nils and Rimé, 2012; Parlamis, 2012; Pirkkalainen et al., 2017). In the health behavior context, patients with type Ⅰ diabetes showed emotional venting, along with humor and self-blame, as a coping mechanism (Tuncay et al., 2008). Similarly, through an experimental study, Stanton et al. (2002) found that cancer patients who expressed their emotions regarding breast cancer showed decreased physical symptoms.

Other than emotional venting people may also seek emotional support as a coping strategy to relieve their stress (Penninx et al., 1998). Emotional support seeking, which refers to the act of an individual with the intent of receiving help from others to effectively cope with emotional distress, has been found to be a useful coping strategy among patients suffering from cancer or other illnesses (Burleson, 2003). Namkoong et al. (2013) concluded that expression of emotions led to increased perceived bonding and positive reframing. Similarly, Kim et al. (2010) found that patients suffering from breast cancer seek social support from others, and that social support had a positive effect on their psychological well-being.

After negative emotions have been already formed due to the COVID-19 pandemic, people are more likely to engage in outward EFC strategies to neutralize and reassess the threat. Therefore, people are more likely to perform outward EFC mechanisms when their perceived threat of the COVID-19 is high.

Based on these prior studies on the effect of perceived threat on inward and outward EFC, the following hypotheses are proposed:

H 1,2. Perceived threat has a positive effect on Inward EFC (Psychological distancing, Wishful thinking)

H 3,4. Perceived threat has a positive effect on Outward EFC (Emotional support seeking, Emotional venting)

Another important factor affecting the cognitive appraisal of COVID-19 is its perceived avoidability. Perceived avoidability is defined as the individual's assessment of the likelihood that they will be able to avoid or prevent the stressful situation, in our case the COVID-19, by taking preventive measures (Liang

and Xue, 2009). Regularly, if the perceived avoidability of the threat is high, it is less likely for people to engage in preventive behavior since they believe they are in control of the situation (Peluso and Pichierri, 2020). In other words, if people feel that they are in control of cause of the stress, they assume that they will not suffer from severe damage or losses.

The relation between perceived avoidability and EFC has been confirmed in several medical studies. Astin et al. (1999) found that breast cancer patients with high levels of sense of control showed the poorest psychosocial adjustment, meaning that they did not actively adopt coping mechanisms. Schulz and Decker (1985) also confirmed that people with high levels of perceived control and avoidability reported higher levels of well-being, which means that they experienced positive emotions rather than negative. On the other hand, when an individual has no control of the situation and is dependent only on the actions of foreign entities, negative emotions may arise (Abraham et al., 2020). Simply put, individuals who regularly exercise, receive medical checkups, and wear masks to prevent COVID-19 will have a sense of control over the situation and show high perceived avoidability levels. These people are less likely to develop negative emotions, and thus less likely to adopt EFC mechanisms. Therefore, we propose the following hypotheses on the relation between perceived avoidability and EFC strategies:

H 5,6. Perceived avoidability has a negative effect on Inward EFC (Psychological distancing, Wishful thinking)

H 7,8. Perceived avoidability has a negative effect on Outward EFC (Emotional support seeking, Emotional venting)

3.2. Impact of Emotion-Focused Coping on Problem-Focused Coping

According to Chen and Liang (2019), EFC both complements and competes with PFC due to its mixed nature. For example, by regaining emotional balance through EFC, people are able to rationally reassess the situation and engage in more rational PFC behavior (Liang et al., 2019). On the other hand, studies including White et al. (2016) suggest that EFC negatively affects PFC among patients suffering from heart disease. To explain this inconsistent result, the TTAT argues that inward and outward EFC each have different effects on PFC (Liang and Xue, 2009).

Inward EFC, composed of psychological distancing and wishful thinking, has been known to cause maladaptive behavior by manipulating the people's evaluation of the threat and thereby, hinder rational behavior (Beaudry and Pinsonneault, 2005; Liang et al., 2019). For example, Völlink et al. (2013) concluded that avoidance coping and optimistic coping worsened depressiveness and health complaints among cyberbullied children. Additionally, Hwang et al. (2018) found that while wishful thinking in patients with chronic kidney disease led to higher life satisfaction, it also was positively correlated with treatment non-adherence.

This shows that while inward EFC could help prevent negative emotions from forming, they also block people from engaging in PFC and fixing the source of the stress. Therefore, we could expect that while inward EFC may be an effective strategy for coping with COVID-19 related stresses, it may have negative

effects on the people's vaccine acceptance intention.

H 9,10. Inward EFC (Psychological distancing, Wishful thinking) has a negative effect on Vaccine acceptance intention

Outward EFC, composed of emotional support seeking and emotional venting, on the other hand, is activated after negative emotions have already formed. This means that outward EFC helps resolve the stress of individuals without manipulating their assessment of the situation.

The positive effect of outward EFC has been confirmed in several studies. In a meta-analysis of literature on medical treatment adherence, DiMatteo (2004) found that both practical and emotional support positively affected the patient's adherence. Specifically, patients who did not received emotional support showed 1.35 higher chances of non-adherence compared to those who did receive emotional support. Scheurer et al. (2012) also confirmed out of 14 observational studies investigating the relation between emotional support and medication adherence, 6 of them supported the relationship. Stickney and Geddes (2014) stated that anger expression is a significant predictor of perceived improvement with problematic settings. Similarly, Smalls et al. (2012) found that emotional expression was positively related to self-care behaviors among type Ⅱ diabetes patients.

Therefore, it is reasonable to hypothesize that people who vent out their emotions toward COVID-19 and seek support from those around them have a higher chance of adhering to the medical advice to accept vaccination.

H 11,12. Outward EFC (Emotional support seeking, Emotional venting) has a positive effect on Vaccine acceptance intention

4. Materials and Methods

4.1. Survey Items

We adopted survey items from studies related to risk perception, coping theory, and TTAT and modified them to fit our research context. The three items to measure perceived threat and perceived avoidability were each adopted from Luo et al. (2021) and Liang et al. (2019) respectively. The three items to measure psychological distancing and the three items to measure wishful thinking were adopted from Liang et al. (2019). The three items to measure emotional support seeking and emotional venting were also adopted from Liang et al. (2019). Finally, the three items to measure vaccine acceptance intention were adopted from Ling et al. (2019). All items were measured based on a 5-point Likert scale, ranging from 1 for "strongly disagree" to 5 for "strongly agree." The survey items are presented below in Table 1.

Table 1. Survey Questionnaire

Variable	Measurement Item
Perceived Threat	PT1. I believe that COVID-19 is a deadly disease.
	PT2. I believe that COVID-19 can cause severe health problems.
	PT3. I believe that COVID-19 is a serious threat to my health.
Perceived Avoidability	PA1. Taking everything into consideration (effectiveness of counter measures, costs, etc.), I believe COVID-19 could be prevented.
	PA2. Taking everything into consideration (effectiveness of counter measures, costs, etc.), I believe I could protect myself from COVID-19
	PA3. Taking everything into consideration (effectiveness of counter measures, costs, etc.), I believe COVID-19 is avoidable.
Psychological distancing	PD1. Regarding COVID-19, I tried not to get too serious about it.
	PD2. Regarding COVID-19, I tried not to think about it too much.
	PD3. Regarding COVID-19, I tried to forget it as much as I can.
Wishful thinking	WT1. Regarding COVID-19, I fantasized that it would go away or somehow be over with.
	WT2. Regarding COVID-19, I fantasized that I would somehow come across a magical solution for it.
	WT3. Regarding COVID-19, I fantasized that everything turns out just fine as if nothing happened.
Emotional support seeking	ES1. Regarding COVID-19, I talked to someone about how I feel.
	ES2. Regarding COVID-19, I tried to get emotional support from friends or relatives.
	ES3. Regarding COVID-19, I tried to get comfort and understanding from someone.
Emotional venting	EV1. Regarding COVID-19, I got upset and let my emotions out.
	EV2. Regarding COVID-19, I said things to let my unpleasant feelings escape.
	EV3. Regarding COVID-19, I got upset and was aware of it.
Vaccine acceptance intention	VI1. I intend to take COVID-19 vaccination according to the vaccination schedule.
	VI2. I intend to take COVID-19 vaccination as soon as possible.
	VI3. I expect to take COVID-19 vaccination within this year.

4.2. Data Collection

An online survey was distributed and collected from April, 2021 via Macromill Embrain, one of the largest online research company in Asia with over 3 million panelists. All respondents provided written informed consent to participate, and the survey was conducted with full anonymity for all participants. Since the authorization of RNA vaccines were granted in December, 2020 and distributed in January, 2021 in Korea, many were still hesitant of taking the vaccine when the survey was conducted, making it an appropriate time for the research. Furthermore, because the vaccine was only targeted to those over the age of

18, all respondents were over the age of 20.

After eliminating 14 responses with insincere responses (e.g., same response for all items, incomplete response), a total of 186 samples were used for the final analysis, resulting in a 93% response rate, which meets the required criteria of 80% (Fincham, 2008). This fits the recommended ratio of number of items and respondents, which is between 1:4 and 1:10 (Chatterjee et al., 2022). The demographic characteristics of the respondents are presented in Table 2.

Table 2. Demographic Characteristics of Respondents

	Classification	Frequency (N=186)	Percentage (%)
Gender	Male	91	48.9
	Female	95	51.1
Age	20s	26	14.0
	30s	32	17.2
	40s	35	18.8
	50s	48	25.8
	60 and over	45	24.2
Marital status	Single	71	38.2
	Married	111	59.7
	Other	4	2.2
Educational level	Less than high school	2	1.1
	High school diploma	30	16.1
	Attending university	11	5.9
	Bachelor's degree	122	65.6
	Attending graduate school	1	0.5
	Master's degree/PhD	20	10.8

5. Results

The survey was analyzed using partial least squares structural equation modeling (PLS-SEM) via SmartPLS 4. PLS-SEM offers several benefits compared to traditional analysis methods. It allows the evaluation of measurement errors and can predict latent variables using observable data. Moreover, it effectively examines the causal connections among multiple intricate variables. Additionally, PLS-SEM shows higher robustness compared to other methods when dealing with non-normally distributed data, which is common in survey-based datasets. Conversely, the CB-SEM approach may show abnormal results when the dataset is small in size (Hair et al., 2019).

According to Hair et al. (2019), other than the hypotheses testing, there are two major steps to confirm the validity of the PLS-SEM result: (1) measurement model testing: consisted of indicator loadings, internal consistency reliability, convergent validity, and discriminant validity and (2) structural model testing: consisted of collinearity (VIF), R^2 value, and Q^2 value. Thus, the following results are presented based on the guidelines presented by Hair et al. (2019).

5.1. Measurement Model Testing

To confirm the validity of the measurement items, the followings criteria must be met: (1) the factor loadings of the survey items exceed 0.7 (indicator loading), (2) the average variance extracted (AVE) of the constructs exceed 0.5 (internal consistency reliability), (3) the composite reliability (CR) and Cronbach's α exceed 0.7 (convergent validity), and (4) the heterotrait-monotrait ratio of the correlations (HTMT) is lower than 0.9 (discriminant validity) (Hair et al., 2019).

As shown below in Table 3 and Table 4, all the values met the required criteria, thus confirming the validity of the measurement model.

Table 3. Measurement Model Validity Testing Results (Factor loadings, AVE, CR, Cronbach's α)

Variable	Factor loadings	AVE	CR	Cronbach's α
Perceived Threat	0.874, 0.849, 0.835	0.727	0.889	0.815
Perceived Avoidability	0.927, 0.890, 0.890	0.814	0.929	0.887
Psychological Distancing	0.887, 0.895, 0.886	0.790	0.919	0.868
Wishful Thinking	0.816, 0.845, 0.877	0.716	0.883	0.803
Emotional Support Seeking	0.905, 0.853, 0.899	0.785	0.916	0.864
Emotional Venting	0.944, 0.892, 0.932	0.852	0.945	0.914
Vaccine Acceptance Intention	0.885, 0.910, 0.883	0.797	0.922	0.873

Table 4. Measurement Model Validity Testing Results (HTMT)

	PT	PA	PD	WT	ES	EV	VA
PT							
PA	0.067						
PD	0.701	0.062					
WT	0.607	0.054	0.680				
ES	0.786	0.070	0.756	0.746			
EV	0.237	0.092	0.088	0.050	0.182		
VA	0.738	0.040	0.847	0.813	0.835	0.097	

Note: PT: Perceived threat, PA: Perceived avoidability, PD: Psychological distancing, WT: Wishful thinking, ES: Emotional support seeking, EV: Emotional venting, VA: Vaccine acceptance intention

5.2. Structural Model and Hypotheses Testing

After confirming the validity of our measurement model, we tested the validity of our structural model and proceeded the hypotheses testing. To confirm the validity of the structural model, the followings criteria must be met: (1) VIF is ideally lower than 3, while VIF > 3–5 is acceptable, VIF higher than 5 indicate collinearity issues, (2) R^2 value of 0.75, 0.50, 0.25 depict substantial, moderate, and weak explanatory power, and (3) $Q^2_{predict}$ value must be larger than 0, while values higher than 0, 0.25, 0.50 depict small, medium, and large predictive accuracy (Hair et al., 2019).

As shown below in Table 5, all the VIF values met the required criteria, thus confirming that collinearity is not an issue. Furthermore, the R^2 value of vaccine acceptance was 0.692, while the $Q^2_{predict}$ value was 0.383, thus indicating moderate explanatory power and medium predictive accuracy of the research model.

Table 5. Structural Model Validity Testing Results (VIF)

	PD	WT	ES	EV	VA
PT	1.000	1.000	1.000	1.000	
PA	1.000	1.000	1.000	1.000	
PD					1.938
WT					1.818
ES					2.229
EV					1.037

Note: PT: Perceived threat, PA: Perceived avoidability, PD: Psychological distancing, WT: Wishful thinking, ES: Emotional support seeking, EV: Emotional venting, VA: Vaccine acceptance intention

After the validity of the structural model was confirmed, the hypotheses testing, using a bootstrap resampling procedure to test path significance, was conducted. The result of the hypotheses testing is presented below in Figure 2 and Table 6.

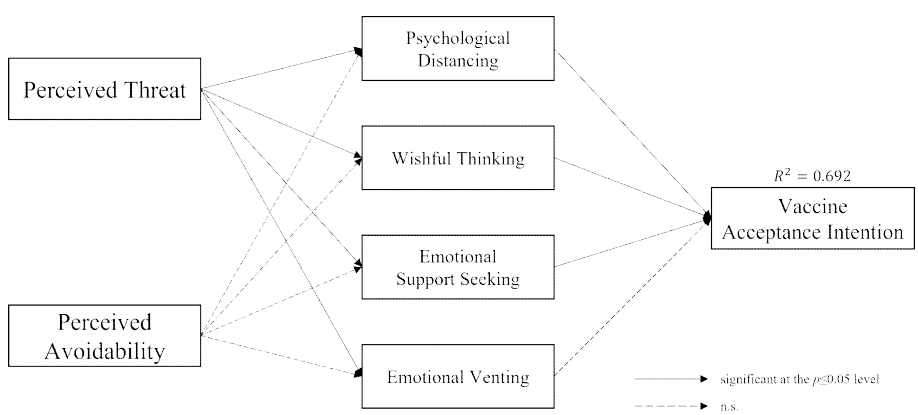

Figure 2. Hypotheses Testing Results
Table 6. Hypotheses Testing Results

Path	Hypotheses	Path coefficient	t-value	Results	f^2
PT → PD	H1	-0.601	13.686	Rejected	0.568
PT → WT	H2	-0.511	8.912	Rejected	0.354
PT → ES	H3	0.681	12.870	Supported	0.873
PT → EV	H4	0.210	3.159	Supported	0.046
PA → PD	H5	0.057	0.917	Rejected	-
PA → WT	H6	0.010	0.146	Rejected	-
PA → ES	H7	-0.060	0.866	Rejected	-
PA → EV	H8	0.080	0.967	Rejected	-
PD → VA	H9	-0.375	5.945	Supported	0.235
WT → VA	H10	-0.278	4.045	Supported	0.138
ES → VA	H11	0.305	4.532	Supported	0.135
EV → VA	H12	-0.004	0.089	Rejected	-

Note: PT: Perceived threat, PA: Perceived avoidability, PD: Psychological distancing, WT: Wishful thinking, ES: Emotional support seeking, EV: Emotional venting, VA: Vaccine acceptance intention

Regarding the effect of perceived treat on inward EFC, there was a significant relation between both perceived threat on psychological distancing and perceived threat on wishful thinking. However, contrary to our expectations, there was a negative relation between the variables. Thus, while the relation was statistically significant, H1 and H2 was rejected. Furthermore, perceived threat had a significant positive effect on both constructs of outward EFC (emotional support seeking and emotional venting) and thus, H3 and H4 were supported.

Perceived avoidability, however, had no significant effect on both inward EFC and outward EFC. Thus, H6,7,8,9 were rejected.

Finally, regarding the effect of inward EFC and outward EFC on PFC (vaccine acceptance intention), both constructs of inward EFC had a significant negative effect on vaccine acceptance intention. Thus, H9 and H10 were supported. However, in the case of outward EFC, only emotional support seeking had a significant positive effect on vaccine acceptance intention, while the relation between emotional venting and vaccine acceptance intention was insignificant. Thus, H11 was supported while H12 was rejected.

Additionally, we examined the Cohen's f^2, which explains the effect size of the independent variable on the dependent variable. According to Cohen (2013), $f^2 \geq 0.02$, 0.15, 0.35 each implies small, medium, and large effect size. Thus, based on Cohen's criteria, H1, H2, and H3 showed large effect size, H9 showed medium effect size, and H4, H10, and H11 shows small effect size.

5.3. PLSpredict Analysis

One weakness of PLS-SEM that has been pointed out over the years is that, while it is well-suited for

analyzing causal relations between variables and assessing the significance of hypotheses, it performs poorly in terms of out-of-sample predictions, thus limiting its practical usefulness (Shmueli et al., 2019).

In order to overcome this weakness, Shmueli et al. (2016) proposed the PLSpredict analysis technique, which executes k-fold cross-validation to evaluate the predictive power of a certain model on data other than the training sample. This allows researchers to evaluate the predictive power of the research model for out-of-sample data. In this study, the number of folds and repetitions were set to 10, which is the default setting.

Interpreting the PLSpredict analysis result involves (1) observing the $Q^2_{predict}$ value of the key endogenous construct, which in this study is the vaccine acceptance intention and (2) comparing the root mean squared error (RMSE) of the PLS-SEM model and the naïve linear regression model (LM) of the key endogenous construct (Shmueli et al., 2019). If the $Q^2_{predict}$ value for all indicators of the key endogenous construct is larger than 0, this implies that the PLS-SEM-based prediction outperform the most naïve benchmark. Once this has been confirmed, researchers must compare the RMSE value of the PLS-SEM model and the LM. The interpretation of the comparison is as follows (Shmueli et al., 2019):

(1) If the PLS-SEM shows lower RMSE for all indicators compared to the LM, the model lacks predictive power
(2) If the PLS-SEM shows lower RMSE for a minority of indicators compared to the LM, the model has low predictive power
(3) If the PLS-SEM shows lower RMSE for a majority of the indicators compared to the LM, the model has medium predictive power
(4) If the PLS-SEM shows lower RMSE for all indicators compared to the LM, the model has high predictive power

As shown below in Table 7, all the indicators showed higher PLS-SEM RMSE compared to the naïve LM benchmark, indicating high predictive power of our research model.

Table 7. PLSpredict Analysis Result

Construct	Indicators	$Q^2_{predict}$	PLS-SEM RMSE	LM RMSE	PLS-LM
Vaccine Acceptance Intention	VA1	0.316	0.931	0.940	-0.009
	VA2	0.300	0.994	1.001	-0.007
	VA3	0.296	0.968	0.979	-0.011

6. Conclusion

6.1. Summary of Results

The results of the hypotheses testing are as follows: first, perceived threat of COVID-19 had a sig-

nificant, but negative effect on both psychological distancing and wishful thinking. Although this result contradicts our expectation, it complies with the results of prior studies. For example, Elsayed et al. (2022) found that individuals with high fear and psychological distress toward COVID-19 in Southern Germany showed lower levels of resilience coping, which include psychological distancing and wishful thinking. It could be interpreted that while individuals may adopt inward EFC regarding threats that are coincidental, it is difficult to distance themselves or wish that the threat would disappear if the threat is too large, which is the case for a global pandemic, such as COVID-19.

Furthermore, because this study was conducted after the third wave of COVID-19 in Korea (Dec, 2020), it is possible that a majority of the participants have already been infected by the virus. Also, considering that the first wave of the pandemic was in March, 2020, the pandemic had been lasting for more than a year. Therefore, it could be inferred that the respondents were already tired and pessimistic about overcoming the pandemic by distancing themselves from the virus. This relation is also confirmed in the study by Arslan et al. (2020) and Yıldırım et al. (2021), which concluded that COVID-19 stress due to the long lasting pandemic was positively related to negative mental outcomes, such as pessimism and burnout. Therefore, it is possible that by the time the survey was conducted, those who showed high levels of perceived threat towards COVID-19 had found emotion-focused coping as unhelpful, thus leading to a negative relation between the two constructs. Thus, the contradictory result from the TTAT's expected outcome can be attributed to the persistent nature of the COVID-19 pandemic, unlike technological threats that are often temporary and sporadic.

Second, perceived threat of COVID-19 had a significant positive effect on emotional support seeking. This relation is consistent with the result of prior studies, such as Ekberg et al. (2014) and Catania et al. (1992), which concluded that health threats, such as cancer and HIV, lead to help seeking and social support seeking. Thus, individuals who have high perceived threat regarding COVID-19 are more likely to rely on others, such as friends or relatives, to cope with the threat.

Next, both types of inward EFC negatively affected vaccine acceptance intention. This is consistent with the original TTAT framework. Liang et al. (2019) states that inward EFC may lead individuals to ignore the problem or neglect the existence of the danger, thereby hindering problem solving behavior. In other words, by distancing themselves from the pandemic and optimistically hoping that the pandemic will be over soon may lead to vaccine hesitancy. On the other hand, emotional support seeking had a positive effect on vaccine acceptance intention. Liang et al. (2019) explains that by talking to others about their fears and stresses, they are able to gain empathy and a deeper understanding on what is causing the stress or fear. This leads them to make more rational decisions that lead to problem solving.

6.2. Research Implications

Our study provides several meaningful implications to researchers and practitioners regarding vaccine acceptance and threat coping behavior.

First, to our knowledge, this is the first study to apply the TTAT in the context of COVID-19 vaccine

acceptance. While the TTAT was aimed to explain individuals' behavior toward technological treats, our research shows that it is also a valid and useful framework to understand behavior toward health threats.

Also, the results of our study overcomes the limitations of prior studies that fail to explain or show mixed results when investigating problem solving behavior by taking into consideration the role of emotional coping. While prior studies focused primarily on problem-focused coping behavior and overlooked the importance of emotion-focused coping, our study considers both inward EFC and outward EFC, thus providing a richer understanding on the antecedents of PFC. The significant effect of EFC on PFC further proves that, in order to promote rational decision making in a threatful situation, various efforts to provide emotional support and help individuals cope with the situation must be preceded.

With global pandemics becoming more frequent and severe, it is crucial to prepare for the next pandemic, considering that vaccine hesitancy delayed the end of the COVID-19 pandemic significantly. Considering the crucial role of both inward and outward EFC, forming support groups to provide mental and emotional support and promote rational PFC could help vaccine acceptance. Furthermore, since perceived threat affects psychological distancing, wishful thinking, and emotional support seeking, providing accurate information regarding the threat, thus preventing unnecessary fear, may help individuals cope with the threat more effectively.

6.3. Limitations and Future Research

Although our study provides meaningful results for safety promotion, it is not without its limitations. First, our survey was conducted after the vaccine was distributed and there was a fear toward the vaccine itself, particularly due to the spread of fake news regarding the vaccine. A survey comparing vaccine acceptance before and after the vaccine development may have showed different results. Furthermore, because the fatality of the disease dropped significantly toward the end of the pandemic, a survey conducted at that period could have demonstrated different results, due to the lower level of perceived threat. Finally, the survey was conducted only in South Korea, where vaccination was mandated by the government and a culture of collectivism is prevalent. Future studies may find it interesting to compare the vaccine acceptance intention of different countries, particularly based on their vaccination policy and culture.

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저자소개

유준우 연세대학교 산업공학과를 졸업하고, 동대학원에서 박사과정에 재학 중이다. 주요 관심분야는 기술경영, 안전관리, 소비자행동 분석 및 의사결정이론 등을 기반으로 한 전략수립 및 가이드라인 개발 등이다.

박희준 미국 George Washington University 공학경영 박사학위를 취득하고 현재 연세대학교 산업공학과 교수로 재직 중이다. 연세대학교 융합기술경영학과 전공주임과 YTN 'ESG코리아' MC로도 활동하였으며, 국가별 품질 경쟁력 수준 평가방법 개발, 녹색기술 확산을 위한 기술 분석 및 소비자 수용촉진 전략에 관한 연구 등을 수행하였다. 주요 관심분야는 혁신이론, 학습이론, 조직이론, 인적자원관리이론 및 정보기술관련 이론 등을 토대로 한 혁신경영 전략수립 및 평가방법론 개발 등이다.