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The Mediation Effects of COVID Vaccine Anxiety, Safety, and Fear on the Relationships between COVID-19 Threat and Efficacy Levels with Parents' Intent to Vaccinate Children

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ABSTRACT

Given the updated, ongoing recommendations for the COVID vaccine series and booster for children ages 6 months and older yet vaccine coverage remaining at less than 50% among children, it is critical for public health communicators to understand sources of vaccine hesitance among parents. A national survey of parents identifies the mediating effects of vaccine anxiety, safety, and fear on the relationships between COVID-19 threat and efficacy with behavioral intentions to vaccinate. Anxiety mediated the relationships between both threat and efficacy with parents' behavioral intentions to vaccinate their children. Vaccine anxiety, safety, and fear mediated parents' decisions to vaccinate themselves. Theoretical and applied implications are reviewed.

KEYWORDS: vaccines, COVID-19, crisis communication, risk communication, self-regulation model, parental decision-making, EPPM

Introduction

In January 2023, a summary of CDC data from the American Academy of Pediatrics (AAP) notes that vaccine coverage in the U.S. for children between the ages of 6 months and 17 years is approximately 57%, with 41 million children having not received one COVID-19 vaccine dose (AAP, 2023). The CDC (2023)

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recommends the primary vaccine series followed by the recently updated bivalent booster, which became available for all children ages 6 months and older on December 9, 2022. Yet, after the bivalent booster was available for people 12 years and older in September 2022, only 2% of children between ages 12 and 17 had received it by November (Kaiser Family Foundation, 2022). Smaller numbers in COVID-19 vaccine trials with children and lack of long-term safety data combined with reduced average severity of children's illness, among other considerations, continue to make parents question if benefits outweigh perceived risks of vaccinating (Mervosh & Goldstein, 2021). Receipt of at least one dose for age groups is as follows, as of early 2023: 11% for 6 months to 4 years; 39% for 5 to 11 years; and 68% for 12 to 17 years (AAP, 2023). COVID-19 vaccine hesitance clearly increases as children's ages decrease, and it is pressing for public health research to unveil the cognitive mechanisms underlying that resistance.

Witte's (1992) extended parallel processing model (EPPM) identifies how rational considerations (in this case, vaccine efficacy) and emotional reactions (vaccine anxiety) affect behavioral decisions (COVID-19 vaccine uptake). The model, with its four central variables of severity, susceptibility, response efficacy, and self-efficacy, has proven to be a robust predictor of health behaviors over decades of scholarly work. This research extends that model to increase its relevance to children using Avery and Park's (2021) concept of protective efficacy. This extension of the model reconceptualizes *self*-efficacy to protective efficacy, which is the perceived ability to take action to protect a dependent other (Avery & Park, 2021).

Given ongoing COVID vaccine recommendations for children (CDC, 2023), it is imperative for the abundant, vibrant body of COVID-19 vaccine research to make concerted efforts to maximize the effectiveness of uptake campaigns. Theoretically, Avery and Park's (2021) protective efficacy construct may enrich the explanatory power of EPPM (Witte, 1992) and is combined with nuanced modeling that has a comprehensive focus on the factors affecting vaccination decisions, which positions this study as a novel and important contribution.

Specifically, this research examines the effects of vaccine anxiety, safety, and fear on the relationships between parents' perceived protective efficacy and decisions to vaccinate their children. It is important to identify how specific attitudinal considerations affect the perceived abilities of parents to protect their children from COVID-19. If perceptions of efficacy are diminished by vaccine anxiety, safety, or fear, that indicates an important focus for campaign message strategy.

Then, to extend that inquiry, vaccine anxiety, safety, and fear are examined for their effects on the relationship between COVID-19 perceived threat (the other central predictor variable in EPPM) and parents' vaccination decisions. Perceived efficacy and perceived threat (Witte, 1992) have been well-established in scholarly literature as reliable predictors of healthy behaviors, and this study adapts and extends those predictors while identifying the mediating effects of vaccine anxiety, safety, and fear on behavioral intentions to vaccinate.

Next, these same questions are asked regarding parents' intentions to vaccinate themselves. Disparities in considerations will inform and drive health campaign messaging as well as unveil differences in cognitive mechanisms and emotional responses underlying vaccination decisions. As updated bivalent boosters became available in the fall of 2022 and were recommended for children ages 6 months and older (CDC, 2023), the ongoing importance of strategy in reaching parents with the most effective, resonating messages remains pressing.

Self-Regulation Model in the Vaccine Context

It is critical for psychological research in the health context to identify the factors that affect an individual's healthy behaviors (Leventhal et al., 1984). Self-regulation theory, also referred to as the common-sense model, identifies "the factors involved in the processing of information by a patient regarding their disease or illness, how this information is integrated to provide a 'lay' view of the illness and how this lay view guides coping behaviors and outcomes" (Hagger & Orbell, 2003, p. 142).

There are two processes in the model: cognitive and emotional. First, when an individual faces an illness, the person evaluates the

information regarding the illness (Leventhal et al., 1984). This cognitive representation consists of five attributes: identity, timeline, cause, controllability, and consequences (Diefenbach & Leventhal, 1996). The identity attribute encompasses an individual's somatic, or bodily, representation of a disease, while timeline references the acuteness of a treatment (Meyer et al., 1985). Causal attribute is the cause of a disease, and controllability is one's levels of control over its symptoms (Hagger & Orbell, 2003). Lastly, consequences are the expected repercussions of an illness. Those five attributes shape the selection and performance of an individual's coping responses, influence evaluation of the responses and outcomes, and determine health behaviors. Next, the emotional process is related to one's feelings surrounding a health threat (Leventhal et al., 1984). For example, if a patient is anxious or fearful about a disease, the patient is likely to take actions such as consulting a doctor, taking medicines, or getting treatments to reduce anxiety or fear (Hagger & Orbell, 2003). All in all, the model argues that both cognitive and emotional processes determine an individual's health behaviors (Boudreaux et al., 2013; Leventhal et al., 2001; Leventhal, et al., 1984) and influence performance of protective behaviors (Miller et al., 2021).

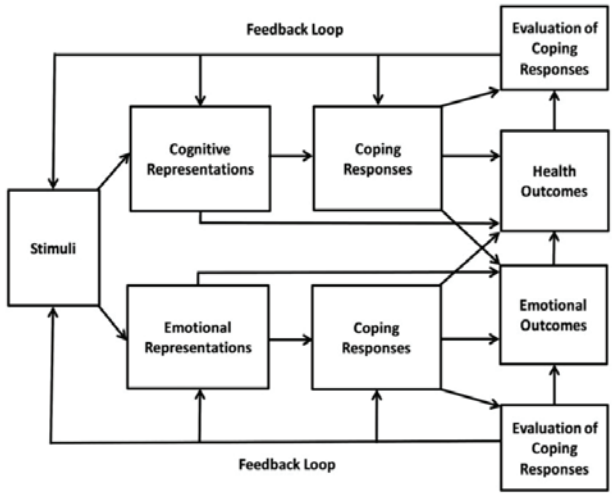

FIGURE 1 Self-Regulation Model

Note: The figure has been adapted from Heffernan et al. (2016)

Since Leventhal et al.'s (1984) pioneering research on self-regulation, scholars have examined the roles of cognitive and emotional processes in the health context (e.g., Chan & Mak, 2016; Cwik et al., 2021; Hudson et al., 2014). However, scholarly research is not clear on whether the cognitive or affective component is more important in vaccine uptake (Hagger & Orbell, 2003).

According to previous studies, attitude toward an issue or object has two dimensions that are aroused either by emotions or rational evaluations (Ajzen & Fishbein, 2005; Breckler & Wiggins, 1993; Xiao, 2021). Specifically, an attitude that is formed by emotions (e.g., vaccine anxiety) and measured on a continuum of positive and negative feelings is called affective attitude, while one that is elicited by rational evaluations and scored on instrumental gains and losses is referred to as cognitive attitude (Lavine et al., 1998; Xiao, 2021; Zanna & Rempel, 1988). For instance, an individual may believe that COVID-19 vaccination is either safe or unsafe; the person may in turn experience relief or anxiety in response to receiving the vaccine (Xiao, 2021).

Parental Decision-Making in Childhood Vaccination

There are several factors affecting parents' vaccination decisions for children. Overall, parents must balance anxiety over vaccine safety (Serpell & Green, 2006) with a sense of responsibility to do everything they can to keep their children healthy (McNeil et al., 2019). Alfieri et al. (2021) surveyed 1,425 parents and found that 33% of them were COVID-19 vaccine-resistant yet, at the same time, felt responsible for keeping their children healthy by preventing infection with the virus. Rhodes et al. (2020) and Szilagyi et al. (2021) argue that parents indicated an unwillingness to vaccinate their children due to the risks of vaccines, while Ellithorpe et al. (2022) found that parents without COVID-19 experience showed a lower vaccination intention for their children.

Previous studies on childhood vaccination in general were also reviewed. Westrick et al. (2017) interviewed the parents or guardians of children ages 11 to 17 years to understand the underlying mechanisms of HPV vaccination uptake and identify two major factors affecting parents' vaccination decision-making based

on behavior change theory (Westrick et al., 2017). Specifically, the first factor is cognitive processing of vaccine information. For example, if parents or guardians are knowledgeable about a vaccine, they were more likely to vaccinate their children, while if a parent or guardian reported lack of vaccination knowledge, behavioral intention decreased (Westrick et al., 2017). The second attribute is an emotional factor; if parents or guardians have a high level of positive perception toward vaccination and experience less anxiety about the vaccine, they tend to show greater intentions to vaccinate children and vice versa. Figure 2 illustrates Westrick et al.'s (2017) model.

A recent study on parents' vaccination hesitancy found the emotional (or affective) component to be more important than the cognitive/rational component in parental vaccine decision-making (Gavaruzzi et al., 2021). However, it is unclear whether that contention holds true in the context of COVID-19 vaccination, but research to that end is important to bolster the effectiveness of uptake campaigns. The extended parallel processing model (EPPM; Witte, 1992) provides a solid and extensively used theoretical foundation for that pursuit.

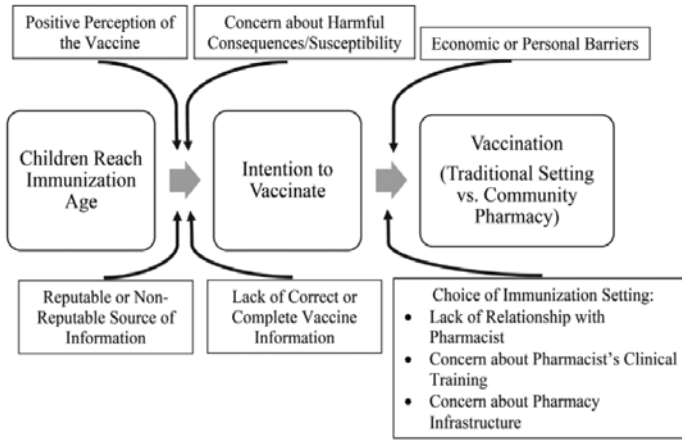

FIGURE 2 Parents' Vaccination Decision-Making for Their Children

Source: Westrick et al. (2017). Parental acceptance of human papillomavirus vaccinations and community pharmacies as vaccination settings: A qualitative study in Alabama. *Papillomavirus Research, 3*, p. 28.

Cognitive/Affective Components and EPPM

EPPM identifies how rational considerations (efficacy beliefs) and emotional reactions (fear of a health threat) affect behavioral decisions (Witte, 1992). There are four central variables in the EPPM model: two related to beliefs about the threat (i.e., perceived severity and perceived susceptibility) and two related to efficacy beliefs (i.e., response efficacy and self-efficacy) (Witte, 1992). Individual behaviors are based on perceived efficacy and threat levels. For example, if perceived levels of threat and efficacy are high, one takes proactive actions to avoid or reduce threat, referred to as "Danger Control." On the other hand, if levels of threat and efficacy are low, the person does not feel at risk and does not take any protective actions (So, 2013; Witte, 1994). Protection motivation theory (Maddux & Rogers, 1983; Rogers, 1975, 1983) suggests a similar process to that of EPPM. According to the theory, individuals' behavioral intentions are based on a coping appraisal (emotional component) and/or threat appraisal (rational component) (Rogers, 1975, 1983). Recent studies on protection motivation theory in the public health crisis context (e.g., Bae & Chang, 2021; Dillard et al., 2012) have found that both cognitive and affective perceptions influenced behavioral intentions.

To extend EPPM in the caregiver context, Avery and Park (2021) developed a new concept of "protective efficacy," which is defined as one's perceived ability to protect a dependent other during a crisis. According to the authors, efficacy will vary based on domains. For example, an individual might be confident in the ability to take actions to protect the self in a crisis but doubt the ability to keep an "other" safe when the performance of safeguarding behaviors is not directly under personal control (Avery & Park, 2021). For example, proper and consistent mask usage may be easy for a parent but hard to manage for a toddler. Moreover, as "every crisis is a unique event that can be expected to evolve in unexpected ways" (Seeger, 2006, p. 243), a *one-size-fits-all* approach is never appropriate during crisis. Therefore, the concept of protective efficacy is highly useful to extend EPPM to the caregiver context during a public health crisis (Avery & Park, 2021). In a similar vein, self-efficacy levels during crisis need to be carefully

considered as individual knowledge levels and preparedness for crisis vary depending on crisis experience (Arpan & Roskos-Ewoldsen, 2005). For that reason, prior research developed and measured the term "crisis self-efficacy" (i.e., one's perceived ability to perform risk-reducing behaviors during a threat to protect oneself [Park & Avery, 2019]) when measuring self-efficacy levels in a public health crisis such as COVID-19 (e.g., Avery & Park, 2021; Baguri et al., 2022; Park & Avery, 2021).

Another core concept in EPPM is threat (Witte, 1992). For instance, if one's perceived threat level is high, the person assesses risk and takes protective actions to decrease that risk (Witte et al., 1998). Also, according to previous research, parents' perceived threat levels are a critical factor in predicting their parenting behaviors (Gurland & Grolnick, 2005). COVID-19 presents varying degrees of perceived risk to parents and their children, so it is important to examine threat levels in the EPPM framework for parents' vaccination decision-making context.

The effects of cognitive and affective factors on individuals' heath behaviors have been extensively explored in previous EPPM studies; however, results are somewhat varied (Popova, 2012; Ruiter et al., 2001). Both cognitive and affective components have been negatively associated with behavioral intentions, but the association between cognitive factors and intention was stronger in one study (Shim & You, 2015). Similarly, Ruiter et al. contend that although the cognitive component was a more powerful predictor of protective behaviors than the emotional component, the influence of the emotional component on behaviors should not be neglected.

Research Questions

To contribute and extend this debate as well as the literature on EPPM, the current study explores cognitive and affective components as mediators in the EPPM model. To examine the effects of cognitive and affective considerations on the relationship between protective efficacy and *parents' decisions to vaccinate their children*, the following questions are asked:

RQ1(a) What, if any, is the effect of vaccine anxiety on the relationship between parents' protective efficacy and behavioral intentions to vaccinate their children?

RQ1(b) What, if any, is the effect of vaccine safety on the relationship between parents' protective efficacy and behavioral intentions to vaccinate their children?

RQ1(c) What, if any, is the effect of vaccine fear on the relationship between parents' protective efficacy and behavioral intentions to vaccinate their children?

To explore the effects of cognitive and affective considerations on the relationship between COVID-19 threat and *parents' decisions to vaccinate their children*, the following questions are asked:

RQ2(a) What, if any, is the effect of vaccine anxiety on the relationship between perceived threat of COVID-19 and parents' behavioral intentions to vaccinate their children?

RQ2(b) What, if any, is the effect of vaccine safety on the relationship between perceived threat of COVID-19 and parents' behavioral intentions to vaccinate their children?

RQ2(c) What, if any, is the effect of vaccine fear on the relationship between perceived threat of COVID-19 and parents' behavioral intentions to vaccinate their children?

To explore the effects of cognitive and affective considerations on the relationship between crisis self-efficacy and *parents' decisions to vaccinate themselves*, the following questions are asked:

RQ3(a) What, if any, is the effect of vaccine anxiety on the relationship between parents' crisis self-efficacy and behavioral intentions to vaccinate themselves?

RQ3(b) What, if any, is the effect of vaccine safety on the relationship between parents' crisis self-efficacy and behavioral intentions to vaccinate themselves?

RQ3(c) What, if any, is the effect of vaccine fear on the relationship between parents' crisis self-efficacy and behavioral intentions to vaccinate themselves?

To explore the effects of cognitive and affective considerations on the relationship between COVID-19 threat and *parents' decisions to vaccinate themselves*, the following questions are asked:

> **RQ4(a)** What, if any, is the effect of vaccine anxiety on the relationship between perceived threat of COVID-19 and behavioral intentions to vaccinate themselves?
>
> **RQ4(b)** What, if any, is the effect of vaccine safety on the relationship between perceived threat of COVID-19 and behavioral intentions to vaccinate themselves?
>
> **RQ4(c)** What, if any, is the effect of vaccine fear on the relationship between perceived threat of COVID-19 and behavioral intentions to vaccinate themselves?

Method

Data Collection

A sample of U.S. adults were recruited via Amazon's Mechanical Turk ($N = 720$) to participate in an IRB-approved online survey in mid-December 2020, as the U.S. government first began administering COVID-19 vaccinations (Loftus & West, 2020). Individuals who had child(ren) ages 18 or younger living with them participated in the survey. Specifically, only participants whose status indicated they were parents in the survey system were allowed to participate. In addition, some qualifications were added to achieve the research goals. Among 1,192 individuals who participated in the survey, participants who did not have a child ($n = 337$), had been diagnosed with COVID-19 ($n = 88$), had child(ren) diagnosed with COVID-19 ($n = 29$), had received the COVID-19 vaccine ($n = 17$), or had child(ren) who had received the COVID-19 vaccine ($n = 1$) were directed out of the survey, leaving a final sample of 720.

The participants completed one of two surveys on COVID-19 vaccination, one about themselves and the other about their children. When participants answered the questions about their children, they were directed to keep their oldest child age 18 or younger and living at home in mind. For both surveys (i.e., self and child), participants answered questions measuring variables

of perceived efficacy, perceived threat, anxiety about vaccine, perceived safety of vaccine, perceived fear, and behavioral intentions (i.e., intentions to get vaccinated). There were 358 parents who completed the survey about themselves, and 362 parents participated in the survey about their children. As compensation for their time and efforts, $1.25 was given to each participant via Amazon.

Measures

Perceived efficacy. Two concepts were utilized to gauge perceived efficacy. First, to measure participants' efficacy, Park and Avery's (2019) crisis self-efficacy (i.e., one's perceived ability to perform risk-reducing behaviors during a crisis to protect oneself) scale was used (Cronbach's $\alpha = .93$) with a 5-point scale (1 = *Strongly disagree*, 5 = *Strongly agree*) (see Park & Avery, 2019, for items). Next, in the survey about their children, the protective efficacy scale developed in Avery and Park's (2021) research as an adaptation of the crisis self-efficacy scale to measure perceived ability to protect a dependent other was utilized ($\alpha = .94$) (refer to Avery & Park, 2021, for items).

Perceived threat. Perceived threat is comprised of two concepts: perceived susceptibility (i.e., "individuals' beliefs about their risk of experiencing the threat") and severity (i.e., "beliefs about the significance or magnitude of the threat") (Witte, 1994, p. 114). Using items from a previous study (Yang, 2015), three questions were asked for each concept using a 5-point scale (1 = *Strongly disagree*, 5 = *Strongly agree*). The reliabilities of the items in each concept were acceptable ($\alpha = .86$ for perceived susceptibility; $\alpha = .89$ for perceived severity).

Vaccine anxiety. In general, anxiety is an emotional reaction and defined as "physiological reactivity to events with uncertain but potentially aversive outcome" (Friman et al., 1998, p. 138). Items used to assess COVID-19 vaccine anxiety were scored from 1 to 5 using the scale (1 = *Strongly disagree*, 5 = *Strongly agree*) in Salkovskis et al.'s (2002) study: (a) I am anxious about me/my child receiving the COVID-19 vaccine; (b) When I hear about

COVID-19 vaccine, I think about its threat to me/my child; (c) I worry about the COVID-19 vaccine and its safety to me/my child ($\alpha = .93$).

Vaccine safety. Scholars have argued that safety is a cognitive response, (e.g., Antonsen, 2009; Flin & Fruhen, 2015). In order to measure participants' perceived vaccine safety, Hwang's (2020) items were used on a 5-point scale (1 = *Strongly disagree*, 5 = *Strongly agree*): (a) I am concerned about the possible side effects of the COVID-19 vaccine to me/my child; (b) I am worried that we have not had time to know if the COVID-19 vaccine is safe for me/my child; (c) I do not know if the possible risks of the COVID-19 vaccine outweigh its benefits to me/my child ($\alpha = .92$).

Fear. Participants' fear (i.e., an internal reaction characterized by subjective experience and physiological arousal [Witte, 1994, p. 114]) about the COVID-19 vaccine was measured using Witte et al.'s (1998) items with adaptation on a 5-point scale (1 = *Strongly disagree*, 5 = *Strongly agree*): (a) Giving the COVID-19 vaccine to me/my child makes me feel anxious; (b) Giving the COVID-19 vaccine to me/my child frightens me; (c) I am scared to receive/for my child to receive the COVID-19 vaccine; (d) I am afraid to get/my child to get the COVID-19 vaccine ($\alpha = .96$).

Intention to vaccinate. For intention to vaccinate, Ajzen & Fishbein's (2005) items were used on a 5-point scale (1 = *Strongly disagree*, 5 = *Strongly agree*): (a) I intend to get the COVID-19 vaccine for me/my child; (b) I will get the COVID-19 vaccine for me/my child; (c) I will work to vaccinate myself/my child from COVID-19 as soon as it becomes available ($\alpha = .92$).

Results

Profile of Participants

Participants included 281 (39.0%) males, 431 (59.9%) females, and 8 (1.1%) individuals who reported as other or declined to answer; the average age of respondents was 41.3 ($SD = 9.35$). The most prevalent ethnic group was White (80.1%, $n = 577$), followed by

Black (9.0%, $n = 65$), Asian (4.7%, $n = 34$), Hispanic (4.2%, $n = 30$), multi-racial (1.4%, $n = 10$), and other (.6%, $n = 4$). For the number of children ages 18 or younger living at home, 384 respondents (53.3%) had one child, 221 (30.7%) had two children, 67 (10.6%) had three children, and 39 (5.4%) had four or more children. Chi-square tests were conducted to examine what differences, if any, between "self" and "other" groups emerged based on demographics. The results indicated that no differences were found for all demographics: gender [(3) = .55, *ns*]; age [(50) = 49.03, *ns*]; race [(5) = 5.74, *ns*]; and number of children [(3) = .63, *ns*].

Research Questions

For RQs 1 and 2, a series of exploratory serial multiple mediation models using the PROCESS macro for SPSS (Model 6, Hayes, 2017) were conducted. Specifically, the sequential relationships of anxiety, safety, and fear were tested in the relationship between efficacy/threat and behavioral intention. The mean scores for each variable when participants were asked to consider vaccinating their children were as follows: efficacy [EFF]: $M = 3.89$ $SD = .56$, threat [THR]: $M = 3.42$ $SD = .69$, anxiety [ANX]: $M = 3.32$ $SD = 1.23$, safety [SAF]: $M = 3.57$ $SD = 1.21$, fear [FEA]: $M = 3.05$ $SD = 1.32$, and behavioral intention [BI]: $M = 3.37$ $SD = 1.29$. Also, Pearson's correlations were explored to examine the relationships between the variables (see Table 1).

TABLE 1 Correlations of the Variables for Child Vaccination

	1.	2.	3.	4.	5.	6.
1. Efficacy	–					
2. Threat	.384**	–				
3. Anxiety	–.463**	.159**	–			
4. Safety	–.438**	.174**	.858**	–		
5. Fear	–.459**	.161**	.872**	.787**	–	
6. BI	.606**	.468**	–.643**	–.662**	–.646**	–

Note: $^{**}p < .01$

Fourteen models were tested as independent variables for both efficacy and threat. The relationships between efficacy/threat, fear, and behavioral intention were not examined because those have been rigorously tested in previous EPPM studies. As shown in Table 2, results indicated that for both independent variables (i.e., efficacy and threat), only the pathways from efficacy/threat through anxiety to behavioral intention were significant. All paths are illustrated in Figure 3.

To answer RQs 3 and 4, the same procedures for RQs 1 and 2 were followed. The mean scores for self-vaccination were efficacy [EFF]: $M = 3.75$ $SD = .60$, threat [THR]: $M = 3.50$ $SD = .71$, anxiety [ANX]: $M = 3.19$ $SD = 1.24$, safety [SAF]: $M = 3.42$ $SD = 1.25$, fear [FEA]: $M = 2.88$ $SD = 1.19$, and behavioral intention [BI]: $M = 3.41$ $SD = 1.34$. Table 3 shows the correlations between the variables.

TABLE 2 The Serial Mediation Pathway Test Results for Child Vaccination

Condition (*n*)	Coefficient	95% CI	
		LL	UL
EFF→ANX→BI	.1907**	.1714	.2195
EFF→SAF→BI	.0303	–.0139	.1088
EFF→FEA→BI	.0208	–.0044	.0783
EFF→ANX→SAF→BI	.2656**	.1470	.4053
EFF→ANX→FEA→BI	.1627**	.0452	.2936
EFF→SAF→FEA→BI	.0031	–.0018	.0105
EFF→ANX→SAF→FEA→BI	.0171**	.0019	.0682
Total	.5618	.4185	.7087
THR→ANX→BI	.0416**	.0369	.0922
THR→SAF→BI	.0191	–.0082	.0672
THR→FEA→BI	.0234	–.0188	.0357
THR→ANX→SAF→BI	.0314*	.0225	.1432
THR→ANX→FEA→BI	.0290**	.0122	.1248
THR→SAF→FEA→BI	.0026	–.0014	.0086
THR→ANX→SAF→FEA→BI	.0075**	.0009	.0288
Total	.2076	.0773	.3308

Note: **significant; *CI* confidence interval; *LL* lower limit; *UL* upper limit; *EFF* efficacy; *ANX* anxiety; *SAF* safety; *FEA* fear; *THR* threat; *BI* behavioral intention.

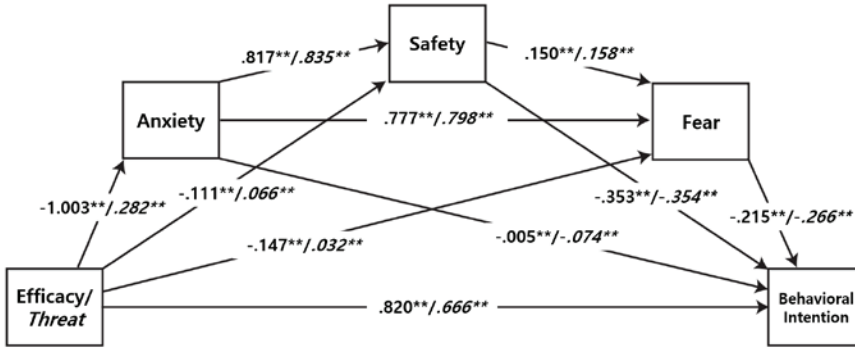

FIGURE 3 **Serial Mediation Model for Child Vaccination**

Note: ** significant; *Italic* coefficients for threat

TABLE 3 **Correlations of the Variables for Self-Vaccination**

	1.	2.	3.	4.	5.	6.
1. Efficacy	–					
2. Threat	.308**	–				
3. Anxiety	–.399**	.074	–			
4. Safety	–.410**	.063	.844**	–		
5. Fear	–.377**	.058	.859**	.783**	–	
6. BI	.602**	.439**	–.609**	–.615**	–.562**	–

Note: $^{**}p < .01$

Another 14 models were tested with efficacy and threat as independent variables. Unlike the results for child vaccination, only the pathways when each mediation variable (i.e., anxiety, safety, and fear) was entered were significant (see Table 4). Figure 4 represents all pathways.

TABLE 4 The Serial Mediation Pathway Test Results for Self-Vaccination

Condition (*n*)	Coefficient	95% CI	
		LL	UL
EFF→ANX→BI	.0848**	.0373	.3718
EFF→SAF→BI	.0273**	0065	.1094
EFF→FEA→BI	.0187**	.0114	.0246
EFF→ANX→SAF→BI	.0597	–.0611	.2990
EFF→ANX→FEA→BI	.0526	–.0826	.1290
EFF→SAF→FEA→BI	.0039	–.0051	.0107
EFF→ANX→SAF→FEA→BI	.0127	–.0178	.0341
Total	.4421	.3180	.5874
THR→ANX→BI	.0299**	.0182	.1018
THR→SAF→BI	.0420**	.0394	.0470
THR→FEA→BI	.0133**	.0132	.0139
THR→ANX→SAF→BI	.0322	–.0222	.1035
THR→ANX→FEA→BI	.0117	–.0107	.0371
THR→SAF→FEA→BI	.0017	–.0032	.0039
THR→ANX→SAF→FEA→BI	.0031	–.0025	.0095
Total	.0803	.0548	.2197

Note: **significant; *CI* confidence interval; *LL* lower limit; *UL* upper limit; *EFF* efficacy; *ANX* anxiety; *SAF* safety; *FEA* fear; *THR* threat; *BI* behavioral intention.

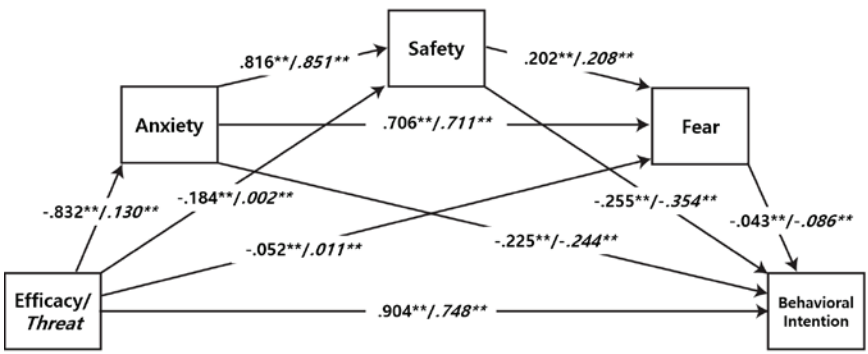

FIGURE 4 Serial Mediation Model for Self-Vaccination

Note: ** significant; *Italic* coefficients for threat

Discussion

The results of this study offer tangible, implementable recommendations for vaccine uptake campaigns targeting parents; they also demonstrate the importance of utilizing the protective efficacy variable in health behavior models as a useful extension of self-efficacy, a construct in many health communication theories and models, when measuring performance of health behaviors to protect another. As noted, the relationships between efficacy/threat and fear with behavioral intention were not a focus of this study as they have been rigorously tested in previous EPPM studies.

Vaccination Anxiety and Intent to Vaccinate Children

With regard to parents' decisions to vaccinate their children, the results indicated that, for both efficacy and threat, only the pathways from efficacy and from threat through anxiety to behavioral intention were significant. This result is provocative in that vaccine anxiety but not safety or fear significantly mediated both the protective efficacy/vaccination and the threat/vaccination relationships. It is also intriguing that, despite the fact that self-efficacy has been a strong predictor of health behaviors over decades of research in health communication (Rimal & Adkins, 2003), anxiety mediated the relationship between it and vaccination behaviors for both crisis self-efficacy (parents' personal vaccination intent) and protective efficacy (parents' intent to vaccinate children).

The common-sense model of self-regulation (Leventhal et al., 1984) explicates how people become aware of a health threat, navigate their affective responses, and use evaluations of the threat and courses of action to formulate a response plan. Cognitive and affective processes are central to the model. Efficacy and perceived threat of COVID-19 align with two of the five cognitive processes identified: controllability, or one's levels of control over managing the disease symptoms (efficacy), and consequences, which are the expected repercussions of an illness (threat) (Hagger & Orbell, 2003). So, efficacy and threat were used as predictors of vaccination behaviors based on Leventhal et al.'s (1984) model.

In this study, emotional response (i.e., anxiety) mediated the cognitive routes to vaccine decision-making. It is interesting that

an affective response to the vaccine influenced behavioral intentions and not the more cognitive, information-based evaluation of the vaccine's safety. This is perhaps a discouraging finding in that it suggests a less mindful, more emotionally reactive approach to parents' vaccine decision-making. It also indicates a challenge for public health campaigns, as information on vaccine safety is easier to communicate than anxiety is to quell. Though the common-sense model of self-regulation (Leventhal et al., 1984) argues that both cognitive and emotional processes determine an individual's health behaviors (Boudreaux et al., 2013; Leventhal et al., 2001) as well as influence performance of protective behaviors (Miller et al., 2021), in this study, for behaviors intended to protect children, the emotional response of anxiety emerged as more influential. Even with high perceived threat of the virus, vaccine anxiety exerts significant influence on parents' intent to vaccinate their children. The pragmatic implications of these findings on public health messaging suggest that instead of focusing risk-related messaging on threat it should focus on reducing vaccine anxiety.

Saddik et al. (2020) demonstrated that participants with higher levels of pandemic anxiety were more likely to report intention to COVID-19 vaccinate (of note, that study was conducted before vaccines were available to the public), and a majority of the participants in the study indicated desire to vaccinate both themselves and their children. It would be interesting for future research to explore the relationship between virus anxiety and vaccine anxiety. Perhaps vaccine anxiety replaced the virus anxiety once it was "real" to publics; the vaccine "in theory" may have been a more readily acceptable solution until it was a reality and a recommended behavior. How people cognitively negotiate anxiety over the threat itself with anxiety over the solution to that threat would be a compelling area for future research.

Parents' Intentions to Vaccinate and the Role of Vaccine Fear, Anxiety, and Safety

For parents, the underlying mechanisms for intentions to vaccinate were different from those for their children. Unlike the results for child vaccination, the pathways were significant when each

mediation variable (i.e., anxiety, safety, and fear) was entered individually. Thus, a compelling finding of this research is that parents seem to be primarily driven by anxiety (or lack thereof) in their decision-making to vaccinate their children. A more comprehensive range of considerations—vaccine safety, anxiety, and fear—mediated both the relationships between self-efficacy and intent to vaccinate as well as between perceived threat of COVID-19 and intent to vaccinate in decisions to vaccinate themselves. Perhaps parents adopt a more thoughtful, comprehensive approach to their own uptake, relying on both cognitive and emotional processes, but are more governed by vaccine anxiety when it comes to vaccinating their children. Any causal explanations for this would be well beyond the scope of this study but should be addressed in future research. Perhaps instead of making more deliberate and cognitively demanding decisions for their children, parents may allow vaccine anxiety to become a shortcut decision-maker when the primary goal is safeguarding their children.

Drawing back to both Levanthal et al.'s (1984) common-sense model of self-regulation and Witte's (1992) EPPM, the effects of cognitive and emotional factors as well as efficacy vary across health decision-making for the self and a dependent other. This study demonstrates the importance of identifying cognitive differences in how people make health decisions for themselves and a dependent other and of developing theoretical constructs to more sensitively tap into unique considerations therein. These efforts inform public health messaging and campaign strategy to bolster their effectiveness.

A large survey (Saddik et al., 2020) demonstrated "the urgency of policy makers to develop effective screening and coping strategies for parents and teachers and more specifically for vulnerable children" (p. 1). Not only may parental anxiety during the pandemic affect vaccination decisions but also it may have mental health consequences on children. Saddik et al. reveal a significant relationship between anxiety among parents and their children during the pandemic; in fact, parents who were severely anxious had a sevenfold increase over less anxious parents in reporting emotional problems in their children. Future research with parents identifying perceived vulnerability of their children would be

an interesting extension of this research. This research and Saddick et al.'s study indicate compelling consequences of anxiety on both the mental and physical health of children.

Practical Implications and Suggestions

Several studies have identified sources of vaccine refusal in parents; Temsah et al. (2021) surveyed 3,167 parents and found less than half intended to vaccinate their children, with the most common reasons for refusal including inadequate safety information and fear of side effects. Yigit et al. (2021) examined COVID vaccine refusal in parents and identified anxiety about side effects and doubts on effectiveness, among others, as responsible for refusal. Even the physical vaccination setting may cause anxiety in parents; Luthy et al. (2013) found that minor changes in physician office policies such as facilitating a quick office check-out exit process may alleviate parents' vaccine anxiety. Also, Luthy et al. note (2013) "because the cause of vaccine-related parental anxiety varies, targeted education is necessary to relieve common cause of vaccine anxiety, even among parents who vaccinate" (p. 667). Scholars have stressed the importance of reliable information and dependable sources use as well as of healthcare providers' sharing of informational sources for vaccine information (Temsah et al., 2021; Luthy et al., 2013). Yet, one study (Bond et al., 1998) identified a lack of balanced and detailed information and poor provider–parent communication as a pressing barrier to uptake. These informational needs were especially important during the mis- and disinformation surrounding COVID vaccination and with the changing protocols.

Beyond information, there is clearly an emotional need—anxiety—to address that emerges in this study and others (Temsah et al., 2021; Yigit et al., 2021), and this angst may not always be diminished with vaccine safety information. In fact, some information may *increase* anxiety; in Luthy et al.'s (2013) study, parents felt overwhelm then anxiety when they were given too much information, especially when it was too technical for them to comprehend.

The results of this study indicate that targeted information is critical to reducing parental vaccine anxiety. Pediatricians and

physicians treating children are critical touchpoints for anxiety reduction. As reviewed, there are broad reasons for COVID-19 vaccine hesitance (Bond et al., 1998) that necessitate a comprehensive understanding of the many factors affecting the decision in parents. Parents negotiate anxieties beyond the vaccine-targeted disease such as fear the vaccine may be more detrimental to health in the future than the disease itself and concern over the stress the vaccine places on the immune system. Access to the vaccine is yet another challenge that some parents face (Bond et al., 1998). Future research should reveal how sources of hesitance vary by factors such as children's ages or geography (rural, suburb, city, small town, etc.). Typically, doctors distribute vaccine information packets with the administered vaccine. However, to increase uptake for COVID-19 and other vaccinations, perhaps very tangible and targeted information should be provided *prior to* the appointment to calm anxious parents and alleviate their anxiety over vaccine safety.

Given the influence of anxiety on vaccination intentions, it is important for public health communicators to understand its unique sources. Just like for crisis management, it is important not to assume a "one-size-fits-all" model as attitudes toward vaccinating will vary for parents not only when applied to themselves or children but also by the children's ages, given that coverage decreases along with age of the child (AAP, 2023). Again, physicians' offices are an ideal intervention point from which to distribute easy-to-read, tangible information to parents that is targeted to assuage their anxieties as well as offer emotional connection and reassurance.

Given that anxiety mediates the relationships between both perceived threat of COVID-19 and protective efficacy levels with parents' intentions to COVID-19 vaccinate their children, public health communicators are advised not to focus their message strategy solely on the threat of the virus, why vaccination is important, or what parents can do to prevent that threat (the efficacy construct). Threat and efficacy are commonly used appeals in health messaging, but sources of anxiety emerge here as the more important target.

Limitations and Conclusions

Results have been presented along with directions for future research. However, there are limitations to consider. First, as noted above, the causal relationships between variables were not examined. Second, the results should be interpreted with consideration that situational/individual factors of COVID-19 (e.g., breaking news, vaccination rates, severity, fatality, etc.) may affect individuals' vaccination intentions. Further, only variables that are negative in nature were measured and analyzed (i.e., anxiety, safety concerns, and fear). Future research should include variables that are positive in nature as well. Next, it was identified that vaccination rate decreases as child(ren)'s age decreases (AAP, 2023). However, the effect of child(ren)'s age is not tested in the study as it was beyond its scope. Future research should explore the impact of age in the vaccination context. Finally, there could be important affective and cognitive variables to identify in addition to anxiety and safety.

Despite these limitations, these results extend Witte's (1992) extended parallel processing model (EPPM) by identifying how rational considerations (in this case, vaccine efficacy) and emotional reactions (vaccine anxiety) affect behavioral decisions to COVID-19 vaccinate. This research extends EPPM's explanatory relevance to parents' safeguarding behaviors for children using Avery and Park's (2021) concept of protective efficacy. Leventhal et al.'s common-sense model of self-regulation (1984) explicates how people become aware of a health threat, navigate their affective responses, and use evaluations of the threat and courses of action to formulate a response plan; cognitive and affective processes are central to the model. In this study, the affective process of anxiety emerged as the more influential in parents' decisions to COVID-19 vaccinate their children, which presents important strategy recommendations for public health campaigns to bolster vaccine uptake among children.

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