

Original Article



Maternal Posttraumatic Stress Symptoms and Psychological Burden in Mothers of Korean Children With Anaphylaxis

Kyunguk Jeong ^{1†}, Jihyun Kim ^{2†}, Hyoung Yoon Chang ³, Tae Won Song ⁴, Jeong Hee Kim ⁵, Meeyong Shin ⁶, Taek Ki Min ⁷, Sun Hee Choi ⁸, Yong Ju Lee ⁹, Kyung Won Kim ¹⁰, Woo Kyung Kim ¹¹, You Hoon Jeon ¹², Hye Yung Yum ¹³, Kangmo Ahn ¹⁴, Sooyoung Lee ¹, Young Min Ahn ¹⁴, Gwang Cheon Jang ^{15*}

OPEN ACCESS

Received: May 11, 2022
Revised: Jun 23, 2022
Accepted: Jul 6, 2022
Published online: Aug 17, 2022

Correspondence to

Gwang Cheon Jang, MD, PhD

Department of Pediatrics, National Health Insurance Service, Ilsan Hospital, 100 Ilsan-ro, Ilsandong-gu, Goyang 10444, Korea.
Tel: +82-31-900-0520
Fax: +82-31-900-0343
Email: janggwangc@yuhs.ac

*Kyunguk Jeong and Jihyun Kim contributed equally to this work as co-first authors.

Copyright © 2022 The Korean Academy of Asthma, Allergy and Clinical Immunology · The Korean Academy of Pediatric Allergy and Respiratory Disease

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ORCID iDs

Kyunguk Jeong
<https://orcid.org/0000-0002-1261-4507>
Jihyun Kim
<https://orcid.org/0000-0001-8493-2881>
Hyoung Yoon Chang
<https://orcid.org/0000-0002-5248-3433>
Tae Won Song
<https://orcid.org/0000-0001-6443-5749>
Jeong Hee Kim
<https://orcid.org/0000-0002-7054-8552>

¹Department of Pediatrics, Ajou University School of Medicine, Suwon, Korea

²Department of Pediatrics, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

³Department of Psychiatry and Behavioral Sciences, Ajou University School of Medicine, Suwon, Korea

⁴Department of Pediatrics, Ilsan Paik Hospital, Inje University College of Medicine, Goyang, Korea

⁵Department of Pediatrics, Inha University Hospital, Inha University College of Medicine, Incheon, Korea

⁶Department of Pediatrics, Soonchunhyang University Bucheon Hospital, Soonchunhyang University School of Medicine, Bucheon, Korea

⁷Department of Pediatrics, Soonchunhyang University Seoul Hospital, Soonchunhyang University College of Medicine, Seoul, Korea

⁸Department of Pediatrics, Kyung Hee University School of Medicine, Seoul, Korea

⁹Department of Pediatrics, Yongin Severance Hospital, Yonsei University College of Medicine, Yongin, Korea

¹⁰Department of Pediatrics, Severance Hospital, Yonsei University College of Medicine, Seoul, Korea

¹¹Department of Pediatrics, Seoul Paik Hospital, Inje University College of Medicine, Seoul, Korea

¹²Hallym University Dongtan Sacred Heart Hospital, Hwaseong, Korea

¹³Department of Pediatrics, Seoul Medical Center, Seoul, Korea

¹⁴Department of Pediatrics, Jangs Hospital, Seoul, Korea

¹⁵Department of Pediatrics, National Health Insurance Service, Ilsan Hospital, Goyang, Korea

ABSTRACT

Purpose: Anaphylaxis is a severe allergic reaction that is potentially life-threatening, but post-traumatic stress symptoms (PTSS) in the caregivers of children with anaphylaxis have not been evaluated. This study aimed to investigate the psychological burden on mothers of children with recent anaphylaxis.

Methods: A total of 188 children with recent anaphylaxis was recruited from 13 hospitals in Korea. Validated questionnaires, including the Korean versions of the Beck Anxiety Inventory (K-BAI), the Beck Depression Inventory (K-BDI), and the Impact of Event Scale Revised-Korean version (IES-R-K), were used to evaluate maternal anxiety, depression, and PTSS.

Results: The median ages of children and their mothers were 4 and 36 years, respectively. PTSS (IES-R-K \geq 25) were identified in 56.9% of mothers, and 57.9% of them showed severe PTSS. The proportions of mothers who had anxiety (K-BAI \geq 22) and depression (K-BDI \geq 17) were 18.6% and 33.0%, respectively. Multivariable logistic regression analysis indicated that the patient's history of asthma (adjusted odds ratio [aOR], 5.46; 95% CI, 1.17–25.59) and the presence of central nervous symptoms (aOR, 3.27; 95% CI, 1.07–9.96) were associated with PTSS. Age of 2 or older (aOR, 2.87; 95% CI, 1.10–7.52) and eggs, milk, or wheat as the cause of anaphylaxis (aOR, 2.87; 95% CI, 1.10–7.52) increased the risk of severe PTSS.

Meeyong Shin 
<https://orcid.org/0000-0003-3699-8741>
Taek Ki Min 
<https://orcid.org/0000-0002-5078-5622>
Sun Hee Choi 
<https://orcid.org/0000-0002-0554-2250>
Yong Ju Lee 
<https://orcid.org/0000-0002-0796-2558>
Kyung Won Kim 
<https://orcid.org/0000-0003-4529-6135>
Woo Kyung Kim 
<https://orcid.org/0000-0001-8730-010X>
You Hoon Jeon 
<https://orcid.org/0000-0002-8164-7580>
Hye Yung Yum 
<https://orcid.org/0000-0002-3997-4094>
Kangmo Ahn 
<https://orcid.org/0000-0001-7751-9829>
Sooyoung Lee 
<https://orcid.org/0000-0003-1734-4101>
Young Min Ahn 
<https://orcid.org/0000-0002-1697-8041>
Gwang Cheon Jang 
<https://orcid.org/0000-0002-2423-9951>

Disclosure

There are no financial or other issues that might lead to conflict of interest.

Conclusions: The rate of PTSS among mothers of children with recent anaphylaxis was high at 56.9%. Clinicians who care for pediatric anaphylaxis patients should be aware of the psychological burden on their caregivers.

Keywords: Anaphylaxis; anxiety; depression; stress disorders, post-traumatic; psychological distress

INTRODUCTION

Post-traumatic stress symptoms (PTSS) are severe anxiety, flashbacks, and/or uncontrollable thoughts, key elements of post-traumatic stress disorder (PTSD), that occur after exposure to emotionally stressful events or experiences of serious medical conditions.^{1,2} PTSD manifests as persistence of intense, painful, and fearfully avoided responses to reminders of the traumatic events, altered mood and cognition, a pervasive sense of impending threats, sleep disturbance, and excessive vigilance after exposure to emotionally stressful events or experiences of serious medical conditions.^{1,3} The lifetime prevalence of PTSD varies from 1.3 to 12.2% depending on social background and country of residence.⁴ A recent meta-analysis reported that about 19% of parents of children with chronic physical illnesses suffered from PTSS, which is much higher than the 3.5% found in the general adult population in the United States.⁵ This indicates that diagnosis of serious chronic diseases in families can be recognized as a traumatic event.⁵

Anaphylaxis is a severe, potentially life-threatening allergic reaction that is mostly triggered by foods, drugs, or insect venom.⁶ The lifetime prevalence of anaphylaxis ranges from 0.3% to 5.1%, and one-quarter of all cases occur in children and adolescents according to European data.^{7,8} The incidence of anaphylaxis is increasing in various regions, and the increase is particularly large in young age groups.^{9,10} Anaphylaxis typically occurs in unpredictable circumstances and is often accompanied by severe systemic symptoms such as respiratory difficulty or hypotension, causing psychological stress to patients and their caregivers.¹¹

Anaphylaxis can be a life-threatening situation and a lifetime traumatic event, and the experience of anaphylaxis in children can have a huge impact on their caregivers.^{12,13} Anaphylaxis has been considered a cause of PTSD because it can be felt as a threat to physical integrity in patients and family members.^{1,14} There have been several studies in adults showing that PTSS were significantly more frequent in patients who have experienced anaphylaxis, but no studies have been conducted on PTSS in the caregivers of children with anaphylaxis.^{14,15} Therefore, we used validated versions of related questionnaires to evaluate the psychological burden, specifically anxiety, depression, and PTSS, of mothers after their children had experienced anaphylaxis.

MATERIALS AND METHODS

Study population and design

A questionnaire-based, cross-sectional study was performed in 13 hospitals in Korea from October 2016 to December 2018. Children aged 0–17 who were diagnosed with anaphylaxis in emergency departments or outpatient clinics within the last two weeks to three months were recruited, and their mothers were given a detailed questionnaire to complete. Anaphylaxis

was defined according to the diagnostic criteria proposed by the National Institute of Allergy and Infectious Diseases/Food Allergy and Anaphylaxis Network.¹⁶ The questionnaire included information regarding sex, age, maternal age, past medical history, family history of allergic diseases, prior anaphylaxis, and symptoms and causes of anaphylaxis. We classified the reported symptoms according to the affected organs: 1) Skin or mucosal symptoms such as urticaria, rash, itching, redness, or angioedema; 2) gastrointestinal symptoms such as vomiting, nausea, abdominal pain, or diarrhea; 3) respiratory symptoms such as cough, dyspnea, or wheezing; 4) cardiovascular symptoms such as chest pain, tachycardia, bradycardia, or hypotension; and 5) central nervous system (CNS) symptoms such as confusion, unconsciousness, hypotonia, dizziness, or seizure.¹² This study was approved by the Institutional Review Boards of Seoul Medical Center No. 2016-04-45, Kyung Hee University Gangdong Hospital No. 2016-07-003, Hallym University Dongtan Sacred Heart Hospital No. 2016-357-1, Inha University Hospital No. 2016-07-015, Inje University Seoul Paik Hospital No. 2016-314, Soonchunhyang University Seoul Hospital No. 2016-08-029, Inje University Ilsan Paik Hospital No. 2016-11-007, Yonsei University Severance Hospital No. 4-2016-0569, Samsung Medical Center No. SMC-2016-06-071, Ajou University Hospital No. AJIRB-MED-SUR-16-357), Soonchunhyang University Bucheon Hospital No. 2016-07-020-003, National Health Insurance Service Ilsan Hospital NHIMC 2016-06-003-006, and Eulji University Nowon Hospital No. 2018-07-140. Written informed consent was obtained from each parent before his/her child participated in the study.

Evaluation of anxiety, depression, and PTSS

The Korean versions of the Impact of Event Scale (IES-R-K)-Revised, a modified Korean version of the IES-R, was used to detect PTSS.¹⁷ This self-rated questionnaire consists of 22 inquiries to evaluate the presence of PTSS, such as hyperarousal (feeling watchful and on guard), avoidance (an effort to avoid reminders of the event), and intrusion (dreaming about the event). IES-R-K scores were categorized into three groups: normal (IES-R-K \leq 24), low risk of PTSS and mild-to-moderate ($25 \leq$ IES-R-K \leq 39); and severe (IES-R-K \geq 40).

The Korean version of the Beck Anxiety Inventory (K-BAI) and the Beck Depression Inventory (K-BDI) were used to assess anxiety and depression, respectively. These self-administered questionnaires consist of 21 questions, and each of the questions is scored with values ranging from 0 to 3. A K-BAI score \geq 22 was considered as the existence of anxiety symptoms, while a K-BDI score \geq 17 was defined as the presence of depressive symptoms.^{18,19}

Statistical analysis

Data were analyzed using SPSS for Windows (version 27.0, SPSS, Chicago, IL, USA). Data were presented as numbers (percentages) or median (range). Univariate and multivariate logistic regression analyses were used to test the associations between clinical characteristics and psychological distress. Variables with a *P* value $<$ 0.1 in univariable analyses were chosen for the multivariable analysis. A *P* value less than 0.05 was considered significant.

RESULTS

Clinical characteristics of the study population

One hundred eighty-eight subjects were enrolled in the study. The median age of children was 4 years, ranging from 4 months to 17 years. Of the 188 mothers who conducted the survey, information on age was collected in 144, of which 23.9% were aged $<$ 35, 33.5% were

Table 1. Baseline characteristics of patients

Characteristics of children with anaphylaxis	Values
Age (yr)	
Median (range)	4 (4 mo–17 yr)
0–1	49 (26.1)
2–6	75 (39.9)
≥ 7	64 (34.0)
Sex	
Male	126 (67.0)
Female	62 (33.0)
Allergic diseases	
Atopic dermatitis	82 (43.6)
Allergic rhinitis	53 (28.2)
Asthma	29 (15.4)
Drug allergy	3 (1.6)
Food allergy	134 (71.3)
Family history of allergic diseases	124 (66.0)
Causes of anaphylaxis	
Food	171 (91.0)
Drug	9 (4.8)
Food-dependent exercise-induced anaphylaxis	3 (1.6)
Other causes	5 (2.7)
Maternal age (yr)	
Median (range)	36 (25–53)
< 35	45/144 (23.9)
35–39	63/144 (33.5)
≥ 40	36/144 (23.4)

Data are shown as number (%).

aged 35–39, and 23.4% were aged 40 years or older. Among the concurrent allergic diseases in children, food allergy (FA) (71.3%) was most common, followed by atopic dermatitis (43.6%), allergic rhinitis (28.2%), and asthma (15.4%). Anaphylaxis was caused by food in most cases, whereas drug-induced, food-dependent, and exercise-induced anaphylaxis were also reported. Other causes of anaphylaxis were physical stimuli or animal exposure. Among food-induced anaphylaxis, tree nuts, egg, grains and seeds, and milk accounted for 75%. The demographic and clinical characteristics are given in **Table 1**.

PTSS and psychological burden in mothers of children with anaphylaxis

The median (range) IES-R-K score was 29 (0–88), and 107 (56.9%) mothers had PTSS (IES-R-K ≥ 25). The median (range) K-BAI score and K-BDI score were 8 (0–63) and 11 (0–68), respectively, and the proportions of mothers who had anxiety (K-BAI ≥ 22) and depression (K-BDI ≥ 17) were 18.6% and 33.0%, respectively (**Fig. 1**).

When classified according to age of the patients, the maternal PTSS rate was 42.9% at 0–1 years, 69.3% at 2–6 years, 56.5% at 7–9 years, and 51.2% at 10 years or older. The maternal anxiety rates for each age group of patients were 8.2% at 0–1 years, 24.0% at 2–6 years, 21.7% at 7–9 years, and 19.5% at 10 years or older. As with PTSS and anxiety, maternal depression was also highest in the 2–6-year group; 26.5% at 0–1 years, 37.3% at 2–6 years, 34.8% at 7–9 years, and 31.7% at 10 years or older.

According to the age of the mother, the psychological burden tended to be lower for those under 35 years of age. The PTSS rates were 46.7%, 63.5%, and 61.1% in those < 35, 35–39, and ≥ 40 years, respectively. Anxiety rates were 13.3%, 23.8%, and 25.0% in those < 35, 35–39, and ≥ 40 years, respectively, and depression rates were 31.1%, 34.9%, and 38.9% in the same age groups.

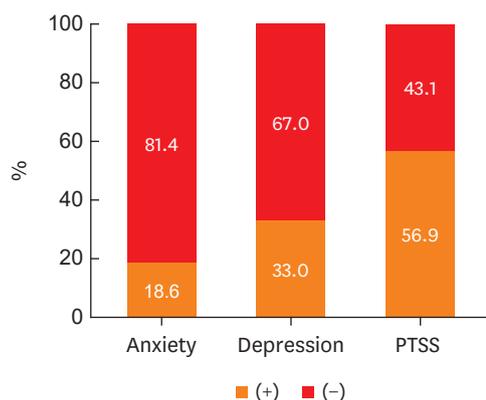


Fig. 1. The proportions of subjects with maternal anxiety, depression, and PTSS. PTSS, post-traumatic stress symptoms.

Among the causes of anaphylaxis, the psychological burden tended to be higher in mothers of children with drug-induced anaphylaxis. The maternal PTSS rate was 66.7% in drug-induced anaphylaxis compared to 57.9% in food-induced anaphylaxis. In drug-induced anaphylaxis, maternal anxiety and depression rates were 22.2% and 44.4%, respectively, which were higher than the 18.7% and 32.7% in food-induced anaphylaxis.

In the analysis of the psychological burden according to the presence or absence of specific symptoms, maternal PTSS was more prevalent in the cases with CNS or cardiovascular symptoms. There was no difference in the prevalence of maternal PTSS in the cases with respiratory symptoms; in the cases with gastrointestinal symptoms, maternal PTSS tended to be fewer. Severe PTSS, defined as IES-R-K score of 40 or higher, was identified in 62 subjects, accounting for one-third of mothers, and 57.9% of those with PTSS.

Correlation between IES-R-K, BDI, and BAI scores

IES-R-K scores were positively correlated with BDI and BAI (rho coefficient = 0.581 and 0.680, respectively; all $P < 0.001$). In addition, there was a positive association between BDI and BAI scores (rho coefficient = 0.709; $P < 0.001$).

Factors associated with maternal psychological distress in children with anaphylaxis

Univariable analysis indicated that age of 2 or older (odds ratio [OR], 2.16; 95% confidence interval [CI], 1.12–4.19), previous history of asthma (OR, 2.74; 95% CI, 1.11–6.77), and CNS symptoms (OR, 2.50; 95% CI, 1.05–5.92) were associated with maternal PTSS (**Table 2**). Age of 2 or older (OR, 2.74; 95% CI, 1.23–6.10) and CNS symptoms (OR, 2.19; 95% CI, 1.00–4.80) were also related to severe PTSS (**Table 2**). The multivariable analysis revealed that history of asthma (adjusted OR [aOR], 5.46; 95% CI, 1.17–25.59) and CNS symptoms (aOR, 3.27; 95% CI, 1.07–9.96) were associated with PTSS (**Fig. 2A**). Additionally, age of 2 or older (aOR, 2.87; 95% CI, 1.10–7.52) and eggs, milk, or wheat as the cause of anaphylaxis (aOR, 2.87; 95% CI, 1.10–7.52) increased the risk of severe PTSS in multivariable analysis (**Fig. 2B**).

Age of 2 or older was the only risk factor for maternal anxiety in univariable and multivariable analyses. Although eggs, milk, or wheat as the cause of anaphylaxis were associated with an increased risk for maternal depression in univariable analysis (**Table 3**), no association between clinical characteristics and maternal depression was found after adjusting for sex,

Table 2. Univariable analyses for clinical characteristics influencing PTSS

Variables	PTSS		Severe PTSS	
	OR (95% CI)	P value	OR (95% CI)	P value
Age (≥ 2 yr)	2.16 (1.12–4.19)	0.022	2.74 (1.23–6.10)	0.014
Maternal age (≥ 35 yr)	1.92 (0.94–3.91)	0.074	1.69 (0.76–3.74)	0.196
Sex (male)	1.03 (0.56–1.90)	0.928	0.68 (0.35–1.32)	0.257
Past medical history				
Atopic dermatitis (yes)	1.23 (0.69–2.20)	0.489	1.47 (0.80–2.71)	0.217
Allergic rhinitis (yes)	0.98 (0.52–1.87)	0.957	0.74 (0.37–1.48)	0.394
Asthma (yes)	2.74 (1.11–6.77)	0.029	1.54 (0.68–3.46)	0.298
Drug allergy (yes)	1.52 (0.14–17.01)	0.733	1.02 (0.09–11.43)	0.989
Food allergy (yes)	1.65 (0.87–3.11)	0.125	1.41 (0.70–2.81)	0.337
Family history of allergic diseases (yes)	1.05 (0.56–1.97)	0.888	1.41 (0.71–2.80)	0.326
Cause of anaphylaxis				
Food	1.55 (0.57–4.20)	0.392	1.67 (0.52–5.35)	0.389
Egg, milk, or wheat	1.53 (0.83–2.81)	0.169	1.74 (0.92–3.29)	0.087
Peanut or tree nuts	0.84 (0.44–1.61)	0.596	0.60 (0.24–1.50)	0.277
Seafood	0.50 (0.18–1.37)	0.175	0.40 (0.11–1.44)	0.161
Drug	1.55 (0.37–6.37)	0.548	1.02 (0.25–4.21)	0.981
Symptoms				
Respiratory	1.01 (0.46–2.23)	0.976	1.43 (0.60–3.42)	0.424
Cardiovascular	1.41 (0.58–3.37)	0.444	2.09 (0.89–4.89)	0.091
Central nervous system	2.50 (1.05–5.92)	0.038	2.19 (1.00–4.80)	0.049
Previous experience of anaphylaxis (yes)	1.30 (0.67–2.54)	0.439	1.85 (0.94–3.63)	0.076
Prescription of epinephrine autoinjector (yes)	1.54 (0.72–3.27)	0.264	1.37 (0.63–3.00)	0.431

PTSS, post-traumatic stress symptoms; OR, odds ratio; CI, confidence interval.

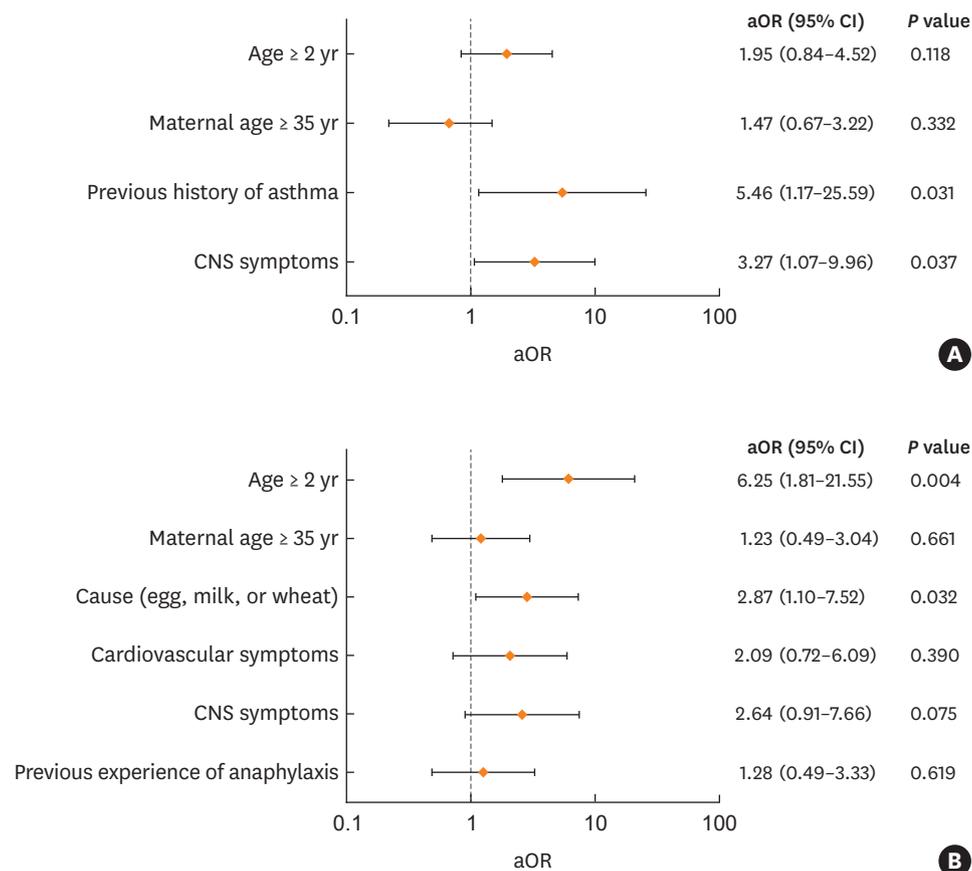


Fig. 2. Multivariable analyses for risk factors influencing maternal PTSS (A) and severe maternal PTSS (B). aOR, adjusted odds ratio; CI, confidence interval; CNS, central nervous system; PTSS, post-traumatic stress symptoms.

Table 3. Univariable analyses for clinical characteristics influencing maternal anxiety and depression

Variables	Anxiety		Depression	
	OR (95% CI)	P value	OR (95% CI)	P value
Age (\geq 2 yr)	3.23 (1.08–9.68)	0.036	1.51 (0.73–3.11)	0.266
Maternal age (\geq 35 yr)	2.08 (0.79–5.51)	0.141	1.27 (0.60–2.69)	0.540
Sex (male)	0.65 (0.29–1.50)	0.313	1.86 (0.94–3.70)	0.074
Past medical history				
Atopic dermatitis (yes)	0.72 (0.34–1.53)	0.393	1.79 (0.97–3.31)	0.064
Allergic rhinitis (yes)	0.86 (0.37–1.98)	0.718	0.84 (0.42–1.66)	0.610
Asthma (yes)	1.49 (0.58–3.82)	0.408	1.29 (0.57–2.94)	0.538
Drug allergy (yes)	0 (0–999.9)	0.999	1.02 (0.09–11.43)	0.989
Food allergy (yes)	1.77 (0.72–4.35)	0.210	1.24 (0.63–2.46)	0.536
Family history of allergic diseases (yes)	0.65 (0.30–1.42)	0.282	0.67 (0.32–1.43)	0.304
Cause of anaphylaxis				
Food	1.07 (0.29–3.96)	0.914	0.89 (0.31–2.54)	0.831
Egg, milk, or wheat	1.22 (0.57–2.63)	0.614	1.94 (1.02–3.70)	0.043
Peanut or tree nuts	0.60 (0.24–1.50)	0.277	0.261 (0.30–1.27)	0.188
Seafood	0.95 (0.26–3.51)	0.934	0.42 (0.12–1.53)	0.188
Drug	1.26 (0.25–6.36)	0.776	1.67 (0.43–6.45)	0.458
Symptoms				
Respiratory	0.90 (0.34–2.40)	0.832	1.43 (0.60–3.42)	0.424
Cardiovascular	1.88 (0.72–4.91)	0.201	1.17 (0.48–2.81)	0.730
Central nervous system	1.34 (0.53–3.43)	0.536	1.35 (0.61–3.00)	0.459
Previous experience of anaphylaxis (yes)	1.25 (0.55–2.86)	0.599	1.40 (0.71–2.77)	0.330
Prescription of epinephrine autoinjector (yes)	1.67 (0.66–4.26)	0.282	2.14 (0.98–4.65)	0.055

OR, odds ratio; CI, confidence interval.

past medical history of atopic dermatitis, or prescription of an epinephrine autoinjector in multivariable analysis.

DISCUSSION

To the best of our knowledge, this is the first study to investigate the association between anaphylaxis in children and maternal PTSS. We found that more than half of the mothers of children with anaphylaxis developed PTSS, and about one of three mothers suffered from severe PTSS. Additionally, 18.6% and 33.0% of mothers had anxiety symptoms and depression, respectively, after their children experienced anaphylaxis. These prevalence rates are higher than the 41.4% for PTSS, 23.2% for severe PTSS, and 28.1% for depression in Korean adult patients with anaphylaxis, whereas the rate of anxiety was not higher than that in an adult study.¹⁴ This indicates that mothers of pediatric patients find anaphylaxis more psychologically frightening and painful than do adult patients. We enrolled only mothers of children with anaphylaxis because the occurrence and severity of PTSS could be influenced by sexual and social factors.³ Previous studies also showed that mothers of children with chronic diseases tend to develop PTSS or PTSD more frequently than fathers.^{20–22}

As in our previous study, food was the most common cause of anaphylaxis, followed by drugs.²³ Eggs, cow's milk, and wheat, the most prevalent food allergens, are common in processed foods, which suggests why they affect severe PTSS in the present study.²⁴ It is inferred that widespread presence of allergens can lead to anxiety about recurrence of serious allergic reactions by accident and subsequent PTSS. In accordance with the possible reasons, anxiety sensitivity was positively related to PTSS severity including avoidance and hyperarousal symptoms.²⁵ Similarly, recent clinical studies suggest that FA is associated with impaired quality of life and increased level of anxiety in patients and caregivers. In Turkish

children with FA, scores related to emotional impact and food anxiety were particularly affected in those with previous anaphylaxis.²⁶ Among caregivers of children with FA in the United States, low quality of life scores were associated with age at the most severe reaction, peanut or tree nut allergy, multiple FAs, and a history of anaphylaxis.²⁷

In the present study, previous history of asthma and CNS symptoms in children increased the likelihood of PTSS in their mothers. The persistence of the fear response in PTSD patients is due to a dysregulated fear response, impaired safety signal learning, and fear-related memory formation.^{3,28} It is postulated that enormous events such as CNS symptoms and a past history of asthma in children can affect fear learning in their mothers. These results are different from those of Korean adults, which showed no association between PTSS and symptoms and severity of anaphylaxis.¹⁴ In addition, mothers of patients aged 2 years or older and who attended childcare facilities or schools had a high risk of severe PTSS in our current study. Previous Korean multicenter studies demonstrated that only one-quarter of pediatric patients were infants, and about 7.7% of food-induced allergic reactions occurred in childcare centers or schools.^{13,29} As severe PTSS in mothers of preschoolers and schoolchildren could have a negative impact on parental burden and maternal stress, social assistance is required for families of children with anaphylaxis.

In a recent meta-analysis, parents of children with epilepsy, diabetes, sickle cell disease, heart disease, and cancer had the highest risk of developing PTSS.⁵ PTSS was reported in 25%–48% and 32%–45% of the parents of children with epilepsy and cancer, respectively, although race and evaluation methods were not the same as those in the present study.^{20,21} Those findings indicate that Korean mothers of pediatric patients with anaphylaxis experience a similar prevalence of PTSS to that of parents of children with other chronic diseases. Parental PTSS can be caused by disease-related life threats, chronic illness-induced damage, serious complications associated with treatment, painful procedures, and emergency hospitalizations, which are also found in anaphylaxis.⁵ However, no studies have been conducted to investigate PTSS in children suffering from chronic diseases or their guardians in Korea, making it difficult to accurately compare maternal psychological stresses among other chronic diseases. More than half of PTSD cases have mood, anxiety, and substance use disorders.³⁰ Similarly, our present study also showed anxiety and depression symptoms in about 18.6% and 33.0% of mothers with PTSS, respectively. In this regard, careful monitoring of PTSS and psychiatric problems is critical in parents of children with anaphylaxis, as PTSS has been reported to have a relationship with suicidal behavior.^{3,31,32}

There are limitations in this study. We did not evaluate biological correlates of PTSS including inflammatory markers and neuroendocrine profiles in the present study, and the diagnosis of PTSS and evaluation of other psychiatric conditions were performed through questionnaires rather than clinical interviews. However, our study is clinically meaningful in that these data are the first known attempt to show the significant association between maternal PTSS and anaphylaxis in children using validated questionnaires.

In conclusion, mothers of children with anaphylaxis are likely to have significant psychological burdens such as PTSS, anxiety, and depression. CNS symptoms and previous history of asthma were associated with PTSS, whereas age of 2 or older and food allergens such as eggs, milk, or wheat increased the likelihood of severe PTSS. Therefore, careful evaluation of emotional symptoms and psychological interventions is needed for mothers of pediatric patients with anaphylaxis.

ACKNOWLEDGMENTS

This study was supported by the Korean Academy of Asthma, Allergy, and Clinical Immunology.

REFERENCES

1. Tal Y, Shany G, Hershko AY, Ribak Y, Mizrahi E, Shamriz O, et al. The association between anaphylaxis and post-traumatic stress disorder in subjects with Hymenoptera venom allergy. *J Allergy Clin Immunol Pract* 2020;8:775-7.
[PUBMED](#) | [CROSSREF](#)
2. Biggs QM, Ursano RJ, Wang J, Krantz DS, Carr RB, Wynn GH, et al. Daily variation in post traumatic stress symptoms in individuals with and without probable post traumatic stress disorder. *BMC Psychiatry* 2019;19:56.
[PUBMED](#) | [CROSSREF](#)
3. Shalev A, Liberzon I, Marmar C. Post-traumatic stress disorder. *N Engl J Med* 2017;376:2459-69.
[PUBMED](#) | [CROSSREF](#)
4. Karam EG, Friedman MJ, Hill ED, Kessler RC, McLaughlin KA, Petukhova M, et al. Cumulative traumas and risk thresholds: 12-month PTSD in the World Mental Health (WMH) surveys. *Depress Anxiety* 2014;31:130-42.
[PUBMED](#) | [CROSSREF](#)
5. Pinquart M. Posttraumatic stress symptoms and disorders in parents of children and adolescents with chronic physical illnesses: a meta-analysis. *J Trauma Stress* 2019;32:88-96.
[PUBMED](#) | [CROSSREF](#)
6. Cardona V, Ansotegui IJ, Ebisawa M, El-Gamal Y, Fernandez Rivas M, Fineman S, et al. World allergy organization anaphylaxis guidance 2020. *World Allergy Organ J* 2020;13:100472.
[PUBMED](#) | [CROSSREF](#)
7. Tejedor Alonso MA, Moro Moro M, Múgica García MV. Epidemiology of anaphylaxis. *Clin Exp Allergy* 2015;45:1027-39.
[PUBMED](#) | [CROSSREF](#)
8. Worm M, Moneret-Vautrin A, Scherer K, Lang R, Fernandez-Rivas M, Cardona V, et al. First European data from the network of severe allergic reactions (NORA). *Allergy* 2014;69:1397-404.
[PUBMED](#) | [CROSSREF](#)
9. Turner PJ, Gowland MH, Sharma V, Ierodiakonou D, Harper N, Garcez T, et al. Increase in anaphylaxis-related hospitalizations but no increase in fatalities: an analysis of United Kingdom national anaphylaxis data, 1992–2012. *J Allergy Clin Immunol* 2015;135:956-963.e1.
[PUBMED](#) | [CROSSREF](#)
10. Jeong K, Lee JD, Kang DR, Lee S. A population-based epidemiological study of anaphylaxis using national big data in Korea: trends in age-specific prevalence and epinephrine use in 2010–2014. *Allergy Asthma Clin Immunol* 2018;14:31.
[PUBMED](#) | [CROSSREF](#)
11. Pouessel G, Antoine M, Lejeune S, Dubos F, Pierache A, Deschildre A, et al. The time course of anaphylaxis manifestations in children is diverse and unpredictable. *Clin Exp Allergy* 2020;50:117-20.
[PUBMED](#) | [CROSSREF](#)
12. Poowuttikul P, Seth D. Anaphylaxis in children and adolescents. *Pediatr Clin North Am* 2019;66:995-1005.
[PUBMED](#) | [CROSSREF](#)
13. Jeong K, Kim J, Ahn K, Lee SY, Min TK, Pyun BY, et al. Age-based causes and clinical characteristics of immediate-type food allergy in Korean children. *Allergy Asthma Immunol Res* 2017;9:423-30.
[PUBMED](#) | [CROSSREF](#)
14. Lee Y, Chang HY, Kim SH, Yang MS, Koh YI, Kang HR, et al. A prospective observation of psychological distress in patients with anaphylaxis. *Allergy Asthma Immunol Res* 2020;12:496-506.
[PUBMED](#) | [CROSSREF](#)
15. Chung MC, Walsh A, Dennis I. Trauma exposure characteristics, past traumatic life events, coping strategies, posttraumatic stress disorder, and psychiatric comorbidity among people with anaphylactic shock experience. *Compr Psychiatry* 2011;52:394-404.
[PUBMED](#) | [CROSSREF](#)

16. Sampson HA, Muñoz-Furlong A, Campbell RL, Adkinson NF Jr, Bock SA, Branum A, et al. Second symposium on the definition and management of anaphylaxis: summary report--Second National Institute of Allergy and Infectious Disease/Food Allergy and Anaphylaxis Network symposium. *J Allergy Clin Immunol* 2006;117:391-7.
[PUBMED](#) | [CROSSREF](#)
17. Lim HK, Woo JM, Kim TS, Kim TH, Choi KS, Chung SK, et al. Reliability and validity of the Korean version of the Impact of Event Scale-Revised. *Compr Psychiatry* 2009;50:385-90.
[PUBMED](#) | [CROSSREF](#)
18. Yook SP, Kim ZS. A clinical study on the Korean version of Beck Anxiety Inventory: comparative study of patient and non-patient. *Korean J Clin Psychol* 1997;16:185-97.
19. Lim SY, Lee EJ, Jeong SW, Kim HC, Jeong CH, Jeon TY, et al. The validation study of Beck Depression Scale 2 in Korean version. *Anxiety Mood* 2011;7:48-53.
20. Carmassi C, Corsi M, Bertelloni CA, Pedrinelli V, Massimetti G, Peroni D, et al. Post-traumatic stress spectrum symptoms in parents of children affected by epilepsy: Gender differences. *Seizure* 2020;80:169-74.
[PUBMED](#) | [CROSSREF](#)
21. Gunjur A. PTSD in parents after childhood cancer. *Lancet Oncol* 2015;16:e320.
[PUBMED](#) | [CROSSREF](#)
22. Cabizuca M, Marques-Portella C, Mendlowicz MV, Coutinho ES, Figueira I. Posttraumatic stress disorder in parents of children with chronic illnesses: a meta-analysis. *Health Psychol* 2009;28:379-88.
[PUBMED](#) | [CROSSREF](#)
23. Jeong K, Ye YM, Kim SH, Kim KW, Kim JH, Kwon JW, et al. A multicenter anaphylaxis registry in Korea: clinical characteristics and acute treatment details from infants to older adults. *World Allergy Organ J* 2020;13:100449.
[PUBMED](#) | [CROSSREF](#)
24. Skypala JJ, McKenzie R. Nutritional issues in food allergy. *Clin Rev Allergy Immunol* 2019;57:166-78.
[PUBMED](#) | [CROSSREF](#)
25. Berenz EC, Vujanovic AA, Coffey SF, Zvolensky MJ. Anxiety sensitivity and breath-holding duration in relation to PTSD symptom severity among trauma exposed adults. *J Anxiety Disord* 2012;26:134-9.
[PUBMED](#) | [CROSSREF](#)
26. Arik Yilmaz E, Cavkaytar O, Buyuktiryaki B, Soyer O, Sahiner UM, Sekerel BE, et al. Factors affecting food allergy-related quality of life from parents' perception in Turkish children. *Allergy Asthma Immunol Res* 2018;10:379-86.
[PUBMED](#) | [CROSSREF](#)
27. Howe L, Franxman T, Teich E, Greenhawt M. What affects quality of life among caregivers of food-allergic children? *Ann Allergy Asthma Immunol* 2014;113:69-74.e2.
[PUBMED](#) | [CROSSREF](#)
28. Jovanovic T, Kazama A, Bachevalier J, Davis M. Impaired safety signal learning may be a biomarker of PTSD. *Neuropharmacology* 2012;62:695-704.
[PUBMED](#) | [CROSSREF](#)
29. Lee SY, Ahn K, Kim J, Jang GC, Min TK, Yang HJ, et al. A multicenter retrospective case study of anaphylaxis triggers by age in Korean children. *Allergy Asthma Immunol Res* 2016;8:535-40.
[PUBMED](#) | [CROSSREF](#)
30. Pietrzak RH, Goldstein RB, Southwick SM, Grant BF. Prevalence and Axis I comorbidity of full and partial posttraumatic stress disorder in the United States: results from Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions. *J Anxiety Disord* 2011;25:456-65.
[PUBMED](#) | [CROSSREF](#)
31. Bryan CJ. Treating PTSD within the context of heightened suicide risk. *Curr Psychiatry Rep* 2016;18:73.
[PUBMED](#) | [CROSSREF](#)
32. Healy NA, Vujanovic AA. PTSD symptoms and suicide risk among firefighters: the moderating role of sleep disturbance. *Psychol Trauma* 2021;13:749-58.
[PUBMED](#) | [CROSSREF](#)