



Trauma exposure characteristics, past traumatic life events, coping strategies, posttraumatic stress disorder, and psychiatric comorbidity among people with anaphylactic shock experience

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Abstract

Objectives: This study investigated the interrelationship between trauma exposure characteristics, past traumatic life events, coping strategies, posttraumatic stress disorder (PTSD) symptoms, and psychiatric comorbidity among people after anaphylactic shock experience.

Method: The design was cross-sectional in that 94 people with anaphylactic shock experience responded to a postal survey. They completed the Posttraumatic Stress Disorder Checklist, the General Health Questionnaire 28, and the COPE Scale. They also answered questions on trauma exposure characteristics. The control group comprised 83 people without anaphylaxis.

Results: Twelve percent of people with anaphylactic shock experience fulfilled the diagnostic criteria for full PTSD. As a group, people with anaphylaxis reported significantly more past traumatic life events and psychiatric comorbidity than did the control. Partial least squares analysis showed that trauma exposure characteristics influenced postanaphylactic shock PTSD symptoms and psychiatric comorbidity, which, in turn, influenced coping strategies.

Conclusions: People could develop PTSD and psychiatric comorbidity symptoms after their experience of anaphylactic shock. The way they coped with anaphylactic shock was affected by the severity of these symptoms. Past traumatic life events had a limited role to play in influencing outcomes.

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1. Introduction

Several studies have investigated posttraumatic stress disorder (PTSD) among people who had life-threatening illnesses [1]. No studies have, thus far, looked at PTSD after a potentially life-threatening anaphylactic shock (postanaphylactic shock PTSD). This is not too surprising given that research on psychological aspects of anaphylaxis is limited [2]. Anaphylaxis is a severe allergic reaction triggered by foods such as peanuts or shellfish, by bee or wasp stings, or by medicines such as ibuprofen. Exposure to the trigger causes the release of immunological mediators such as histamines, prostaglandins, and leukotrienes. Allergic reactions generally involve a nettle rash or hives (urticaria) and/or swelling of the face (angioedema). In addition to these symptoms, people with this condition also develop (1) breathing difficulty due to swelling of the throat or (2) a drop

in blood pressure, which can result in collapse and loss of consciousness. In severe cases, both the breathing difficulty and the drop in blood pressure can lead to death.

During anaphylactic shock, people may experience a strong sense of doom or feel that they are going to die. Understandably, this can be an emotionally traumatic experience. Such emotional trauma is often exacerbated by the fear of not being able to breathe, by extreme anxiety, and by losing consciousness, alongside extremely uncomfortable physical symptoms such as burning lips, blisters on skin, nausea and vomiting, and swelling of the tongue.

The current study aimed to investigate the extent of PTSD symptoms that developed after anaphylactic shock (postanaphylactic shock PTSD) and the psychological mechanisms involved in the development of PTSD and psychiatric comorbidity. In particular, it aimed to examine the interrelationship between trauma exposure characteristics, past traumatic life events, coping strategies, postanaphylactic shock PTSD, and psychiatric comorbidity. To guide our investigation, we turn to a theoretical model depicting the

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interrelationship between trauma exposure characteristics, coping, and PTSD outcomes among people exposed to type IV traumas [3]. This type of trauma results from a distressing anomalous event, which is defined by an alteration in the victim's relationship to the biosphere or environment. Trauma exposure leads to the development of PTSD symptoms (eg, hypervigilance) and psychiatric comorbidity (eg, anxiety and depression). Victims of this type of trauma feel that they are unable to terminate the potential threat from the event and that their sense of safety within their biosphere or environment has been violated. Trauma exposure, consequently, generates a high level of uncertainty for them and impacts on the way in which they cope. In addition, based on victims exposed to repeated and unpredictable terrorist attacks as one example of type IV trauma, Somer et al [4] claimed that PTSD symptoms after trauma exposure also affect how people cope with repeat occurrences of the event.

In the current study, we postulate that anaphylactic shock or repeated anaphylactic shock is another example of type IV trauma. Anaphylactic shock is an anomalous, distressing, and potentially life-threatening event, after which people need to change their basic relation to the environment by doing all they can to avoid the trigger event. After anaphylactic shock experience, people often feel that they are unable to terminate the potential threat of further anaphylactic reactions and feel unsafe within their biosphere or environment. This may be because, after anaphylactic shock, any ordinary assumption of safety has been violated. Their schema or beliefs about the world have changed, and they have become preoccupied by the danger in their environment [5]. They know that to be open to the threat of anaphylaxis is a real threat, and it will be triggered if they are in contact with the allergens. Hence, they cannot underestimate the importance of ritual checking and have to be constantly vigilant, for example, checking with friends or waiters about whether the food that they are about to eat contains the allergen. However, despite the ritual checking, they still feel a sense of uncertainty about whether food eaten away from home will provoke an attack [6,7].

Thus, based on this definition of type IV trauma and research of Somer et al [4], we hypothesized that:

- (1) trauma exposure characteristics to anaphylactic shock (hereinafter referred to simply as *trauma exposure characteristics*) influence the development of postanaphylactic shock PTSD and psychiatric comorbidity,
- (2) trauma exposure characteristics influence the use of coping strategies to cope with or save them from experiencing future anaphylactic shock, and
- (3) postanaphylactic shock PTSD and psychiatric comorbidity influence coping strategies.

It is noteworthy that similar hypotheses were tested in the study of Somer et al [4] on victims exposed to repeated and

unpredictable terrorist attacks, but these hypotheses have not been tested on people with anaphylactic shock experiences. In addition, the study of Somer et al on terrorist attacks did not take account of psychiatric comorbidity, which was somewhat surprising, given that the definition of type IV trauma makes it explicit that people exposed to this type of trauma could develop psychiatric comorbidity symptoms.

In addition, Somer et al [4] did not take account of the effect of cumulative past traumas on the development of PTSD associated with the terrorist attack, no doubt because they, like many others, followed the *Diagnostic and Statistical Manual of Mental Disorders* criteria that PTSD symptoms develop after exposure to a specific traumatic event [8]. However, research suggests that many people experience more than 1 major traumatic event sometime in their lives [9] and that there is a generalized effect of cumulative trauma [10], which could influence people's manifestation of PTSD symptoms and psychiatric comorbidity associated with a current trauma. This has been demonstrated in studies looking at, for example, victims of mass violence [11] and holocaust survivors [12].

To this end, for the present study, we also hypothesized that

- (4) past traumatic life events influence postanaphylactic shock PTSD and psychiatric comorbidity.

The 4 hypotheses were combined to form the path diagram shown in Fig. 1.

2. Methods

2.1. Participants

Ninety-four (male, 17; female, 77) people with anaphylactic shock experience participated in the study. They were all white and, on average, 44 years old (range, 18–76 years). More than half were married, and more than one third were single. The rest were divorced or separated. Just more than half and one third were in the low- and medium-income category, respectively. The income level was determined by their occupational status. Twelve percent of the participants were in the high-income category. On average, they had experienced 4 anaphylactic shocks, of which the most severe was about 7 years ago. For most people, the cause of their anaphylactic shock was related to food.

Eighty-three (male, 17; female, 66) people with no experience of anaphylaxis were recruited from the general public to form the control group. They were matched as much as possible with the anaphylactic shock group in sociodemographic variables. There were no significant differences between the 2 groups in these variables. The proportion of men and women in the control group was similar to that of the anaphylactic shock group ($\chi^2 = 0.00$, $df = 1$, not significant [NS]). All of the participants in the control group were also white. Although the control group was slightly older, there was no significant difference in age

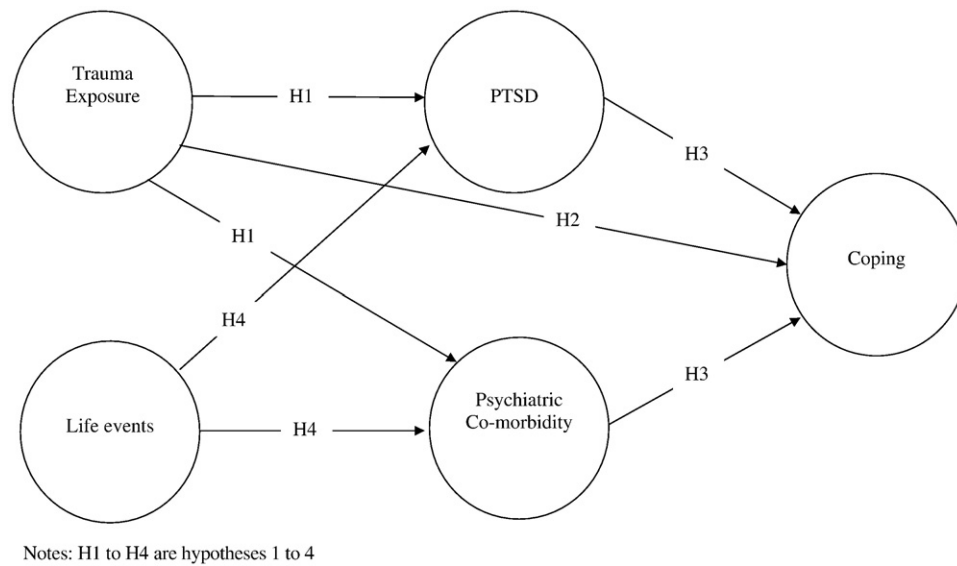


Fig. 1. The path model describing the interrelationships between trauma exposure characteristics, past traumatic life events, coping strategies, postanaphylactic shock PTSD symptoms, and psychiatric comorbidity.

($t = -1.69$, $df = 175$, NS) or marital status (dummy variables: living with an intimate partner vs not living with an intimate partner, $\chi^2 = 0.46$, $df = 1$, NS) between the 2 groups. The income categories of the both groups were also similar ($\chi^2 = 3.12$, $df = 2$, NS; see Table 1).

2.2. Procedure

A charity organization, which offers support to people with anaphylactic shock, was contacted for this research. Upon their agreement, the coordinator of the organization was asked to identify the appropriate people on their record using the inclusion criterion, which was that they were adults (≥ 18 years) who had been given a diagnosis of anaphylaxis. There were 749 names on their database. However, 432 were excluded because they were medical professionals (physicians and nurses) or family members of people with anaphylaxis and because their diagnosis was unclear or contact details were incomplete. Of the remaining 317 individuals, 195 were younger than 18 years. The remainder individuals were sent letters explaining the purpose of the research, asked to complete a package of questionnaires, and return it to the research assistant using the enclosed, stamped address envelope. Ninety-four people returned their questionnaires, which represents a 77% response rate. The package consisted of a demographic sheet, a page asking about their most severe anaphylactic shock, the Posttraumatic Stress Disorder Checklist (PCL), the General Health Questionnaire 28 (GHQ-28), and the COPE Scale. It was made explicit that completion of the questionnaires entailed giving consent to the study.

A control group that consisted of members of the general public from one city in the United Kingdom was recruited by means of advertisements in leisure clubs, shops, churches,

Table 1

Demographic information and traumatic life events of people with anaphylactic shock experience and the control

	Anaphylactic shock		Control	
	Mean	SD	Mean	SD
Demographic information				
Age (y)	44.20	14.68	48.13	16.09
No. of anaphylactic shock	3.90	4.09	–	–
How long ago was the most severe anaphylactic shock (mo)	81.93	75.75	–	–
	n	%	n	%
Causes: food related	73	78	–	–
Male	17	18	17	20
Female	77	82	66	80
Single	36	38	21	25
Married	53	57	51	61
Divorced	2	2	8	10
Separated	3	3	0	0
Widowed	0	0	3	4
Low income	50	53	55	67
Medium income	33	35	21	25
High income	11	12	7	8
White	94	100	83	100
Traumatic life events				
Natural disaster	11	12	7	8
Fire/explosion	18	19	5	6
Transportation accident	40	43	9	11
Other serious accident	21	22	18	22
Physical assault	27	29	19	23
Sexual assault	10	11	6	7
Unwanted sexual experience	21	22	5	6
Life-threatening injury	54	57	8	9
Severe human suffering	33	35	12	14
Sudden violent death	10	11	2	2
Sudden unexpected death	43	46	27	32
Asthma	20	21	0	0

and a university campus and by approaching people on the high street. The advertisement stated the purpose of the study, which was to measure the general well-being of the population. The participants in the control group confirmed that they did not have anaphylaxis or any other major life-threatening illnesses and were asked to complete a demographic sheet and the GHQ-28. The data were compared with the data from the anaphylaxis group to investigate whether there was a greater incidence of psychiatric comorbidity in people with anaphylaxis. The control group was not asked to complete the COPE Scale because we were interested in how coping strategies related to other variables in the model among people with anaphylactic shock experiences, and thus, it was not necessary to know whether coping of the control group would relate to the other variables. The study was approved by the Research Ethics Committee of the School of Psychology at the University of Plymouth.

2.3. Measures

2.3.1. Demographic information

The demographic sheet recorded general personal information on age, sex, marital status, occupation, and ethnicity for both groups.

2.3.2. Trauma exposure characteristics

For the anaphylactic shock group, a page of questions was included to record the experience of the anaphylactic episode they judged as most severe. The questions asked were about the number of times that they experienced anaphylactic shock, how long ago they experienced the most severe one, where they were at the time of the anaphylactic episode, whether they were alone when it occurred, how they felt during it, whether they felt that they were going to die, how they managed to stop it, whether they were anxious about the possibility of future attacks, whether they felt helpless in preventing future attacks, and whether they felt angry about having anaphylaxis. This page also included a list of anaphylactic symptoms, and participants were asked to indicate which of these they had experienced.

2.3.3. Posttraumatic Stress Disorder Checklist

This is composed of 2 parts [13]. Part 1 asks participants to identify whether they have experienced any past traumatic life events including natural disasters, accidents, physical or sexual assault, combat or exposure to war zone, sudden violent or unexpected death of someone close, and life-threatening injury. We added life-threatening illness, apart from anaphylactic shock, as another example of traumatic life event. Part 2 assesses PTSD symptoms resulting from having experienced the most traumatic anaphylactic shock. It is composed of the 17 symptoms contained in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*, diagnostic criteria and generates 3 subscales: intrusion, avoidance, and hyperarousal. It aims to assess how much respondents have been bothered by each symptom using a

5-point Likert-type scale (1, not at all; 2, a little bit; 3, moderately; 4, quite a bit; and 5, extremely). Excellent internal consistency ($\alpha = .97$) and test-retest reliability over a 2- to 3-day period (0.96) have been recorded. This checklist is known to be strongly correlated with other measures of PTSD such as the Mississippi Scale (0.93) and the Impact of Event Scale (0.90).

2.3.4. General Health Questionnaire 28

This aims to estimate the likelihood of participants being diagnosed as having general psychiatric morbidity at interview [14]. When the questions are scored using the scoring method of 0-0-1-1, a total GHQ score exceeding the recommended cutoff point of 4 indicates an increased risk of being diagnosed as having a general psychiatric disorder. As we showed the mean scores of the GHQ-28, however, we based the analyses on the rating scale of 1-2-3-4. The questionnaire yields 4 subscales, which are somatic problems, anxiety, social dysfunction, and depression. Based on the above cutoff, the GHQ-28 has shown a sensitivity value of 88% at a specificity of 84.2% and an overall misclassification rate of 14.5%.

The COPE Scale [15] aims to measure 15 distinct coping strategies. Based on a second-order factor analysis, these strategies were grouped into 4 factors: factor 1 was composed of active coping, planning, and suppression of competing activities; factor 2 was composed of seeking instrumental social support, seeking emotional social support, and focusing on and venting emotions; factor 3 was composed of denial, mental disengagement, and behavioral disengagement, turning to alcohol or drug use, and humor; factor 4 consisted of acceptance, restraint coping, positive reinterpretation and growth, and turning to religion. In their study looking at coping after myocardial infarction, Lowe et al [16] have renamed factors 1, 2, 3, and 4 as problem-focused, emotion-focused, avoidance-focused, and acceptance-focused, respectively. Participants indicated the extent to which they endorsed these strategies (1, I usually do not do this at all; 2, I usually do this a little bit; 3, I usually do this a medium amount; and 4, I usually do this a lot) in coping with or preventing future anaphylactic shock. This instrument shows good internal consistency (Cronbach $\alpha = .62-.92$) and test-retest correlations between 0.42 and 0.77.

2.4. Data analysis plan

We examined the assumptions and diagnostics pertaining to multivariate analysis. Because of nonnormality, we carried out some transformation procedures in which the 4 subscales of the GHQ-28 were subjected to square-root transformation, and the 3 subscales of the PCL were subjected to log transformation. We did not detect any outliers (Mahalanobis, ≥ 3 SD) during the exploration of diagnostics. After exploration and transformation, assumptions relating to multivariate normality, linearity, and homoscedasticity were met.

Descriptive statistics were used to describe the demographic details of the anaphylactic and control groups. *t* Test and χ^2 test were used to compare some demographic variables between the 2 groups. *t* Tests were also used to compare the 2 groups in GHQ-28 scores. Partial least squares (PLS) [17,18] analysis was used to examine the interrelationship between the constructs in the hypothesized model. The Sobel test was used to investigate mediational relationships identified in the final model.

3. Results

Table 1 also shows information on past traumatic life events experienced by the 2 groups. In the anaphylactic shock group, more than half experienced life-threatening injury, and just less than half experienced the sudden unexpected death of someone close to them and transportation accidents. Just more than one third described that they had some severe human suffering sometime in their lives. Just below 30% experienced physical assault, and slightly more than 20% were involved in other serious accidents and unwanted sexual experience. Less than 20% experienced fire or explosion incidents, natural disasters, sexual assaults, and sudden violent death of someone close. The control group experienced significantly less total traumatic life events than did the anaphylaxis group (anaphylaxis: mean $\pm$ SD, 6.60 $\pm$ 5.46 vs control: mean $\pm$ SD, 3.18 $\pm$ 3.56, $t = 4.99$, $P < .001$).

As part of the past traumatic life events, we also took account of potential life-threatening illnesses, other than anaphylactic shock, that they experienced at some time in their lives. In the anaphylactic shock group, slightly less than a quarter had asthma, and a small proportion had hypertension (5%), cancer (2%), and myocardial infarction (1%). The control group did not report having experienced any life-threatening illnesses.

Given that there were significant differences between the anaphylactic shock group and the control in the total number of traumatic life events and life-threatening illnesses, one could argue that, contrary to our earlier suggestion, the 2 groups were not matched. However, one needs to remember that the 2 groups were not matched case by case. Rather, they were matched to the best of our ability in socio-demographic variables. Thus, differences in some of these variables were inevitable.

Table 2 shows the range of anaphylactic shock symptoms that people experienced during their most traumatic anaphylactic episode and the corresponding trauma exposure characteristics. More than 90% experienced a very strong sense of doom and felt extremely fearful and anxious about what happened to them. A large proportion of them experienced difficulty in breathing due to severely swelled airways, had swollen tongue and lips, and had tingling burning lips. They also had fainting spells during the anaphylactic attack. Sixty percent had blisters or large red wheals on their bodies. Otherwise, less than half

Table 2

Anaphylactic shock symptoms and trauma exposure characteristics

	n	%
Anaphylactic shock symptoms		
Strong sensation of doom, extreme fear, fright, and anxiety	87	93
Difficulty in breathing due to severe swelling airways	76	81
Swelling of tongue and lips and tingling, burning sensation in lips	72	77
Feeling faint	62	66
Blisters on the skin and large red wheals on body	56	60
A rapid heartbeat	41	44
Sneezing and watery and itchy eyes	40	43
Nausea and vomiting	31	33
Unconscious	22	23
Trauma exposure characteristics		
Experienced anaphylactic shock at own home	39	42
You were alone when anaphylaxis occurred	24	25
Felt that you were going to die during anaphylactic shock	56	60
Felt confused	27	29
Felt exhausted and weak	34	36
Stopped anaphylactic shock using EpiPen	12	13
Stopped anaphylactic shock by hospitalization	63	67
Felt anxious about future anaphylactic shock	70	75
Felt helpless in preventing future anaphylactic shock	36	38
Felt angry about what happened to you	31	33

experienced rapid heartbeat, sneezing, watery and itchy eyes, nausea, and vomiting. Twenty-three percent actually became unconscious.

In trauma exposure characteristics, less than half of the participants experienced anaphylactic shock in their own homes, and a quarter were alone when the most severe anaphylactic reaction occurred. During the attack, more than half felt that they were going to die, and some people felt exhausted and confused. A large majority stopped their anaphylactic shock by receiving help from hospital. Otherwise, a small proportion stopped it using an EpiPen. At the time of the study, more than 70% still felt anxious about a future anaphylactic attack, and just more than one third felt helpless in preventing it. One third felt angry that they had the condition.

Table 3 shows information on PTSD symptoms, psychiatric comorbidity, and coping strategies. With regard to PTSD symptoms after anaphylactic shock, the most prevalent was avoidance behavior followed by intrusive symptoms. The severity of hyperarousal symptoms was not too different from that of intrusive symptoms. The PCL revealed that 12% of the people with anaphylactic shock experience might have met the diagnostic criteria for full PTSD, 43% might have met the diagnostic criteria for partial PTSD (2 of the 3 cardinal domains were met: intrusion, avoidance, and hyperarousal), and 45% did not probably meet any criteria for PTSD.

In psychiatric comorbidity, people with anaphylactic shock reported significantly more somatic problems ($t = 4.46$, $df = 175$; $P < .001$), anxiety ($t = 3.62$, $df = 163$; $P < .001$), social dysfunction ($t = 2.80$, $df = 175$; $P < .01$), and depression ($t = 2.29$, $df = 168$; $P < .03$) than did the control group. There were significantly more people with

Table 3

The means and SDs of posttraumatic stress symptoms, comorbidity, and coping strategies

	Anaphylactic shock		Control	
	Mean	SD	Mean	SD
Intrusion	9.03	4.06	–	–
Avoidance	11.79	5.42	–	–
Arousal	8.67	3.91	–	–
Somatic problems	13.77	5.65	11.09	2.94
Anxiety	13.37	6.90	10.53	3.06
Social dysfunction	14.82	2.90	13.74	2.08
Depression	9.36	4.24	8.19	2.57
Problem-focused coping				
Active coping	9.61	3.64	–	–
Planning	9.25	3.65	–	–
Suppression of competing activities	6.30	2.48	–	–
Emotion-focused coping				
Seeking instrumental social support	8.23	3.39	–	–
Seeking emotional social support	8.19	3.28	–	–
Focusing on and venting emotions	6.73	2.98	–	–
Avoidance-focused coping				
Denial	4.98	1.47	–	–
Mental disengagement	6.40	3.15	–	–
Behavioral disengagement	5.38	2.02	–	–
Turning to alcohol/drug	5.05	2.37	–	–
Using humor	5.88	2.84	–	–
Acceptance-focused coping				
Positive reinterpretation and growth	9.13	3.43	–	–
Restraint coping	6.64	2.24	–	–
Acceptance	12.65	3.07	–	–
Turning to religion	8.28	4.02	–	–

anaphylactic shock meeting the GHQ-28 cutoff than the control (anaphylaxis: 39% vs control: 23%; $\chi^2 = 5.52$, $df = 1$; $P < .02$) so that there was a significantly higher probability for them to be diagnosed as having a general psychiatric disorder. One could argue that the higher psychiatric comorbidity among people with anaphylactic shock can be attributed to their higher rates of previous traumatic life events. However, no significant correlations were found between the number of previous traumatic life events and psychiatric comorbidity for the anaphylactic shock group ($r = 0.08$, NS).

Turning to coping strategies, on the whole, people with anaphylactic shock relied heavily on acceptance-focused coping strategies. Most of them accepted their illness (93%) and learned to live with it (95%). A large proportion also used problem-focused coping in that they took action one step at a time to do what needed to be done to cope with their anaphylaxis (82%). The majority often thought about how they might best handle their illness (82%) and arrived at plans of action (56%). This was why they used a lesser degree of avoidance-focused coping. Only 10%, for example, sometimes pretended that they had not had anaphylactic shock. Nevertheless, a proportion still used mental disengagement strategies by turning to work to take their minds off their illness (46%) or turning to entertainment (25%). Relatively, a large proportion used emotion-focused

coping in that they sought instrumental social support. They talked to people and found out information about their illness (68%). They also sought emotional social support in that they discussed their feelings and got sympathy and understanding from people (66%; see Table 3).

Using PLS Graph 3.00 [17,18], PLS analysis was carried out to examine the interrelationship between the constructs in the hypothesized model. Partial least squares analysis resembles structural equation modeling (SEM) in that it provides a method for fitting path models and determining the nature and strength of the interrelationships of different constructs. Like SEM, it deals with models that treat latent constructs as being indirectly measured through their relationships to multiple observed variables. In common with SEM and in contrast to classical techniques such as multiple regression, it allows for fallibility in the measurement of constructs by taking advantage of the use of multiple measures. However, PLS has several advantages over SEM in the current application. It readily handles a mixture of formative constructs in which the construct is determined by, or formed from, several observed variables [19] and reflective constructs in which each observed variable is construed as an imperfect indicator of the latent construct. Partial least squares analysis can also handle relatively complex models with more modest sample size requirements. Finally, in contrast to the assumption of multivariate normality when SEM is carried out using maximum likelihood estimation, PLS makes no distributional assumption.

Partial least squares analysis generates outer and inner model estimates. The former refers to the loadings or weights for each indicator and shows how strongly it relates to the construct. The latter relates to the regression coefficients, which characterize the linear relationship between constructs. Instead of testing the model fit, PLS provides estimates of path coefficients for the paths in the model and tests of whether these path coefficients differ significantly from zero. Partial least squares graph makes use of bootstrap resampling to carry out these tests without distributional assumptions. As recommended by Chin [17], 200 bootstrap samples were produced in the current study.

Partial least squares analysis requires complete data, so regression imputation was used to replace missing data. Although there are problems with single-imputation methods when the quantity of missing data is significant, the current study had less than 1% of missing responses, and in this situation, regression imputation introduces little distortion [20]. In addition, given the limited sample size and to restrict the number of parameters in the model, we divided coping strategies into problem-focused, emotion-focused, avoidance-focused, and acceptance-focused in line with a recent study [16].

Table 4 shows the estimated loadings and weights of the scale items. The weights of 20 formative indicators and the loadings of 3 reflective indicators were not significantly different from zero and, subsequently, removed to increase

Table 4
Loadings and weights of indicators on the constructs (latent variables)

Latent variable	Indicator ^a	SE	Loading	Weight
Trauma exposure characteristics	Experienced anaphylactic shock at home or not	0.174	–	–0.087 ^b
	Being alone when anaphylaxis occurred	0.200	–	0.035 ^b
	Feeling terrified or frightened	0.158	–	–0.148 ^b
	Feeling that you were going to die during anaphylactic shock	0.175	–	0.525**
	Feeling confused	0.201	–	–0.105 ^b
	Feeling exhausted and weak	0.204	–	–0.099 ^b
	Feeling anxious about future anaphylactic shock	0.171	–	0.434*
	Feeling helpless in preventing future anaphylactic shock	0.205	–	–0.050 ^b
	Feeling angry about what happened to you	0.192	–	0.371 ^b
	The no. of anaphylactic shock	0.155	–	0.117 ^b
	The onset of the most severe anaphylactic shock	0.146	–	–0.361*
	Causes of anaphylactic shock	0.150	–	–0.255 ^b
Life events	Total symptoms of anaphylactic shock	0.202	–	0.210 ^b
	Natural disaster	0.251	–	0.396 ^b
	Fire or explosion	0.214	–	–0.173 ^b
	Transportation accident	0.228	–	0.202 ^b
	Other serious accident	0.245	–	0.050 ^b
	Physical assault	0.265	–	–0.396 ^b
	Sexual assault	0.353	–	0.802*
	Unwanted sexual experience	0.299	–	–0.230 ^b
	Life-threatening injury	0.264	–	0.430*
	Severe human suffering	0.270	–	–0.322 ^b
	Sudden violent death	0.353	–	0.248 ^b
	Sudden unexpected death	0.248	–	–0.273 ^b
PTSD	Asthma attack	0.250	–	0.243 ^b
	Intrusion	0.049	0.849***	–
	Avoidance	0.025	0.888***	–
Psychiatric comorbidity	Hyperarousal	0.029	0.861***	–
	Somatic problems	0.040	0.838***	–
	Anxiety	0.026	0.867***	–
Problem-focused coping	Social dysfunction	0.076	0.707***	–
	Depression	0.045	0.802***	–
	Active coping	0.053	0.854***	–
Emotion-focused coping	Planning	0.058	0.862***	–
	Suppression of competing activities	0.055	0.855***	–
	Seeking instrumental social support	0.077	0.776***	–
Avoidance-focused coping	Focus on and venting of emotions	0.039	0.897***	–
	Seeking emotional social support	0.064	0.813***	–
	Denial	0.094	0.667***	–
Acceptance-focused coping	Mental disengagement	0.097	0.709***	–
	Behavioral disengagement	0.121	0.662***	–
	Alcohol/drug use	0.130	0.623***	–
	Humor	0.186	0.350 ^b	–
	Acceptance	0.150	0.582***	–
	Restraint coping	0.111	0.932***	–
	Positive reinterpretation and growth	0.262	0.432 ^b	–
	Turning to religion	0.310	0.254 ^b	–

^a The indicators for trauma exposure characteristics and life events are called *formative indicators*, whereas the indicators for PTSD, psychiatric comorbidity, and coping are called *reflective indicators*.

^b Dropped items.

* $P < .05$.

** $P < .01$.

*** $P < .001$. Significance levels are based on bootstrapped SEs.

construct validity. The correlation matrix for the indicators used in the modeling is found in Table 5. Fig. 2 shows the final structural model. The resulting path coefficients for relationships between constructs are shown in the figure, which also indicates their significance. As was stated previously, PLS analysis does not examine the degree of model fit but the predictive capability of the model

characterized by the presence of strong construct loadings (>0.60), standardized path coefficients (>0.20), and at least moderate R^2 values. Most of the construct loadings were strong. The path coefficients of the significant paths were also strong (see the succeeding paragraphs), and the average R^2 of the overall model was 0.152 (average communality, 0.581; average redundancy, 0.099).

Table 5

Estimated correlations between the transformed variables used in the PLS model

	Die	AnxF	Onset	SexA	Injury	Intru	Avoid	Arou	Soma	Anx	Social	Dep	ProbF ^a	EmoF ^a	AvoidF ^a
Die ^b	1.00	0.16	0.09	0.14	0.16	0.35**	0.35**	0.41**	0.28**	0.37**	0.22*	0.27**	0.09	0.06	0.13
AnxF ^b		1.00	−0.20*	0.04	−0.06	0.26**	0.23*	0.20*	0.19	0.21*	0.08	0.12	0.29**	0.18	0.15
Onset ^b			1.00	−0.02	0.09	−0.18	−0.24*	−0.09	−0.05	−0.03	−0.05	−0.05	−0.15	−0.16	−0.21*
SexA ^b				1.00	0.15	0.15	0.27**	0.18	0.23*	0.19	0.04	0.18	0.08	0.04	0.19
Injury ^b					1.00	−0.01	0.10	0.08	0.22*	0.15	0.07	0.04	0.07	0.13	0.11
Intru						1.00	0.61**	0.58**	0.27**	0.40**	0.16	0.38**	0.24*	0.34**	0.35**
Avoid							1.00	0.67**	0.35**	0.35**	0.31**	0.29**	0.31**	0.26*	0.37**
Arou								1.00	0.40**	0.54**	0.43**	0.39**	0.20*	0.22*	0.29**
Soma									1.00	0.76**	0.44**	0.52**	0.08	0.21*	0.33**
Anx										1.00	0.41**	0.63**	0.10	0.24*	0.37**
Social											1.00	0.43**	0.16	0.23*	0.33**
Dep												1.00	0.11	0.19	0.38**
ProbF													1.00	0.66**	0.29**
EmoF														1.00	0.38**
AvoidF															1.00

Die indicates feeling that you were going to die; AnxF, feeling anxious about future anaphylactic shock; Onset, the onset of the most severe anaphylactic shock; SexA, sexual assault; Injury, life-threatening injury; Intru, intrusion; Avoid, avoidance behavior; Arou, hyperarousal; Soma, somatic problems; Anx, anxiety; Social, social dysfunction; Dep, depression; ProbF, problem-focused coping; EmoF, emotion-focused coping; AvoidF, avoidance-focused coping.

^a The indicators of ProbF, EmoF, and AvoidF are not shown on this table because of space constraint.

^b The variables Die, AnxF, Onset, SexA, and Injury were dichotomous. Consequently, correlations involving these variables and one other were point biserial correlations, whereas correlations involving 2 of these variables were ϕ coefficients.

* $P < .05$.

** $P < .01$.

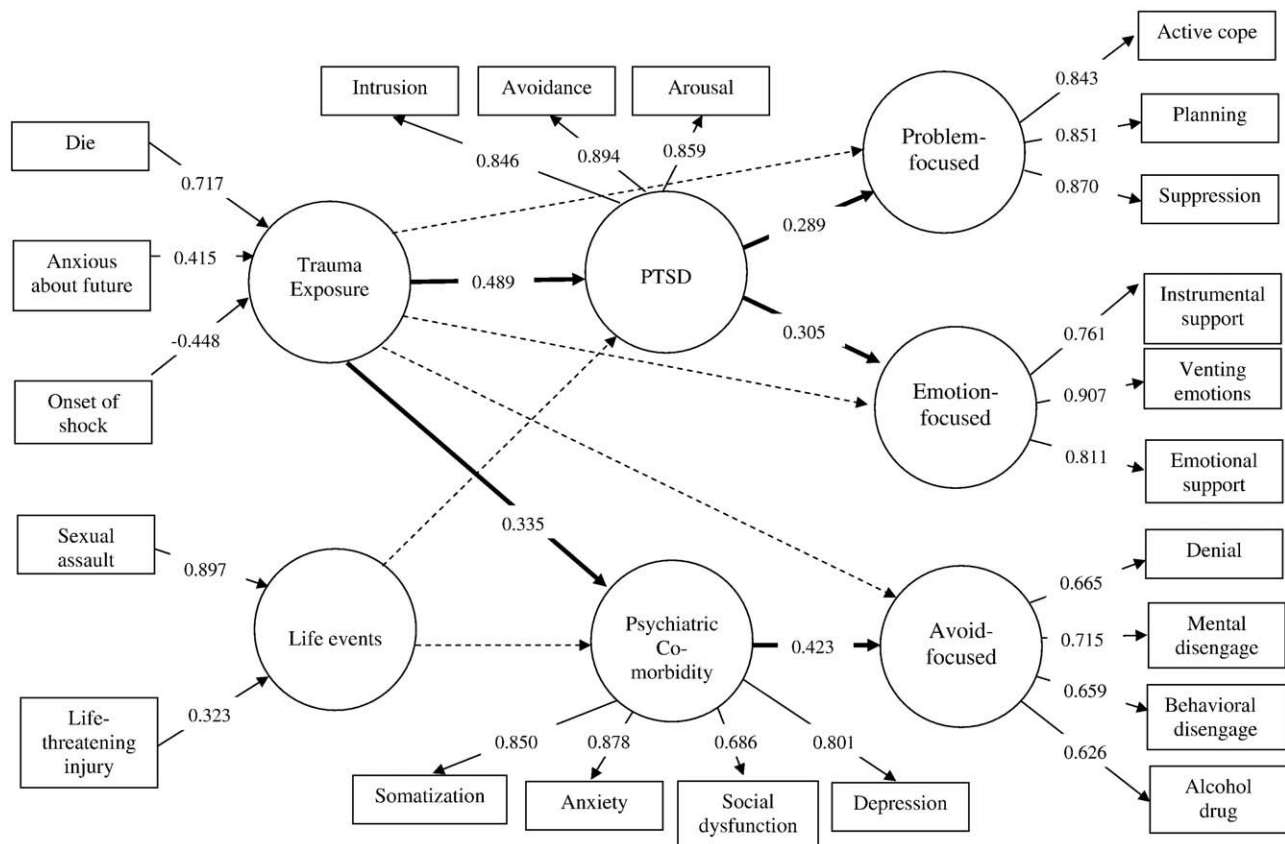


Fig. 2. The final PLS model with significant paths at 5% or better.

Trauma exposure characteristics were significantly associated with PTSD ($B = 0.489$; $SE, 0.068$; $P < .001$) and psychiatric comorbidity ($B = 0.335$; $SE, 0.080$; $P < .001$). Posttraumatic stress disorder was significantly associated with problem-focused coping ($B = 0.289$; $SE, 0.139$; $P < .05$) and emotion-focused coping ($B = 0.305$; $SE, 0.112$; $P < .01$). Psychiatric comorbidity was significantly associated with avoidance-focused coping ($B = 0.423$; $SE, 0.113$; $P < .001$).

Postanaphylactic shock PTSD and psychiatric comorbidity acted as mediators for trauma exposure characteristics and coping strategies. The Sobel test was then carried out to ascertain whether the degree of PTSD significantly carried the influence of trauma exposure characteristics to problem- and emotion-focused copings and whether psychiatric comorbidity significantly carried the influence of trauma exposure characteristics to avoidance-focused coping. The results show that PTSD significantly carried the influence of trauma exposure characteristics to problem-focused ($z = 2.58$, $P < .01$) and emotion-focused ($z = 2.73$, $P < .01$) copings. Psychiatric comorbidity also significantly carried the influence of trauma exposure characteristics to avoidance-focused coping ($z = 2.93$, $P < .01$).

4. Discussion

This study investigated the interrelationship between trauma exposure characteristics, past traumatic life events, coping strategies, postanaphylactic shock PTSD symptoms, and psychiatric comorbidity. The results showed that 12% of people with anaphylactic shock met the diagnostic criteria for full PTSD. People with anaphylactic shock reported significantly more psychiatric comorbidity than did the control. Trauma exposure characteristics influenced PTSD, which, in turn, influenced problem- and emotion-focused copings. Trauma exposure characteristics also influenced psychiatric comorbidity, which, in turn, influenced avoidance-focused coping. Hypotheses 1 and 3 were supported, whereas the others were not.

In line with the findings from Somer et al [4], the results supported a mediational model in that trauma exposure characteristics did not influence coping strategies directly but indirectly through PTSD symptoms. This mediational finding also reflected the basic principles of the well-established 2-stage appraisal of stress model, in that people's exposure to stressors influence coping strategies indirectly through such mediators as appraisal [21]. An interesting feature of the present findings is that the degree of psychological difficulty (ie, PTSD symptoms and psychiatric comorbidity) served as mediators. People's exposure to anaphylactic shock led to the development of PTSD symptoms and psychiatric comorbidity, which then impacted the way they coped with or protected themselves from experiencing future anaphylactic shock. Arguably, such

findings revealed the effect of PTSD; that is, PTSD with its associated psychiatric difficulties affected the different levels of human psychological functioning including changes in behavioral mechanisms and changes in the intrapsychic organization of the self-structure [3] or their core identity [22]. Subsequently, people's coping behavior also changed because the latter was that which was governed by the self. This is why PTSD after anaphylactic shock and psychiatric comorbidity influenced the degree to which people coped with or protected themselves from experiencing future anaphylactic shock.

The kinds of coping strategies that they used were related to the severity of PTSD symptoms and psychiatric comorbidity. The more severe the postanaphylactic shock PTSD symptoms and psychiatric comorbidity, the more they used problem-, emotion-, and avoidance-focused coping strategies. In emotion- and avoidance-focused copings, this finding was not too surprising. Literature has shown that people with PTSD symptoms after life-threatening illnesses and with different psychiatric comorbidity tended to engage in emotion- and avoidance-focused copings [23–25].

However, in problem-focused coping, the finding contradicted the trend in literature that severity of PTSD symptoms is largely negatively correlated with problem-focused coping. For example, patients with cancer who used less problem-focused coping, such as seeking social support, but used more avoidance-focused coping tended to report the most severe PTSD symptoms [26]. Such negative correlations basically suggest that problem-focused coping tends to be a beneficial coping strategy for people with life-threatening illnesses [27]. However, a positive correlation was found in our study which probably relates to the nature of the illness. Living with anaphylaxis requires problem-focused coping in that, as was mentioned in the results, people needed to concentrate their efforts and take action to do what needed to be done (eg, avoiding food, which triggers anaphylactic shock) or to think about how best to handle their illness (eg, always carrying the EpiPen) to cope with anaphylaxis or prevent future anaphylactic shocks. Problem-focused coping is a necessary coping strategy that people endorse to reduce the potential threat of anaphylactic shock and to keep themselves safe within their biosphere or environment. Thus, that postanaphylactic shock PTSD symptoms influenced problem-focused coping in a positive direction basically means that PTSD symptoms, as was stated earlier, impacted on the sense of self, which, in turn, heightened the use of problem-focused coping to keep themselves safe within their environment or to protect themselves from experiencing an anaphylactic shock in the future.

This finding echoed the study of Somer et al [4] in that traumatized survivors of terrorism also reported intense solution-focused coping behavior. They implied that this kind of solution or problem-focused type of coping with type IV traumas was particularly synonymous with PTSD and, possibly, a manifestation of it, that is, the trauma after

anaphylactic shock was driving the use of problem-focused coping. This makes sense because in so doing, they protected themselves.

The finding that the amount of cumulative past traumatic life events did not influence or exacerbate people's manifestation of postanaphylactic shock PTSD and psychiatric comorbidity was intriguing. One possible explanation is that past traumatic life events are very much intimately linked with their own specific types of traumas. This echoes the claim that psychological responses to traumatic events vary depending on the type of disaster [28,29]. Previous traumatic life events of a certain type (eg, accidents) do not necessarily produce generalized effects affecting, in any significant way, the traumatic responses related to other types of traumas such as anaphylactic shock. This is at odds with the findings of various studies, which claimed that the generalized effect of previous traumatic life events existed and could predict PTSD symptoms and psychiatric comorbidity of subsequent traumas [10,30,31].

However, one could argue that the lack of significant influence of previous traumatic life events on postanaphylactic shock PTSD and psychiatric comorbidity might simply result from our simplistic approach to measuring traumatic life events. We simply collected information on the number and kinds of traumatic events that participants experienced in the past. Perhaps, using a more in-depth questionnaire to probe, for example, subjective responses of life threat or injury of the traumatic events might give us more information about the impact of traumatic life events on these people. Such additional information might affect the results and help to establish the link between past traumatic life events and postanaphylactic shock PTSD and psychiatric comorbidity more effectively.

There are several limitations in this study. First, we had to rely on participants to inform us whether and how long they had anaphylaxis. We were unable to verify such information by checking medical records. However, that all participants were able to provide information on trauma exposure characteristics suggested that they must have experienced some anaphylactic episodes. There is no reason to suspect that they fabricated their anaphylactic experience on the questionnaire.

Second, we could have increased the response rate by sending out reminder letters to the participants. Unfortunately, we were not able to do so because of limited research funding and time constraints. Third, there might be an issue with the representativeness of the sample. We were not able to establish why some people did not wish to participate in the study. They declined, possibly because they were the traumatized individuals who displayed avoidance behavior. Some people with a high degree of PTSD symptoms might not have been included in the sample. This problem is not exclusive to this research but exists in PTSD research in general. Finally, the study would have been strengthened if data on personality traits had been collected. Increasingly, evidence emerges to show that

PTSD outcomes are not related to coping alone but personality traits as well [32,33]. Where exactly personality traits are placed in the hypothesized model would depend on the theoretical rationale.

To conclude, after anaphylactic shock, people developed PTSD and psychiatric comorbidity symptoms, which impacted the way in which they coped with future anaphylactic shock. The impact of past traumatic life events on traumatic responses to anaphylactic shock and current psychiatric comorbidity seemed to be limited.

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