





Adaptation and Validation of the Stanford Acute Stress Reaction Questionnaire to COVID-19 Related Events in China Mainland

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Abstract. Objective To develop and validate the COVID-19 Related Event Stress Reaction Questionnaire (CRESRQ) based on the Stanford Acute Stress Reaction Questionnaire (SASRQ), and to make the CRESRQ suitable for evaluating the general population's stress reaction on COVID-19 related events. **Methods** The items were screened for adaptation by the variability method, the total correlation coefficient method, the Cronbach α coefficient method, the factor analysis method utilizing data of 1162 cases collected by the SASRQ during the COVID-19 pandemic in 2020, as well as by the results of the structured cognitive interviews. Validity and reliability evaluation was applied utilizing data of 2281 cases in 2022. **Results** (1) The 20-item CRESRQ was developed by 4 methods of data analysis and structured cognitive interviews. (2) The three common factors of the 20 items utilizing the exploratory factor analysis were extracted to divide the dimensions of the questionnaire. The three-factor structure was named as avoidance and re-experiencing, physiological and emotional responses, as well as social alienation based on the items' content. The three-factor and the overall Cronbach α coefficient were 0.839–0.931. (3) The confirmatory factor analysis and internal consistency evaluation revealed that the three-factor structure was stable and had good convergent/discrimination validity and internal consistency. **Conclusion** The procedure of developing CRESRQ is standardized and the performance of CRESRQ is acceptable, which better reflect the general population's stress reaction on Covid-19 related events. In future, the general population's stress reaction to unpredicted public health emergencies can be measured by the questionnaire after adaptive evaluation.

Keywords: Stanford Acute Stress Reaction Questionnaire · COVID-19 Related Event Stress Reaction Questionnaire · performance evaluation · public health emergencies

1 Introduction

In major public health emergencies or catastrophic events, people are prone to acute stress reactions. This hinders their work performance and even reduces their quality of life. Acute stress reaction is also called acute psychogenic reaction. It refers to a transient mental disorder caused by individuals suffering from strong and sudden stressful life events or continuous difficulties [1]. Excessive and long-term acute stress reaction causes serious and long-term damage to human body and mind, and even lead to acute stress disorder (ASD) [2]. The COVID-19 pandemic is characterized by urgency, abruptness, severity, social harmfulness and high uncertainty [3]. It is easy to make people react to stress. Accurate and effective pandemic evaluation of people's stress response is the basis for guiding work and formulating pandemic prevention policies.

At present, there are two main ways to measure acute stress reaction. One is the comprehensive use of multiple scales [4], and the other is the use of a single evaluation tool. Among them, Stanford Acute Stress Reaction Questionnaire (SASRQ) [5] is widely used. SASRQ is one of the commonly used tools to evaluate ASD internationally. In China, Yan Qi [6] et al. used it to evaluate the people's acute stress reaction at the initial stage of the COVID-19 pandemic, and Sai-ling Guo [7] et al. used it to study the stress psychology of the isolated. The questionnaire has been widely used in clinical stress disorder diagnosis [8], disaster psychological trauma evaluation [9], and medical staff psychological evaluation [10, 11], but the relevant research is only limited to the direct use of the Chinese version of SASRQ [12], which lacks the appropriate use environment and reasonable exploration.

At the end of 2019, the first outbreak of COVID-19 pandemic and the second large-scale spread of the pandemic at the end of 2022 were two major public health emergencies, both of which led to different levels of acute stress reactions among the public. At the beginning of 2020, there was no acute stress reaction questionnaire specifically used for the COVID-19 at the time of this investigation. Referring to relevant research such as SARS in 2003 [13], we applied SASRQ to the investigation to evaluate the degree of acute stress reaction of the population during the pandemic.

The pandemic did not end in a short time. In the process, the people experienced some uncertain events and may still have acute stress reactions. The impact of these events on the people is diverse and complex. It is limited not only to the harm of the disease itself to the human body, but also has a multifaceted impact on people's work, study, life, etc. [14]. Moreover, with the deepening of the normalization management of the pandemic, the impact of the pandemic on people has shifted more and more from the disease itself to the pandemic related events, such as the inability of people to work normally after infection, the difficulty of purchasing drugs as needed, and the limited scope of life activities due to pandemic prevention and control [15]. At the same time, during the survey, the respondents reflected that some items of SASRQ were not suitable, and the data analysis did not conform to the original 5-factor structure of SASRQ. Furthermore, using this questionnaire directly, it was difficult to achieve the purpose of truly measuring the public's stress response. Therefore, the purpose of this study is to adapt the SASRQ through interviews and data analysis, so as to adapt it to the stress response evaluation of the public under the complex situation of events related to the COVID-19 pandemic.

Table 1. Study Data Summary

Time	Process	Respondents	Male/Female	Age	Goals
Feb-March 2020	SASRQ Survey	1162	325/837	34.74 ± 12.16	Items screening; Preliminary performance evaluation of the adapted questionnaire
Nov 2022	Structured Cognitive Interview	33	11/22	35.48 ± 14.61	Items screening
Dec 2022-Jan 2023	CRESRQ Survey	2281	898/1383	27.11 ± 9.97	Evaluation and validation of the adapted questionnaire

2 Data and Methods

2.1 Study Design

Using quantitative analysis combined with structured cognitive interviews, items of SASRQ were screened, and the performance of the adapted questionnaire was evaluated through data validation.

2.2 Data Sources

The data comes from the survey and cognitive interviews of the Chinese people on the COVID-19 pandemic. (1) During the three years from 2020 to 2022 when the COVID-19 continued, the team carried out five surveys of the COVID-19 among Chinese mainland people (Among them, stress reaction evaluation: SASRQ was used for the first four times, and the questionnaire after item screening was used for the fifth time). 8509 valid data were obtained. In this study, the data of 1162 cases obtained from the first survey in 2020 (at the beginning of the pandemic outbreak) and 2281 cases obtained from the fifth survey in 2022 were used for quantitative analysis. (2) In order to evaluate the content of SASRQ items, we conducted a structured cognitive interview with 33 people and conducted a qualitative analysis as shown in Table 1.

2.3 Stanford Acute Stress Reaction Questionnaire

The research team used the Chinese version of SASRQ in the initial stage of the COVID-19 outbreak and the post pandemic period of the normalized management. On the basis of the questionnaire, data were collected after the adaptation of the pandemic situation to the question items. Each item was scored according to Likert's score of 0 to 5, with 0 representing "no experience" and 5 representing "always experience". (Table 2).

Table 2. Adapted Items from SASRQ

No	Item	No	Item
Q1	I had difficulty falling or staying asleep	Q16	I had problems remembering important details about the Covid-19 related events
Q2	I felt restless	Q17	I tried to avoid thoughts about the Covid-19 related events
Q3	I felt a sense of timelessness	Q18	Things I saw looked different to me from how I know they really looked
Q4	I was slow to respond	Q19	I had repeated and unwanted memories of the Covid-19 related events
Q5	I tried to avoid feelings about the Covid-19 related events	Q20	I felt distant from my own emotions
Q6	I had repeated distressing dreams of the Covid-19 related events	Q21	I felt irritable or had outburst of anger
Q7	I felt extremely upset if exposed to Covid-19 that reminded me of an aspect of the Covid-19 related events	Q22	I avoided contact with people who reminded me of the Covid-19 related events
Q8	I would jump in surprise at the least thing	Q23	I would suddenly act or feel as if the Covid-19 related events were happening again
Q9	The Covid-19 related events made it difficult for me to perform work or other things I needed to do	Q24	My mind went blank
Q10	I did not have the usual sense of who I am	Q25	I had amnesia for large periods of the Covid-19 related events
Q11	I tried to avoid activities that reminded me of the Covid-19 related events	Q26	The Covid-19 related events caused problems in my relationships with other people
Q12	I felt hypervigilant or “on edge”	Q27	I had difficulty concentrating
Q13	I experienced myself as though I were a stranger	Q28	I felt estranged/detached from other people
Q14	I tried to avoid conversations about the Covid-19 related events	Q29	I had a vivid sense that the Covid-19 related events were happening all over again
Q15	I had a bodily reaction when exposed to reminders of the Covid-19 related events	Q30	I tried to stay away from places that remind me of the Covid-19 related events

2.4 Item Selection

2.4.1 Item Selection Criteria

Four quantitative analysis and structured cognitive interview methods were used to screen items and items that meet the requirements of at least four methods were retained.

2.4.2 Item Selection Method

2.4.2.1 Quantitative Analysis

Using the survey data of 1162 people's stress response in 2020, the variability method, the total correlation coefficient method, Cronbach α coefficient method and the factor analysis method were used to screen items. (a) Variability method: Screen item from a sensitivity perspective. The dimensions of each item in the original SASRQ scale are the same, and the standard deviation of each item's score can reflect the degree of variation. We deleted item with standard deviation less than 0.9. (b) Total correlation coefficient method: Screen item from a representative perspective. We calculated the correlation coefficient between each item and the total score of all items, and deleted items with correlation coefficient less than 0.5. (c) Cronbach α Coefficient method: Screen item from an internal consistency perspective. If one item's α coefficient removed from all items has increased significantly, which indicates this item will reduce the overall consistency. Consider deleting this item. (d) Factor analysis: From the perspective of representativeness, the items were screened, and the principal component factors were analyzed using the maximum variance rotation method. The items with the maximum factor loading less than 0.5 and the items with the same or more factor loadings were considered to be deleted.

2.4.2.2 Structured Cognitive Interview

In November 2022, an interview group composed of 13 medical experts and scholars developed the outline of "Structured Cognitive Interview on Stress Reaction to COVID-19 related Events" and conducted one-on-one interviews with 33 people. The interview obtained the informed consent of all respondents, including 11 men and 22 women. The age range is 19–80 years old. The pandemic risk level in the region is 28 people with low risk and 5 people with high risk. The level of education of the population covers primary school to Doctor degree. The interview content includes basic personal information and opinions on the 30 items of SASRQ in Table 2. Each item mainly includes the following four questions: (a) How do you feel about the following questions? (0 No experience, 1 Little experience, 2 Occasionally experience, 3 Some experience, 4 Frequently experience, 5 Always experience)? (b) How important do you think each question is to evaluate the annoyance caused by the COVID-19 pandemic? (1 very unimportant, 2 not very important, 3 generally important, 4 relatively important, 5 very important) (c) What is your basis for answering the first two questions? (Specify text description, for example). (d) Do you think this question is clear, understandable and easy to answer? (1 Yes, 2 No - describe how to improve). Among them, question (d) and question (b) are the respondents' direct evaluation of the question items, which are related to whether the questions can be easily understood and accurately reflect the state of stress response under the COVID-19 pandemic, and serve as the basis for screening

items. Question (a) is the answer to the item itself, and question (c) represents the basis for the respondents to answer the question subjectively. The answers to these two questions are used as a supplement for screening items.

2.5 Formation of the Provisionally Adapted Questionnaire

Exploratory factor analysis was used to screen the questionnaire formed by five methods, and the questionnaire dimension structure was formed by combining the content analysis of the question items. The Cronbach α coefficient was used for internal consistency evaluation.

2.6 Performance Evaluation of the Adapted Questionnaire

The data obtained from the public survey was analyzed and verified in December 2022 by using the provisionally adapted version of the questionnaire.

2.6.1 Confirmatory Factor Analysis

The confirmatory factor analysis was used to examine the structure validity, convergent validity and discrimination validity of the questionnaire. (1) Structure validity: Check the rationality of the composition of each dimension of the questionnaire, that is, the structure model of the questionnaire is appropriate. Since the sample size of this study is far more than the sample size of 200 to 300 suitable for Amos analysis, chi-square expansion and poor fitting effect will occur. Therefore, Bollen-Stine Bootstrap was used to modify the model [16], and the number of runs was set to 5000. When the value of χ^2/df is less than 3, the values of GFI, AGFI, NFI, TLI, IFI, RFI and CFI are all more than 0.9 and the value of RSMEA is less than 0.08, indicating that the structure validity is good. (2) Convergent validity: Evaluate the consistency between the measured content of the questionnaire and the real situation. In this study, the combined reliability composite reliability (CR) value and average of variance extracted (AVE) value amount, $CR > 0.7$, $AVE > 0.36$, indicate that the internal consistency is acceptable and the convergence validity is good. (3) Discrimination validity: The Bootstrap method was used to test the content discrimination validity. The number of repetitions was set at 5000. The 95% confidence interval of the correlation coefficient of each dimension was used to test. When the 95% confidence interval of the correlation coefficient of each dimension of the Bootstrap method does not contain 1, it indicates that the content of the questionnaire has good discrimination validity.

2.6.2 Internal Consistency Evaluation

Cronbach α coefficient was used to evaluate and verify the internal consistency of the questionnaire.

3 Results

3.1 Item Analysis and Screening

In the cognitive interview, no fewer than 4 respondents in Q3, Q8, Q10, Q13, Q18, Q20 and Q29 did not understand the item in the 33 respondents' answers to the question "whether the statement is clear, understandable and easy to answer" (That was, more than 10% of respondents did not understand). In the response to "question importance evaluation", no fewer than 20 people (i.e. more than 60% of respondents) in Q8, Q10, Q13, Q20, Q24 and Q25 thought that the item was "unimportant". (Answer "very unimportant" or "not very important"). The common items considered as "not understandable" and "not important" included Q8, Q10, Q13 and Q20. Based on the subjective description of questions (a) and (b) in question (c), it can be considered that Q16, Q18, Q19, Q23, Q25, Q29 and questions related to the recall experience of pandemic events are ambiguous and do not conform to the subjective feelings during the pandemic, while Q21 is more a test of personal character, and the inducement of this "irritation" is rarely caused by the pandemic itself and/or the pandemic related events. For this reason, the following items are considered to be deleted through structured interview: Q8, Q10, Q13, Q16, Q18, Q19, Q20, Q21, Q23, Q24, Q25, Q29. In combination with quantitative analysis, the results of screening items by four methods are shown in Table 3. After the analysis of 30 items, a total of 8 items (Q8, Q10, Q13, Q16, Q18, Q19, Q21, Q25) were deleted. According to experts' opinions, Q23 and Q29 are easy to be ambiguous, so deletion is considered.

3.2 Exploratory Factor Analysis and Internal Consistency Evaluation of the Provisionally Adapted Questionnaire

Using the survey data in 2020, the maximum variance rotation method of principal component factor analysis was adopted to obtain the scale dimension division as shown in Table 4. Among them, Q7, Q12, Q22 and Q30 are the maximum factor loadings of four items, and the two principal components are similar. In addition to the above four items, other items are divided into corresponding principal components according to the maximum factor loading. According to the content, it can be concluded that principal component 1 represents "avoidance" and "re-experience" of the pandemic situation. Principal component 2 represents "social alienation", that is, maladaptation to social environment. Principal component 3 represents the "physiological and emotional responses" during the pandemic. According to the contents of the main representatives of the above principal components, it is reasonable to attribute Q7 and Q12 to principal component 3 and Q22 and Q30 to principal component 1. Each item in the questionnaire is graded according to Likert's score of 0 to 5, with 0 representing "no experience" and 5 representing "always experience". 20-item and 3- dimension structure is named as: Avoidance and re-experience (Including 8 items: Q5, Q6, Q9, Q11, Q12, Q13, Q15 and Q20), Social alienation (Including 5 items: Q14, Q16, Q17, Q18 and Q19), Physiological and emotional responses (Including 7 items: Q1, Q2, Q3, Q4, Q7, Q8 and Q10). The original score of each dimension is simply added and calculated, and then converted into

Table 3. Results of Item Screening

No.	Variability (SD)	Total correlation coefficient method	Cronbach α coefficient	Factor analysis	Structured Cognitive Interview	No. of Selected times	Retain in adapted questionnaire?
Q1	1.37	0.56	0.954	✓	✓	5	Y
Q2	1.20	0.68	0.952	✓	✓	5	Y
Q3	1.45	0.55	0.954	✓	✓	5	Y
Q4	1.21	0.65	0.952	✓	✓	5	Y
Q5	1.25	0.68	0.952	✓	✓	5	Y
Q6	0.85	0.60	0.953	✓	✓	4	Y
Q7	1.21	0.71	0.952	✓	✓	5	Y
Q8	1.01	0.66	0.952	X ^{ab}	X	3	N
Q9	1.47	0.56	0.954	X ^{ab}	✓	4	Y
Q10	1.10	0.58	0.953	X ^a	X	3	N
Q11	1.03	0.74	0.951	✓	✓	5	Y
Q12	1.27	0.67	0.952	✓	✓	5	Y
Q13	0.86	0.71	0.952	X ^b	X	2	N
Q14	0.89	0.69	0.952	✓	✓	4	Y
Q15	1.08	0.66	0.952	✓	✓	5	Y
Q16	0.86	0.70	0.952	✓	X	3	N
Q17	0.92	0.74	0.952	✓	✓	5	Y
Q18	1.26	0.65	0.952	X ^a	X	3	N
Q19	0.85	0.74	0.952	✓	X	3	N
Q20	1.01	0.68	0.952	✓	X	4	Y
Q21	1.18	0.70	0.952	X ^{ab}	X	3	N
Q22	0.94	0.71	0.952	X ^{ab}	✓	4	Y
Q23	1.11	0.71	0.952	✓	X	4	Y
Q24	0.90	0.69	0.952	✓	X	4	Y
Q25	0.78	0.64	0.952	X ^b	X	2	N
Q26	0.87	0.66	0.952	✓	✓	4	Y
Q27	1.19	0.69	0.952	✓	✓	5	Y
Q28	1.12	0.67	0.952	✓	✓	5	Y
Q29	0.97	0.65	0.952	✓	X	4	Y
Q30	0.97	0.72	0.952	✓	✓	5	Y

Overall Cronbach α coefficient is 0.954;

Individual Cronbach α coefficients retain 3 decimal places to be discriminated from other Questions;

a, Maximum factor loading < 0.5;

b, Maximum factor loadings are similar on the 2 common factors;

ab, Maximum factor loading < 0.5 & similar maximum factor loadings on the 2 common factors; Q23/Q29 had ambiguous meanings and were deleted according to expert opinions.

0–100 points. The higher the score, the heavier the stress response of events related to the COVID-19.

Internal consistency Cronbach α coefficient results show that the three dimensions of pandemic “Avoidance and re-experience” are 0.892. The “Social alienation” is 0.846, the “Physiological and emotional responses” is 0.839, and the total questionnaire is 0.931. After deleting each item, Cronbach α coefficient does not increase significantly, indicating good consistency.

3.3 Confirmatory Factor Analysis of the Adapted Questionnaire

3.3.1 Structure Validity Evaluation

The structure equation model using 2281 survey data in 2022 is shown in Fig. 1. The survey data verifies that the value of structure equation χ^2/df is 1.65 (less than 3) while the value of GFI, AGFI, NFI, TLI, IFI, RFI and CFI is greater than 0.9 and the value of RSMEA is 0.02 (less than 0.08) indicating that the structure equation has good model structure validity.

Dimension1, Avoidance & re-experiencing; Dimension2, Physiological & Emotional responses; Dimension3, Social alienation.

3.3.2 Convergent Validity Evaluation

The convergent validity of the structure equation model of the 2022 survey data is shown in Table 5. It can be concluded that the CR value of each dimension is greater than 0.7, and the AVE value is greater than 0.36, indicating that the questionnaire has good convergent validity.

3.3.3 Discrimination Validity Evaluation

As shown in Table 6, the 95% confidence interval of the correlation coefficient between all dimensions of the 2022 survey data using the Bootstrap method does not contain 1, indicating that the 3-dimension COVID-19 related event stress reaction questionnaire (CRESRQ) has good content discrimination validity.

3.3.4 Internal Consistency Evaluation of the Adapted Questionnaire

Internal consistency Cronbach α coefficient of the adapted questionnaire results show that the dimension of the pandemic “Avoidance and re-experience” is 0.931, the dimension of “Social alienation” is 0.885, the dimension of “Physiological and emotional responses” is 0.859, and the total questionnaire is 0.951. After deleting each item, Cronbach α coefficient does not increase significantly. It is verified again that CRESRQ has good internal consistency. (Table 7).

Table 4. Factor analysis of 20-item questionnaire

No in SARSQ	No in CRESRQ	Item	Principal component factor & Loading factor		
			Factor 1	Factor 2	Factor 3
Q5	q5	I tried to avoid feelings about the Covid-19 related events	0.623	0.192	0.374
Q6	q6	I had repeated distressing dreams of the Covid-19 related events	0.596	0.127	0.303
Q11	q9	I tried to avoid activities that reminded me of the Covid-19 related events	0.741	0.309	0.227
Q14	q11	I tried to avoid conversations about the Covid-19 related events	0.744	0.326	0.108
Q15	q12	I had a bodily reaction when exposed to reminders of the Covid-19 related events	0.564	0.204	0.353
Q17	q13	I tried to avoid thoughts about the Covid-19 related events	0.791	0.337	0.111
Q22	q15	I avoided contact with people who reminded me of the Covid-19 related events	0.564^c	<i>0.510^c</i>	0.120
Q30	q20	I tried to stay away from places that remind me of the Covid-19 related events	0.563^c	<i>0.544^c</i>	0.120
Q20	q14	I felt distant from my own emotions	0.360	0.653	0.159
Q24	q16	My mind went blank	0.293	0.664	0.250
Q26	q17	The Covid-19 related events caused problems in my relationships with other people	0.319	0.690	0.149
Q27	q18	I had difficulty concentrating	0.130	0.684	0.415

(continued)

Table 4. (continued)

No in SARSQ	No in CRESRQ	Item	Principal component factor & Loading factor		
			Factor 1	Factor 2	Factor 3
Q28	q19	I felt estranged/detached from other people	0.180	0.764	0.259
Q1	q1	I had difficulty falling or staying asleep	0.279	0.028	0.690
Q2	q2	I felt restless	0.320	0.180	0.728
Q3	q3	I felt a sense of timelessness	0.079	0.248	0.660
Q4	q4	I was slow to respond	0.117	0.382	0.674
Q7	q7	I felt extremely upset if exposed to Covid-19 that reminded me of an aspect of the Covid-19 related events	0.586 ^c	0.111	0.540^c
Q9	q8	The Covid-19 related events made it difficult for me to perform work or other things I needed to do	0.142	0.310	0.536
Q12	q10		0.468 ^c	0.160	0.518^c

Measure of Smapling Adequacy KMO value = 0.950, Bartlett’s Test of Sphericity $c^2 = 12515.378$ ($p < 0.001$), which represent that the data are suitable for factor analysis;
 c, Similar Maximum factor loadings on the 2 common factors.

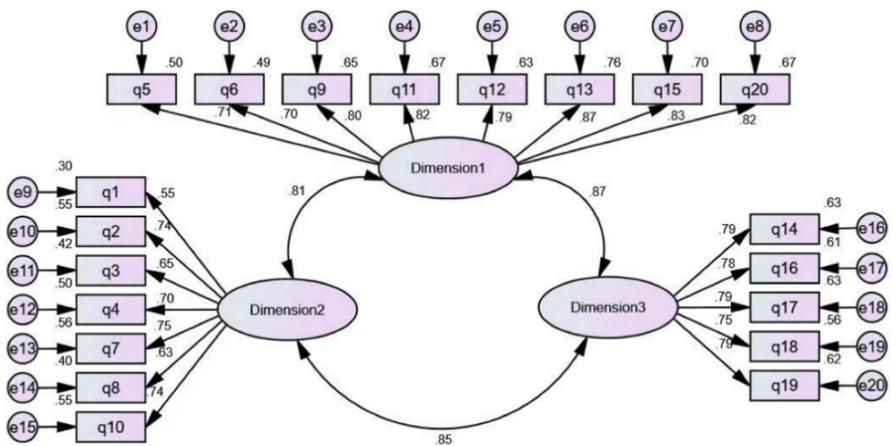


Fig. 1. Structure equation model of 2022 study

Table 5. Convergent validity evaluation of the adapted questionnaire

Dimension	Item	Standardized factor loadings	Non-standardized factor loadings	S.E.	t-value	P	SMC	CR	AVE
Avoidance & re-experiencing	q5	0.710	1.000				0.504	0.932	0.634
	q6	0.699	0.813	0.025	32.523	***	0.489		
	q9	0.804	1.117	0.030	37.461	***	0.646		
	q11	0.821	1.037	0.027	38.093	***	0.674		
	q12	0.794	1.018	0.028	36.725	***	0.630		
	q13	0.872	1.139	0.028	40.435	***	0.760		
	q15	0.834	1.055	0.027	38.675	***	0.696		
	q20	0.819	1.085	0.029	37.903	***	0.671		
Social alienation	q14	0.791	1.000				0.626	0.886	0.609
	q16	0.784	0.954	0.023	40.717	***	0.615		
	q17	0.795	0.997	0.024	41.062	***	0.632		
	q18	0.745	1.057	0.028	37.583	***	0.555		
	q19	0.785	1.056	0.026	40.382	***	0.616		
Physiological & Emotional responses	q1	0.551	0.763	0.031	24.883	***	0.304	0.859	0.468
	q2	0.741	0.958	0.028	34.262	***	0.549		
	q3	0.650	0.951	0.032	29.588	***	0.423		
	q4	0.704	0.984	0.031	32.032	***	0.496		
	q7	0.746	1.000				0.557		
	q8	0.634	0.984	0.033	29.658	***	0.402		
	q10	0.739	1.004	0.029	35.178	***	0.546		

*** p < 0.001

Table 6. Discrimination validity evaluation of the adapted questionnaire (Bootstrap Method)

Factor combination			r	S.E.	Bias-corrected 95% CI		95% CI	
					Lower	Upper	Lower	Upper
Avoidance & re-experiencing	<->	Social alienation	0.867	0.012	0.846	0.885	0.847	0.885
Physiological & Emotional responses	<->	Social alienation	0.847	0.012	0.827	0.865	0.826	0.865
Avoidance & re-experiencing	<->	Physiological & Emotional responses	0.808	0.014	0.785	0.831	0.784	0.830

Table 7. α Coefficients of three dimensions in the adapted questionnaire

Avoidance & re-experiencing	α Coefficient	Social alienation	α Coefficient	Physiological & Emotional responses	α Coefficient
Total	0.931	Total	0.885	Total	0.859
q5	0.928	q14	0.863	q1	0.851
q6	0.927	q16	0.860	q2	0.829
q9	0.921	q17	0.858	q3	0.841
q11	0.919	q18	0.865	q4	0.834
q12	0.922	q19	0.856	q7	0.836
q13	0.915			q8	0.844
q15	0.918			q10	0.840
q20	0.921				

4 Discussion

We adapted SASRQ to events related to the COVID-19 pandemic and formed COVID-19 Related Event Stress Reaction Questionnaire (CRESRQ). As a large-scale public health emergency, the COVID-19 pandemic has brought various stress reactions to the public. These stress reactions come not only from the injury of the disease itself, but also from the impact on work and life caused by pandemic prevention and control, social panic, etc. [17, 18]. A systematic review of the few studies on stress response measurement tools in the COVID-19 pandemic has certain application value, but most of them are not clear and refined in content validity and dimension division. The explanation for the source of stress is basically reflected in the psychological perspective, but cannot reflect the impact of stress on individual physiological and social adaptability. Based on the internationally and widely used stress response assessment tool SASRQ, this study takes into account the different stress sources of people in the early and post COVID-19 pandemic [19–21] era, and adopts structured cognitive interview and four quantitative analysis methods (the variability method, the total correlation coefficient method, the Cronbach α coefficient method, the factor analysis method). Combined with experts' opinions, we used these above-mentioned methods to develop a stress response questionnaire for a wide range of people, avoiding the problems of using the unmatched situation and not reflecting the authenticity caused by the mechanical use of ready-made questionnaires and scales to assess people's psychological status during the pandemic period.

The 20-item COVID-19 related event stress reaction questionnaire was adapted and formed. Exploratory factor analysis found that the three dimensions of "Avoidance and reexperience", "Social alienation", and "Physiological and emotional responses" were consistent with the content of the items, and were more consistent with the theoretical framework. Confirmatory factor analysis also confirmed its structural rationality. The

analysis results of internal consistency reliability, convergent validity and discrimination validity show that the evaluation indicators are ideal, indicating that the overall performance of the questionnaire is good.

5 Conclusion

The CRESRQ based on SASRQ has fewer items, good performance evaluation, and is well matched with events related to the COVID-19 pandemic, which can scientifically evaluate the degree of stress response of the people affected by the Chinese mainland COVID-19 pandemic. It needs to be applied in the research of other public health emergencies in the future, to investigate the applicability and feasibility of its evaluation of stress response under different scenarios.

6 Limitations

It should be noted that this study still has certain limitations, that is, it does not consider adding new items. Therefore, whether the questionnaire needs additional items and refined dimensions, as well as the application of effects in other countries and regions, also needs further scenario research and exploration.

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