Psychological strains after the crisis: evaluating separation anxiety among Iranian children and adolescents in the post-COVID-19 era

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Abstract

Objectives The objective of this study was to specifically investigate Separation Anxiety Disorder (SAD), as one of the noteworthy disorders within the spectrum of anxiety disorders, among children and adolescents, after overcoming the crises caused by the Coronavirus Disease 2019 (COVID-19) pandemic. Efforts were also made to identify socio-demographic factors that could be associated with changes in SAD level and also to assess the effect of different constituting dimensions of SAD on the severity of this disorder.

Methods In this cross-sectional study, face-to-face interviews were conducted with the parents of 317 (7-13-year-old) Iranian students, who were selected through a multi-stage random sampling method in the city of Shiraz. During the interviews, socio-demographic data were collected, and subsequently, SAD symptoms and dimensions were assessed using the Separation Anxiety Assessment Scale (Parent Version) (SAAS-P) questionnaire. Later, employing the Partition Around Medoids (PAM) statistical method, the participants were categorized into two groups with low and high levels of SAD. Also, to understand the interaction between the different dimensions of SAD, the network analysis method was employed. Finally, univariate analysis and logistic regression were utilized, with a significance level of 0.05, to determine potential associating factors with the level of SAD.

Results The sample included 128 girls and 189 boys with a mean age of 9.63 ± 2.63 and 9.63 ± 1.95 years respectively. Based on the PAM method, 51.1% of the participants presented a high level of SAD. According to network analysis, it was demonstrated that the "fear of abandonment" dimension plays a central role in high levels of SAD. Based on logistic regression, female gender, age ≥ 10 years, parents' unacademic educational background, mother's employment, and child's history of physical/mental problems were significantly associated with the high level of SAD.

Conclusions A considerable number of the participants in this study presented a high level of SAD with the "fear of abandonment" being a key influential dimension of elevated levels of this disorder. Maternal employment, female gender, child's history of health issues, and low parental education were identified as important contributors to the

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high SAD level. Considering these factors allows for more effective diagnostic and therapeutic interventions. However, the need for further studies remains crucial.

Keywords Adolescents, Children, Separation anxiety disorder

Introduction

Anxiety disorders, which impact 10 to 30% of children and adolescents, are the most common mental disorders among youth [1–4]. A number of anxiety disorders, such as Generalized Anxiety Disorder (GAD), social anxiety disorder, panic disorder, and Separation Anxiety Disorder (SAD), are more frequently observed in this population and due to their comorbidity and common clinical manifestations, are included in a spectrum of differential diagnoses [1, 5]. Previous studies have proposed a biopsychosocial theory to explain the pathogenesis of such anxiety disorders [1, 6, 7]. Offspring of parents with anxiety disorders are more likely to develop these disorders themselves, as previous research showed the influence of genetic factors by estimating at least 30% heritability [1, 8–11]. In addition, female gender, some temperamental characteristics such as shyness, cognitive factors such as overestimating stimuli and threats, being under overprotective, abusive, or neglectful parenting, and also external stressors such as loss of family members, child's health condition, or changes in the child's environment can be associated with higher levels of anxiety [1, 6, 12–18].

SAD, with a prevalence between 0.7% and 15.7% in different studies, is one of the common and even, according to some resources, the most common anxiety disorder among children and adolescents [19–29]. Separation anxiety, as a natural part of childhood development with survival value, usually manifests before the age of one, shaping children's awareness of separation from their mother or caregiver [1, 5]. However, this feature diminishes around the age of two and a half, allowing the child to feel at ease even when separated from their parents [1]. When the anxiety of separation or even anticipation of separation from the primary attachment figure is excessive, unrealistic, and beyond developmental expectations, the diagnosis of SAD should be considered [1, 6, 19, 30]. In addition, other common symptoms of this disorder include excessive worry about parents getting harmed upon separation, being lost or kidnapped, getting out or being alone at home, nightmares, and even somatic symptoms such as headache, stomachache, and nausea and vomiting [1, 19, 30]. According to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5), these symptoms should persist for at least four weeks and be accompanied by a significant disruption in the child's routine functioning [30].

From February 2020, when the World Health Organization (WHO) announced the onset of the Coronavirus Disease 2019 (COVID-19) pandemic, until May 2023, when WHO declared its end as a public health emergency of international concern, notable social and psychological burdens have been imposed on various societies, including Iran [31–35]. Over this timeframe, numerous studies demonstrated the impact of this pandemic on the significant rise of anxiety disorder symptoms among children and adolescents [6, 36–43]. Moreover, conditions such as quarantines, school closures, distance learning, and possibly experiencing death from COVID-19 among family members, all could serve as external stressors and potentially increase the likelihood of SAD in this population [38, 41, 44–49].

However, even as we move beyond the challenges of the pandemic and witness a relative return to the pre-pandemic conditions, the necessity of monitoring the mental health of children and adolescents persists. Considering the mentioned background and the fact that previous studies have mostly examined the spectrum of anxiety disorders as a whole rather than individually, the objective of this study was to specifically investigate SAD, as one of the noteworthy disorders within this spectrum, in this particular group. Furthermore, efforts were made to not only identify socio-demographic factors that could potentially be associated with the changes in SAD level but also to assess the effect of different constituting dimensions of SAD on the severity of this disorder.

Methods

Ethical considerations

The Research Ethics Committee of Shiraz University of Medical Sciences (SUMS) approved the procedure and the informed consent forms of this study with the approval code of IR.SUMS.REC.1400.610. Written informed consent was obtained from each participant before starting the interview, and all principles of confidentiality, anonymity, and voluntary involvement, following the Declaration of Helsinki, were maintained.

Study design and data collection

In this cross-sectional study, a total of 317 parents of elementary school students from the city of Shiraz, one of Iran's major cities, were selected through a multi-stage sampling from June to July 2023. From each four educational districts in Shiraz, two primary schools (a girls' school and a boys' school) were chosen randomly from the list of primary schools (clusters). Then 40 students from each school were randomly selected by a simple random sampling method using a random number table. Data were gathered through an in-person interview with

a trained interviewer in schools with the mother or father of the students. After explaining the study objectives and obtaining consent, a structured questionnaire was completed during these face-to-face interviews. Parents who were under 18 years old or whose children were not in the age range of 7 to 13 years were excluded from the study.

Questionnaire

A two-section questionnaire was designed for this study. The first section was aimed at gathering socio-demographic data and exploring some aspects of the relationship between the parents and the child. These data included parents' age, educational background, employment status, psychiatric disorders history, and substance abuse history, as well as the family's monthly income, monthly medical expenditure, number of children, and the quality of the parent-child relationship. In addition, data were collected regarding the child's gender, age, and physical and mental health status, educational status, experiencing the death of relatives due to COVID-19, and experiencing calamitous events in the past year.

The second section was the Separation Anxiety Assessment Scale (Parent Version) (SAAS-P). This 34-item questionnaire, which various studies have supported its reliability, validity, and clinical applicability, encompasses four main dimensions of SAD, including fear of being alone, fear of abandonment, fear of physical illness, and worry about calamitous events, and two other research subscales including frequency of calamitous events, and safety signals index [50–52]. A 2016 study conducted by Talaienejad et al. [53] analyzed the psychometric properties of the SAAS-P questionnaire and suggested it as a promising measure to evaluate SAD in the Iranian population of children and adolescents. The obtained Cronbach's alpha coefficient for the total score of this questionnaire was 0.86, and for the main subscales of fear of being alone, fear of abandonment, fear of physical illness, and worry about calamitous events were 0.74, 0.73, 0.68, and 0.62 respectively [53]. In addition, a 2018 study also conducted by Talaienejad et al. [54], explained the method of calculating the total and each subscale's score from this questionnaire, however, no cut-off point was suggested to determine the severity level of each of them. Therefore, to assess the extent of separation anxiety symptoms among the participants, and determine the importance of each of the 6 dimensions of SAD evaluated by the SAAS-P questionnaire; specific statistical methods, explained below, were employed.

Statistical analysis

Data were summarized using frequency (percentage), and mean±Standard Deviation (SD) for qualitative and quantitative variables, respectively.

The Partition Around Medoids (PAM) method was used to classify the questionnaire's score into distinct clusters. The clustering technique is based on minimizing the dissimilarities between the individuals within a cluster. This method is more robust in the presence of outliers than the traditional k-means clustering. The best number of clusters was determined using internal clustering validity indices and stability measures. The number of clusters (k) with the maximum value of internal clustering validity (here Silhouette and Calinski-Harabsz) and minimum values of stability measures (here APN: Average Proportion of Non-Overlap, and ADM: Average Distance Between Means) is optimal. The indices recommended that considering two clusters (k=2), namely low level and high level, classifies SAD best. Mean dimensions were compared between the two clusters using an independent-sample t-test and Cohen's d, reported as effect size.

Univariate and adjusted Odds Ratios (OR) and 95% Confidence Intervals (CI) were used to assess the relationship between independent variables and the two clusters of SAD symptoms (namely low and high levels). The adjusted ORs were computed using a logistic regression model and backward selection method to select influential independent variables.

Network analysis based on the Gaussian graphical model was employed to better understand the interaction between the 6 dimensions (nodes) of the SAAS-P questionnaire. The methods report strength, betweenness, and closeness centrality measures to assess the role of each node in the relationship graph. The edges were estimated by the G-Lasso method.

Package "cluster" [55] and "qgraph" [56] were used to implement PAM and network analysis, respectively, in R software version 4.3.2 [57]. Throughout this study, the type I error rate (α) was set to 0.05.

Results

Of the 317 children recruited in the study, 128 were girls and 189 were boys. The children aged 7 to 13 with a mean of 9.63±2.14 years. Mothers constituted the majority of respondents (76.3%). The mean age of mothers and fathers was 34.81±5.88 and 39.49±6.42 years, respectively.

The PAM method revealed that considering two clusters (namely low and high) can adequately categorize the SAAS-P questionnaire score of the participants. Based on this classification, 162 (51.1%) children had a high level of separation anxiety. The mean total score and the 6 dimensions of the questionnaire in the two clusters of SAD levels are presented in Table 1. The results indicated that the mean total and all 6 dimensions' scores in the cluster with the low level of SAD were significantly lower than the other cluster (all *P*<0.001). Moreover, all

Table 1 Mean total and 6 dimensions' score of the SAAS-P questionnaire categorized into two clusters, estimated by the PAM method

	SAD category			
	Low level	High level	*P* value[*]	Cohen's d
Fear of being alone	7.04 ± 1.97	12.68 ± 2.57	< 0.001	2.46
Fear of abandonment	5.66 ± 1.20	11.36 ± 3.08	< 0.001	2.42
Fear of physical illness	6.17 ± 1.27	10.97 ± 2.65	< 0.001	2.30
Worry about calamitous events	7.48 ± 2.01	11.93 ± 2.61	< 0.001	1.90
Frequency of calamitous events	22.57 ± 2.75	29.57 ± 3.14	< 0.001	2.37
Safety signals index	6.84 ± 1.79	3.48 ± 1.75	< 0.001	1.82
Total score	55.75 ± 6.90	87.90 ± 9.35	< 0.001	3.90

The values in the table are mean ± Standard Deviation (SD)

[*]Independent-sample t-test

Cohen's d effect sizes indicated that the mean differences were noticeably large (>0.8). Among the 6 dimensions, the greatest differences belonged to the "fear of being alone", "fear of abandonment", "frequency of calamitous events", and "fear of physical illness" dimensions.

The network analysis results for the 6 dimensions of the SAAS-P questionnaire for children in the categories of low and high levels of SAD are presented in Figs. 1 and 2. Table 2 also presents the values of centrality measures used in Fig. 2. It was illustrated that the network of children with a high level of SAD had a simpler and more centered network, with more zero edges between dimensions (nodes). The "worry about calamitous events"

dimension has no edge in the high-risk network. In this network, the "fear of abandonment" dimension is the most central and important, with the highest strength and attained all possible betweenness scores. Interestingly, the "fear of being alone" and "frequency of calamitous events" dimensions are connected indirectly to the "fear of physical illness" and "safety signals index" dimensions via the "fear of abandonment" dimension, and there is no direct edge between them. One can conclude that any change in the "fear of abandonment" dimension is accompanied by a direct change in other dimensions. Therefore, this dimension can be considered as a predominant variable for early identification and any possible intervention to reduce separation anxiety. In contrast, the network of the children in the category of the low level of SAD was more dispersed. The most central dimension was the "frequency of calamitous events" followed by the "fear of physical illness". Although the network of the category with the low level of SAD included more dimensions with non-zero edges, the relationships were not as strong as those obtained in the network of the category with the high level of SAD.

Table 3 shows univariate analysis and logistic regression results for examining the association between parents' and children's demographic features and the child's level of SAD. Univariate analysis showed that the child's gender, child's age, respondent to the questionnaire, mother's age, parents' educational background, mother's employment status, relatives' death due to COVID-19, parent's substance abuse history, monthly medical expenditure, child's health status, the quality of parent-child
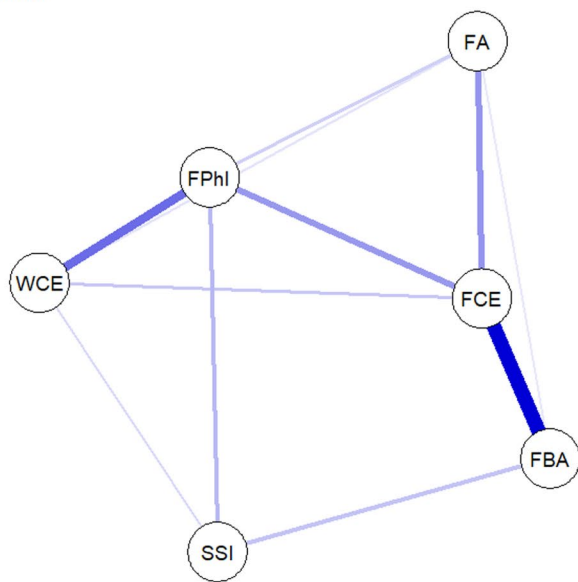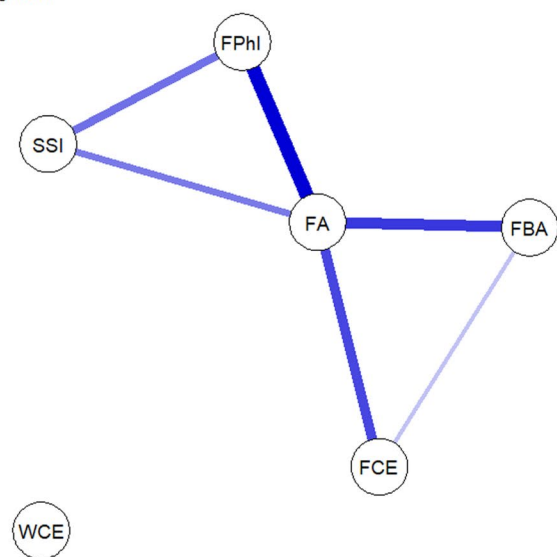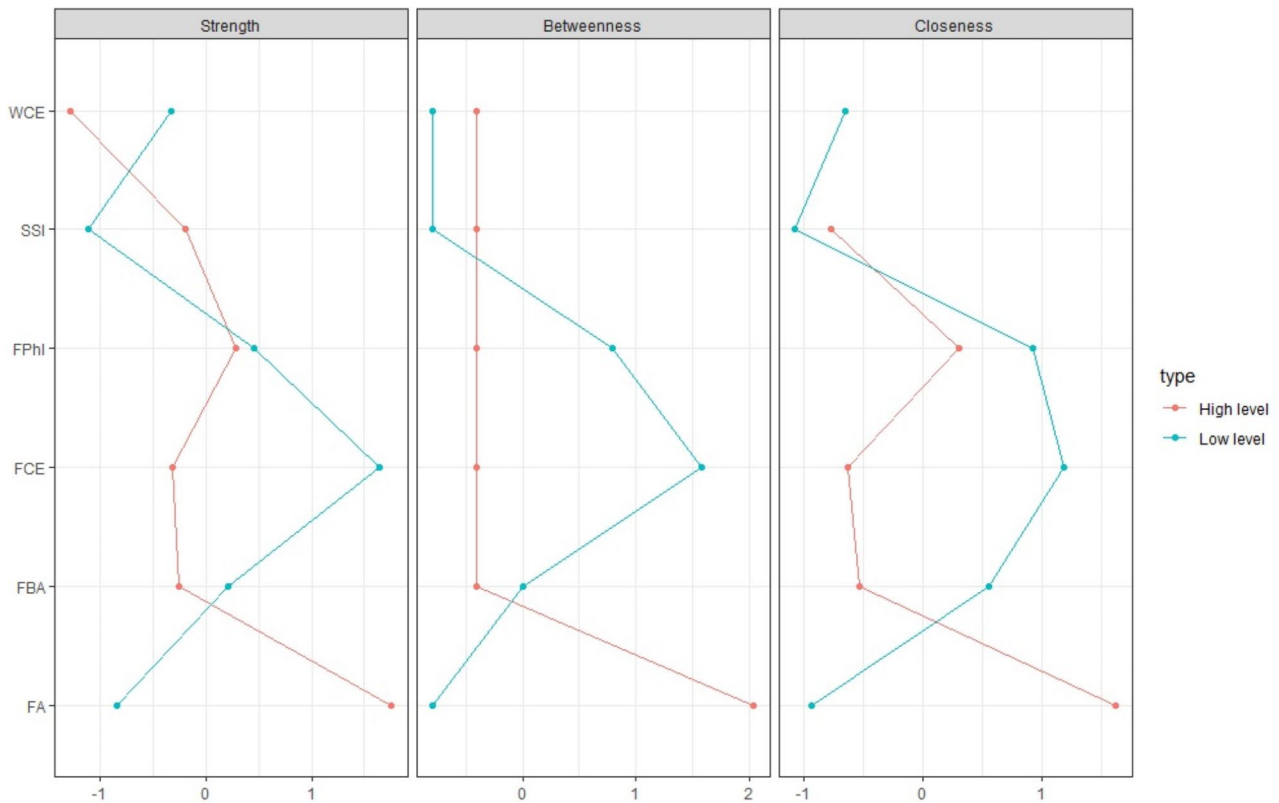

Fig. 1 Network (relationship graph) for the 6 dimensions (nodes) of the SAAS-P questionnaire by risk clusters resulting from the PAM method (low- and high-level groups). FA: Fear of abandonment; FBA: Fear of being alone; FCE: Frequency of calamitous events; FPhI: Fear of physical illness; SSI: Safety signals index; WCE: Worry about calamitous events

Fig. 2 Standardized values of centrality measures for the 6 dimensions (nodes) of the SAAS-P questionnaire by risk clusters resulted from the PAM method (low- and high-level of SAD). Participants in the low-level group are represented by the blue line, and the high-level group by the red line. FA: Fear of abandonment; FBA: Fear of being alone; FCE: Frequency of calamitous events; FPhI: Fear of physical illness; SSI: Safety signals index; WCE: Worry about calamitous events

Table 2 Centrality measures of the network analysis for each of the 6 dimensions of the SAAS-P questionnaire for children with low- and high-level of SAD (the standardized centrality measure, z-score values, reported)

	SAD category					
	Low level			**High level**		
	Strength	**Betweenness**	**closeness**	**Strength**	**Betweenness**	**closeness**
Fear of being alone	0.21	0.00	0.55	−0.25	-0.41	-0.53
Fear of abandonment	-0.85	-0.79	-0.93	1.76	2.04	1.62
Fear of physical illness	0.45	0.79	0.92	0.29	-0.41	0.30
Worry about calamitous events	-0.33	-0.79	-0.65	-1.28	-0.41	-
Frequency of calamitous events	1.64	1.58	1.18	-0.31	-0.41	-0.63
Safety signals index	-1.11	-0.79	-1.07	-0.20	-0.41	-0.77

relationship and child's past year's history of calamitous events were significantly associated with the high level of SAD.

Based on logistic regression results, being a girl (OR=2.79, %95CI:1.37–5.65), age equal or over 10 years (OR=3.56, %95CI:1.63–7.76), mother's unacademic educational background (under diploma: OR=4.95, %95CI:1.56–15.72, diploma: OR=3.23, %95CI: 1.30–8.05), father's unacademic educational background (under diploma: OR=4.13, %95CI:1.27–13.44, diploma: OR=4.07, %95CI: 1.65–10.03), mother's employment status (full-time: OR=2.57, %95CI: 1.08–6.11, part-time:

OR=28.56, %95CI: 6.80-119.90), and child having a physical/mental problem (OR=5.0, %95CI: 1.50-16.72), were positively associated with the high level of SAD.

Discussion

In this study, 51.1% of the participants presented high levels of separation anxiety symptoms. Although this number cannot necessarily be interpreted as the prevalence of SAD among the 7-13-year-old children investigated in this study, it still suggests that a relatively large number of children in this age group may suffer from this type of anxiety [3, 21, 23, 24, 27]. Previous studies have

Table 3 Association between parents' and child's demographic features with the child's level of SAD based on logistic regression

		SAD		OR (95% CI) *	P value	OR (95% CI) **	P value
		Low level	High level				
Child's gender	Girl	52 (40.6)	76 (59.4)	**1.75 (1.11–2.75)**	**0.015**	**2.79 (1.37–5.65)**	**0.005**
	Boy	103 (54.5)	86 (45.5)	1	-	1	-
Child's age	< 10	126 (70.4)	53 (29.6)	1	-	1	-
	≥ 10	29 (21.0)	109 (79.0)	**8.94 (5.31–15.03)**	**< 0.001**	**3.56 (1.63–7.76)**	**0.001**
Respondent to the questionnaire	Mother	128 (52.9)	114 (47.1)	1	-	1	-
	Father	27 (36.0)	48 (64.0)	**2.00 (1.17–3.41)**	**0.011**	0.48 (0.21–1.10)	0.083
Mother's age	Less than 30	12 (20.7)	46 (79.3)	**6.13 (2.76–13.76)**	**< 0.001**	-	-
	30–39	103 (53.1)	91 (46.9)	1.41 (0.80–2.51)	0.237	-	-
	More than 40	40 (61.5)	25 (38.5)	1	-	-	-
Mother's educational background	Under diploma	31 (43.7)	40 (56.3)	**4.21 (2.10–8.44)**	**< 0.001**	**4.95 (1.56–15.72)**	**0.007**
	Diploma	62 (37.6)	103 (62.4)	**5.42 (2.97–9.91)**	**< 0.001**	**3.23 (1.30–8.05)**	**0.012**
	University	62 (76.5)	19 (23.5)	1	-	1	-
Father's educational background	Under diploma	34 (56.7)	26 (43.3)	1.69 (0.86–3.31)	0.128	**4.13 (1.27–13.44)**	**0.018**
	Diploma	57 (34.8)	107 (65.2)	**4.14 (2.40–7.14)**	**< 0.001**	**4.07 (1.65–10.03)**	**0.002**
	University	64 (68.8)	29 (31.2)	1	-	1	-
Mother's employment status	Full-time/ retired	23 (39.0)	36 (61.0)	**2.74 (1.51–4.99)**	**0.001**	**2.57 (1.08–6.11)**	**0.033**
	Part-time	4 (7.0)	53 (93.0)	**23.23 (8.08–66.80)**	**< 0.001**	**28.56 (6.80-119.90)**	**< 0.001**
	Housewife	128 (63.7)	73 (36.3)	1	-	1	-
Father's employment status	Full-time/ retired	55 (45.8)	65 (54.2)	0.95 (0.35–2.56)	0.912	1.25 (0.29–5.45)	0.764
	Part-time	92 (51.4)	87 (48.6)	0.76 (0.29-2.00)	0.575	0.56 (0.14–2.29)	0.422
	Unemployed	8 (44.4)	10 (55.6)	1	-	1	-
Income status	< expenses	88 (47.6)	97 (52.4)	1	-	-	-
	≥expenses	67 (50.8)	65 (49.2)	0.88 (0.56–1.38)	0.577	-	-
Relatives' death due to COVID-19	No	129 (59.2)	115 (47.1)	1	-	-	-
	Yes	25 (34.7)	47 (65.3)	**2.11 (1.22–3.64)**	**0.007**	-	-
Parents' psychiatric disorder history	No	145 (49.7)	147 (50.3)	1	-	-	-
	Yes	10 (40.0)	15 (60.0)	1.48 (0.64–3.40)	0.354	-	-
Parent's substance abuse history	No	151 (50.7)	147 (49.3)	1	-	-	-
	Yes	4 (21.1)	15 (78.9)	**3.85 (1.25–11.88)**	**0.012**	-	-
Monthly medical expenditure	≤ 10% of monthly income	120 (56.3)	93 (43.7)	1	-	-	-
	> 10% of monthly income	35 (33.7)	69 (66.3)	**2.54 (1.56–4.15)**	**< 0.001**	-	-
Number of children in the family	1	24 (38.7)	38 (61.3)	1.46 (0.73–2.90)	0.282	2.84 (0.99–8.12)	0.052
	2	96 (52.7)	86 (47.3)	0.83 (0.48–1.42)	0.488	1.10 (0.48–2.50)	0.828
	≥ 3	35 (47.9)	38 (52.1)	1	-	1	-
Child's health status	Healthy	147 (52.7)	132 (47.3)	1	-	1	-
	Physical/mental problem	8 (21.1)	30 (78.9)	**4.18 (1.85–9.43)**	**< 0.001**	**5.00 (1.50-16.72)**	**0.009**
Child's educational status	Very good	75 (68.2)	35 (31.8)	0.50 (0.21–1.18)	0.115	0.87 (0.22–3.40)	0.837
	Good	48 (39.0)	75 (61.0)	1.68 (0.73–3.89)	0.223	3.40 (0.90-12.78)	0.071
	Relatively good	18 (31.6)	39 (68.4)	2.33 (0.91–5.97)	0.077	2.22 (0.52–9.51)	0.281
	Weak	14 (51.9)	13 (41.8)	1	-	1	-
Quality of parent-child relationship	Very good	103 (69.6)	45 (30.4)	1	-	1	-
	Good	38 (33.6)	75 (66.4)	**4.52 (2.67–7.63)**	**< 0.001**	1.90 (0.86–4.23)	0.115
	Relatively good	9 (20.5)	35 (79.5)	**8.90 (3.95–20.05)**	**< 0.001**	3.85 (0.95–11.32)	0.060
	Weak	5 (41.7)	7 (58.3)	3.20 (0.97–10.64)	0.059	2.22 (0.52–9.51)	0.281
Child's past year's history of calamitous events	No	141 (51.5)	133 (48.5)	1	-	-	-
	Yes	14 (32.6)	29 (67.4)	**2.20 (1.11–4.34)**	**0.021**	-	-

* Univariate analysis odds ratios and 95% confidence interval

** Adjusted odds ratio and 95% confidence interval resulted from the logistic regression method

The odds ratios with bold style were statistically significant

shown that the COVID-19 pandemic led to a significant rise in anxiety disorders among youth. Even though the current study was conducted shortly after the pandemic subsided, these high levels of separation anxiety symptoms may still be influenced by the profound challenges that emerged during that period [36, 38, 42, 47, 58–60].

The SAAS-P questionnaire was employed in this study for the evaluation of SAD. This questionnaire not only allows for an overall evaluation of the SAD but also enables the investigation of its six distinct dimensions. The results of the analyses indicated that in the category of participants with a high level of SAD, the "fear of abandonment" dimension plays a key role. This dimension, which indirectly connects the dimensions of the "fear of being alone" and "frequency of calamitous events" to the "fear of physical illness" and "safety signals index", can serve as a central point for diagnostic and therapeutic interventions. This result is congruent with the findings of the 2005 study conducted by Hajinlian et al. [52], which demonstrated the "fear of abandonment" as the most predictive dimension (83%) of SAD. On the other hand, network analysis revealed that the dimension of "worry about calamitous events" had no connection with the other five dimensions. Nevertheless, similar to the other five dimensions, this dimension exhibited a P-value<0.001 and a Cohen's d effect size>0.8, indicating its significant role. Therefore, it can be stated that this dimension remains an independent factor that can generally influence the level of SAD symptoms and should not be overlooked.

Additionally, the results of the analyses of this study revealed that multiple socio-demographic factors are associated with the high level of SAD. Among them, factors such as the father being the respondent to the questionnaire, mother's age less than 30, child's relatives' death due to COVID-19, parent's substance abuse history, monthly medical expenditure more than 10% of monthly income, good quality of parent-child relationship, and child's past year's history of calamitous events were found to be statistically significant in univariate analysis, however, in logistic regression, they were omitted from the statistical model or their association with SAD levels were no longer significant. This absence of association based on logistic regression, particularly regarding factors like the death of relatives, parents' substance abuse, high medical expenses in the family, and the occurrence of calamitous events for the child, which can each act as external stressors or disrupt the family's safe environment, seems to be somehow incongruent with previous studies [1, 6, 12, 23, 27]. This omission of certain factors from the statistical model or the lack of significant associations after logistic regression seems to be due to differences in the choice of statistical models in different studies and also the presence of multicollinearity. For

example, factors such as high medical expenses and substance abuse may be correlated, thus reducing their individual statistical significance after the logistic regression. Moreover, previous studies have indicated the genetic predisposition of anxiety disorders and the association between parental psychiatric problems and increased SAD symptoms among children [11–13, 58]. However, in this study, despite estimating an odds ratio of 1.48, this relationship did not reach statistical significance.

Among the factors that had a significant association with the high level of SAD based on the logistic regression, the most prominent one was the part-time employment status of the mother. While full-time maternal employment also showed a significant relationship with SAD symptoms, part-time employment with an odds ratio of 28.56, indicated that it could be a highly noteworthy risk factor for this condition among children. The employment status of mothers, who are considered the main caregivers for the children in Iranian society, affects the main cause of this disorder, which is separation from the major attachment figure [1, 19] In addition, it has been observed that there is a possibility that the worry about potential harm to the mother following separation may result in severe distress and even nightmares in children [1, 30]. The higher impact of part-time employment compared to full-time may stem from the variation in the mother's working hours and reduced predictability of the duration spent alongside the mother for the child.

Based on logistic regression results, this study also indicated that girls and children with a history of physical or mental health issues significantly presented more SAD symptoms, which is congruent with the findings of various previous studies [3, 17, 23, 27, 47]. Regarding age, this study demonstrated that older children had significantly more SAD symptoms. However, the findings of previous studies on this matter were diverse, with some suggesting an increase in symptoms and others indicating a decrease in symptoms with advancing age [3, 12, 47, 58]. Meanwhile, some other studies indicated changes in the nature and types of SAD symptoms with age variations [19, 61, 62]. Another finding of the present study indicated a significant increase in SAD symptoms in the group whose parents had lower educational levels. Prior studies suggested that when parents have a better understanding of the nature of anxiety and choose more effective coping strategies, such as avoiding overprotection or excessive restriction, SAD can be better controlled and this fact can explain the finding of this study regarding parents' educational level [19, 63–65].

SAD, as a noteworthy anxiety disorder with comorbidity with many other disorders in this spectrum, has the potential to persist even into adulthood and be a risk factor for other psychiatric diseases, therefore, it demands adequate attention both in research and clinical

settings [1, 19, 66, 67]. Given that effective therapeutic approaches such as parent-focused interventions, psychotherapy, and pharmacotherapy have been suggested for the management of this disorder, early diagnosis, and intervention, especially in children with risk factors can prevent many potential future subsequences [1, 63, 68].

Strengths and limitations
To enhance precision, the entire data-gathering process was conducted through in-person interviews. Moreover, in this study, efforts were made to examine the symptoms and dimensions of SAD distinctly compared to previous studies, utilizing specific statistical methods. On the other hand, however, the time-consuming and cost-intensive nature of conducting face-to-face interviews restricted the sample size of this study. Also, considering the need to provide special conditions for interviewing children, the possibility of conducting interviews with them alongside their parents did not take place. Additionally, the conducted study was cross-sectional, therefore, it inherently had limitations, such as the inability to examine the psychological characteristics of the study population over a specific timeframe.

Conclusion
This study revealed that a considerable number of the investigated children and adolescents presented a high level of SAD. The "fear of abandonment" emerged as a key dimension influencing elevated levels of this disorder in this population. Additionally, maternal part-time employment, female gender, child's history of physical or mental health issues, and low parental education levels were among the most important contributors that can predispose children to this disorder. By considering these influential dimensions and potential risk factors, this disorder can be diagnosed more effectively and therapeutic interventions can be targeted toward the correct aspects. However, the necessity for further studies to clarify the diverse elements of this disorder remains crucial.

Abbreviations
GAD	Generalized Anxiety Disorder
SAD	Separation Anxiety Disorder
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, fifth edition
WHO	World Health Organization
COVID-19	Coronavirus Disease 2019
SAAS-P	Separation Anxiety Assessment Scale (Parent Version)
PAM	Partition Around Medoids
ADM	Average Distance Between Means
OR	Odds Ratios
CI	Confidence Interval
SD	Standard Deviation
SUMS	Shiraz University of Medical Sciences

Declarations

Ethics approval and consent to participate
The Research Ethics Committee of Shiraz University of Medical Sciences (SUMS) approved the procedure and the informed consent forms of this study with the approval code of IR.SUMS.REC.1400.610. Written informed consent was obtained from each participant before starting the interview, and all principles of confidentiality, anonymity, and voluntary involvement, following the Declaration of Helsinki, were maintained.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References
1. Boland RJ, Verduin ML, Ruiz P, Shah A, Kaplan HI, Sadock BJ. Kaplan & Sadock's synopsis of psychiatry. Philadelphia: Wolters Kluwer Philadelphia; 2022. https://emergency.lwwhealthlibrary.com/book.aspx?bookid=3071
2. Kessler RC, Avenevoli S, Costello EJ, Georgiades K, Green JG, Gruber MJ, et al. Prevalence, persistence, and sociodemographic correlates of DSM-IV disorders in the National Comorbidity Survey Replication adolescent supplement. Arch Gen Psychiatry. 2012;69(4):372–80.
3. Merikangas KR, He JP, Burstein M, Swanson SA, Avenevoli S, Cui L, et al. Lifetime prevalence of mental disorders in U.S. adolescents: results from the National Comorbidity Survey replication–adolescent supplement (NCS-A). J Am Acad Child Adolesc Psychiatry. 2010;49(10):980–9.
4. Wagner G, Zeiler M, Waldherr K, Philipp J, Truttmann S, Dür W, et al. Mental health problems in Austrian adolescents: a nationwide, two-stage epidemiological study applying DSM-5 criteria. Eur Child Adolesc Psychiatry. 2017;26(12):1483–99.
5. Bennett S, Walkup JT. Anxiety disorders in children and adolescents: Assessment and diagnosis. In: TW P, editorAccessed on January 26,. UpToDate. UpToDate, Waltham, MA, (2024): Wolters Kluwer.

6.   Bennett S, Walkup JT. Anxiety disorders in children and adolescents: Epidemiology, pathogenesis, clinical manifestations, and course. In: TW P, editorAccessed on January 26,. UpToDate. UpToDate, Waltham, MA, (2024): Wolters Kluwer.

7.   Essau CA, Petermann F. Anxiety disorders in children and adolescents: Epidemiology. risk factors and treatment: Routledge; 2013.

8.   Havinga PJ, Boschloo L, Bloemen AJ, Nauta MH, de Vries SO, Penninx BW, et al. Doomed for disorder? High incidence of Mood and anxiety disorders in offspring of depressed and anxious patients: a prospective cohort study. J Clin Psychiatry. 2017;78(1):e8–17.

9.   Trzaskowski M, Eley TC, Davis OS, Doherty SJ, Hanscombe KB, Meaburn EL, et al. First genome-wide association study on anxiety-related behaviours in childhood. PLoS ONE. 2013;8(4):e58676.

10.   Schiele MA, Costa B, Abelli M, Martini C, Baldwin DS, Domschke K, et al. Oxytocin receptor gene variation, behavioural inhibition, and adult separation anxiety: role in complicated grief. World J Biol Psychiatry. 2018;19(6):471–9.

11.   Johnson JG, Cohen P, Kasen S, Brook JS. Parental concordance and offspring risk for anxiety, conduct, depressive, and substance use disorders. Psychopathology. 2008;41(2):124–8.

12.   Blanco C, Rubio J, Wall M, Wang S, Jiu CJ, Kendler KS. Risk factors for anxiety disorders: common and specific effects in a national sample. Depress Anxiety. 2014;31(9):756–64.

13.   Narmandakh A, Roest AM, de Jonge P, Oldehinkel AJ. Psychosocial and biological risk factors of anxiety disorders in adolescents: a TRAILS report. Eur Child Adolesc Psychiatry. 2021;30(12):1969–82.

14.   Dadds MR. A brief parent-focused intervention reduces anxiety disorders in socially inhibited children. Evid Based Ment Health. 2011;14(2):49.

15.   Asselmann E, Wittchen HU, Lieb R, Beesdo-Baum K. The role of the mother-child relationship for anxiety disorders and depression: results from a prospective-longitudinal study in adolescents and their mothers. Eur Child Adolesc Psychiatry. 2015;24(4):451–61.

16.   Bruce LC, Heimberg RG, Goldin PR, Gross JJ, CHILDHOOD MALTREATMENT, AND RESPONSE TO COGNITIVE BEHAVIORAL THERAPY AMONG INDIVIDUALS WITH SOCIAL ANXIETY DISORDER. Depress Anxiety. 2013;30(7):662–9.

17.   Naldan ME, Karayagmurlu A, Ahıskalıoglu EO, Cevizci MN, Aydin P, Kara D. Is surgery a risk factor for separation anxiety in children? Pediatr Surg Int. 2018;34(7):763–7.

18.   Battaglia M, Touchette É, Garon-Carrier G, Dionne G, Côté SM, Vitaro F, et al. Distinct trajectories of separation anxiety in the preschool years: persistence at school entry and early-life associated factors. J Child Psychol Psychiatry. 2016;57(1):39–46.

19.   McKay D, Storch E. Handbook of Child and Adolescent Anxiety Disorders2011.

20.   Mohammadi MR, Badrfam R, Khaleghi A, Hooshyari Z, Ahmadi N, Zandifar A. Prevalence, comorbidity and predictor of separation anxiety disorder in children and adolescents. Psychiatr Q. 2020;91(4):1415–29.

21.   Shear K, Jin R, Ruscio AM, Walters EE, Kessler RC. Prevalence and correlates of estimated DSM-IV child and adult separation anxiety disorder in the National Comorbidity Survey Replication. Am J Psychiatry. 2006;163(6):1074–83.

22.   Bowen RC, Offord DR, Boyle MH. The prevalence of overanxious disorder and separation anxiety disorder: results from the Ontario Child Health Study. J Am Acad Child Adolesc Psychiatry. 1990;29(5):753–8.

23.   Silove D, Alonso J, Bromet E, Gruber M, Sampson N, Scott K, et al. Pediatric-Onset and adult-onset separation anxiety disorder across countries in the World Mental Health Survey. Am J Psychiatry. 2015;172(7):647–56.

24.   Franz L, Angold A, Copeland W, Costello EJ, Towe-Goodman N, Egger H. Preschool anxiety disorders in pediatric primary care: prevalence and comorbidity. J Am Acad Child Adolesc Psychiatry. 2013;52(12):1294–e3031.

25.   Jalali M, Pourahmadi E. P-132 - prevalence of anxiety disorders among 10–14 years old children in Gorgan. Eur Psychiatry. 2012;27(S1):1.

26.   Cartwright-Hatton S, McNicol K, Doubleday E. Anxiety in a neglected population: prevalence of anxiety disorders in pre-adolescent children. Clin Psychol Rev. 2006;26(7):817–33.

27.   Nassi A, Mehrabizade Honarmand M, Shehni Yailagh M, Bassaknejad S, Talebpour A. The epidemiology of separation anxiety disorder in Isfahan Primary School Male Students. Iran J Epidemiol. 2012;8(3):47–57.

28.   Amiri S, Mohammadi MR, Ahmadi N, Khaleghi A, Nourouzi S, Asl Rahimi V, et al. Prevalence of Psychiatric disorders among children and adolescents in the East Azerbaijan Province, Tabriz, Iran in 2017. Iran J Psychiatry Behav Sci. 2019;13(4):e88594.

29.   Zarafshan H, Mohammadi MR, Salmanian M. Prevalence of anxiety disorders among children and adolescents in Iran: a systematic review. Iran J Psychiatry. 2015;10(1):1–7.

30.   Diagnostic and statistical manual of mental disorders. DSM-5. 5th ed. ed. Arlington, VA :: American Psychiatric Association; 2013.

31.   Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497–506.

32.   Doosti-Irani A, Haghdoost AA, Najafi F, Eybposh S, Moradi G, Bagheri Amiri F, et al. How can the epidemic curve of COVID-19 in Iran be interpreted? J Res Health Sci. 2020;20(3):e00491.

33.   Mowla A, Ardekani A, Feili A, Rahimian Z. Effects of COVID-19 pandemic and lockdown on mental health of Iranian people. Przegl Epidemiol. 2021;75(4):484–9.

34.   Pfefferbaum B, North CS. Mental Health and the Covid-19 pandemic. N Engl J Med. 2020;383(6):510–2.

35.   Statement on the fifteenth meeting of the IHR. (2005) Emergency Committee on the COVID-19 pandemic World Health Organization2023 https://www.who.int/news/item/05-05-2023-statement-on-the-fifteenth-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-coronavirus-disease-(covid-19)-pandemic

36.   Racine N, McArthur BA, Cooke JE, Eirich R, Zhu J, Madigan S. Global prevalence of depressive and anxiety symptoms in children and adolescents during COVID-19: a Meta-analysis. JAMA Pediatr. 2021;175(11):1142–50.

37.   Smirni P, Lavanco G, Smirni D. Anxiety in older adolescents at the time of COVID-19. J Clin Med. 2020;9(10).

38.   Meherali S, Punjani N, Louie-Poon S, Abdul Rahim K, Das JK, Salam RA et al. Mental Health of children and adolescents amidst COVID-19 and Past Pandemics: a Rapid systematic review. Int J Environ Res Public Health. 2021;18(7).

39.   Jones EAK, Mitra AK, Bhuiyan AR. Impact of COVID-19 on Mental Health in adolescents: a systematic review. Int J Environ Res Public Health. 2021;18(5).

40.   Panchal U, Salazar de Pablo G, Franco M, Moreno C, Parellada M, Arango C, et al. The impact of COVID-19 lockdown on child and adolescent mental health: systematic review. Eur Child Adolesc Psychiatry. 2023;32(7):1151–77.

41.   Saulle R, De Sario M, Bena A, Capra P, Culasso M, Davoli M, et al. School closures and mental health, wellbeing and health behaviours among children and adolescents during the second COVID-19 wave: a systematic review of the literature. Epidemiol Prev. 2022;46(5–6):333–52.

42.   Nearchou F, Flinn C, Niland R, Subramaniam SS, Hennessy E. Exploring the impact of COVID-19 on Mental Health outcomes in Children and adolescents: a systematic review. Int J Environ Res Public Health. 2020;17:22.

43.   Tang S, Xiang M, Cheung T, Xiang YT. Mental health and its correlates among children and adolescents during COVID-19 school closure: the importance of parent-child discussion. J Affect Disord. 2021;279:353–60.

44.   Magson NR, Freeman JYA, Rapee RM, Richardson CE, Oar EL, Fardouly J. Risk and Protective Factors for Prospective Changes in Adolescent Mental Health during the COVID-19 pandemic. J Youth Adolesc. 2021;50(1):44–57.

45.   Terin H, Açıkel SB, Yılmaz MM, Şenel S. The effects of anxiety about their parents getting COVID-19 infection on children's mental health. Eur J Pediatr. 2023;182(1):165–71.

46.   Kolcakoglu K, Yucel G. Anxiety and harmful oral habits in preschool children during the 2020 first-wave COVID–19 lockdown in Turkey. Dent Med Probl. 2021;58(4):433–9.

47.   Di Riso D, Bertini S, Spaggiari S, Olivieri F, Zaffani S, Comerlati L et al. Short-term effects of COVID-19 lockdown in Italian children and adolescents with type 1 diabetes Mellitus: the role of separation anxiety. Int J Environ Res Public Health. 2021;18(11).

48.   Sinnathamby A, Ng SH, Zain A, Lu L, Yong C, Thong X et al. Anxiety in hospitalised families: lessons from the early phase of the COVID-19 pandemic. Singap Med J. 2023.

49.   Alnamnakani M, Alenezi S, Temsah H, Alothman M, Murshid RE, Alonazy H, et al. Psychosocial impact of Lockdown on children due to COVID-19: a cross-sectional study. Clin Pract Epidemiol Ment Health. 2022;18:e174501792203210.

50.   Hahn L, Hajinlian J, Eisen AR, Winder B, Pincus DB. Measuring the dimensions of separation anxiety and early panic in children and adolescents: The Separation Anxiety Assessment Scale. 37th annual convention of the Association for Advancement of Behavior Therapy; Boston, MA2003.

51.   Hajinlian J, Hahn LG, Eisen AR, Zilli-Richardson L, Reddy LA, Winder B, et al. The phenomenon of separation anxiety across DSM-IV internalizing and externalizing disorders. 37 ed. Boston, MA: Annual Convention of the Association for the Advancement of Behavior Therapy; 2003.

52. Hajinlian J, Mesnick J, Eisen AR. Separation anxiety symptom dimensions and DSM-IV anxiety disorders: Correlates, comorbidity, and clinical utility. 39th annual convention of the Association for Behavioral and Cognitive Therapies; Washington, DC2005.

53. Talaeinejad N, Ghanbari S, Mazaheri M, Asgari A. Preliminary Properties of Separation Anxiety Assessment Scale (parent version). Dev Pscychology. 2016;12(47):225–35.

54. Talaienejad N. Separation anxiety Assessment Scale (parent version): instruction and scoring. (Persian Version). 2018;14(55):343–6.

55. Maechler M, Rousseeuw P, Struyf A, Hubert M, Hornik K, Studer M, Roudier P, Gonzalez J. Package 'cluster'. 2013.

56. Epskamp S, Costantini G, Haslbeck J, Cramer AO, Epskamp MS, RSVGTipsDevice. S. Package 'qgraph'. 2017.

57. R Core Team. R: a Language and Environment for Statistical Computing. Vienna, Austria: R Foundation for Statistical Computing; 2023.

58. Dotto C, Montanaro M, Spaggiari S, Cecinati V, Brescia L, Insogna S et al. Early evidence of the interplay between separation anxiety symptoms and COVID-19-Related worries in a group of children diagnosed with Cancer and their mothers. Child (Basel). 2022;9(4).

59. Kathirvel N. Post COVID-19 pandemic mental health challenges. Asian J Psychiatr. 2020;53:102430.

60. Iqbal SZ, Li B, Onigu-Otito E, Naqvi MF, Shah AA. The long-term Mental Health effects of COVID-19. Psychiatric Annals. 2020;50(12):522–5.

61. Hale WW 3rd, Raaijmakers Q, Muris P, van Hoof A, Meeus W. Developmental trajectories of adolescent anxiety disorder symptoms: a 5-year prospective community study. J Am Acad Child Adolesc Psychiatry. 2008;47(5):556–64.

62. Last CG. Somatic complaints in anxiety disordered children. J Anxiety Disord. 1991;5(2):125–38.

63. Rapee RM, Kennedy SJ, Ingram M, Edwards SL, Sweeney L. Altering the trajectory of anxiety in at-risk young children. Am J Psychiatry. 2010;167(12):1518–25.

64. Fisak B, Penna A, Mian ND, Lamoli L, Margaris A, Cruz S. The effectiveness of anxiety interventions for Young children: a Meta-Analytic Review. J Child Fam Stud. 2023:1–12.

65. Eisen AR, Raleigh H, Neuhoff CC. The unique impact of parent training for separation anxiety disorder in children. Behav Ther. 2008;39(2):195–206.

66. Lewinsohn PM, Holm-Denoma JM, Small JW, Seeley JR, Joiner TE. Separation anxiety disorder in Childhood as a risk factor for Future Mental illness. J Am Acad Child Adolesc Psychiatry. 2008;47(5):548–55.

67. Kendall PC, Brady EU, Verduin TL. Comorbidity in childhood anxiety disorders and treatment outcome. J Am Acad Child Adolesc Psychiatry. 2001;40(7):787–94.

68. Compton SN, Walkup JT, Albano AM, Piacentini JC, Birmaher B, Sherrill JT, et al. Child/Adolescent anxiety Multimodal Study (CAMS): rationale, design, and methods. Child Adolesc Psychiatry Ment Health. 2010;4:1.

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