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RESEARCH

Clinical and psychopathological profiles of children with somatic symptom disorders in a pediatric emergency unit: an observational study before and during the SARS-CoV-2 pandemic

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Abstract

Somatic symptom disorders (SSDs) are a group of clinical conditions characterized by heterogeneous physical symptoms, not directly supported by a demonstrable organic process. Despite representing a growing problem in the pediatric age, the literature lacks studies assessing the psychopathological and clinical features of subjects with SSD, particularly during the SARS-CoV-2 pandemic. This is a retrospective, observational study, involving two historical cohorts of children admitted to a tertiary referral Italian hospital over the 2 years preceding and following the start of the SARS-CoV-2 pandemic. Demographic, clinical, socio-economical, and psychological variables were investigated. Standardized tests for the developmental age were administered to assess psychopathological variables. Overall rates and trends of accesses for SSD, as compared to the total accesses for any cause at the Pediatric Emergency Room during the same periods, were reported as well. Fifty-one (pre-pandemic, 29; pandemic, 22) children with SSD were enrolled (age, 11.4 ± 2.4 years, $F = 66.7\%$). Subjects in the pandemic historical cohort reported more frequently fever ($p < 0.001$), headache ($p = 0.032$), and asthenia ($p < 0.001$), as well as more chronic conditions in personal and family history, and fewer previous hospital accesses, as compared to the pre-pandemic cohort. Depressed mood and anxious traits were documented in both samples. None of them had an ongoing or a previously reported SARS-CoV-2 infection. During the pandemic, a clinical psychologist was more frequently consulted before the hospital discharge to mental health services, to support the diagnosis.

Conclusion: This study showed the significant burden of SSD in children, highlighting the need to implement pediatricians' education to optimize the management of these patients. Children with SSD who accessed during the SARS-CoV-2 pandemic presented specific clinical features. Future studies, conducted on longitudinal and controlled samples, are indicated to further investigate children with these conditions.

What is Known:
- *Somatic symptoms disorders (SSDs) are frequent in the pediatric age, especially in early adolescence.*
- *Evidence remains scarce on the impact of the SARS-CoV-2 pandemic on SSDs in children.*

What is New:
- *Children with SSD who accessed during the SARS-CoV-2 pandemic presented specific clinical features.*
- *The implementation of pediatricians' education and a multidisciplinary approach are needed to optimize the management of SSDs.*

Keywords Children · Somatic symptom disorder · Somatization · SARS-CoV-2 · Pandemic

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Introduction

Somatic symptom disorders (SSDs) are a group of distressing mental health conditions, characterized by heterogeneous physical symptoms, related to psychological problems [1]. The criteria reported in the fourth edition of the *Diagnostic and statistical manual of mental disorders* (DSM-IV-Text Revision) emphasized the centrality of medically unexplained symptoms, giving attention to a diagnosis grounded on the absence of a demonstrable organic process [2]. In the fifth edition of the manual (DSM-5), conversely, the authors focused the description of the diagnostic criteria on positive symptoms and signs of these disorders, giving more importance to the mental status of the patient [2]. The accuracy in defining somatic symptoms as "medically unexplained" is currently limited, as even when a medical explanation can be found, the diagnosis of SSD cannot be excluded if the subjects have excessive thoughts, feelings, and behaviors about their health [3].

Somatic symptoms and related disorders are frequent in the pediatric age, especially in early adolescence, accounting for 10–15% of visits in primary care [4]. SSDs are more frequent in girls than in boys, and this difference seems to increase with age [5]. Typically, these disorders are encountered in primary care settings instead of mental health services, causing relevant diagnostic dilemmas to pediatricians [1]. The delay in the diagnosis of these conditions frequently results in significant functional impairment, school absenteeism, and risk of iatrogenic injury due to unnecessary evaluation or treatment.

The etiopathogenesis of these disorders is multifactorial, as psychological, biological, and social factors have been considered to be underlying SSDs [1]. Children affected by SSD usually display an internalizing personality and an inability to cope with stressful events, which may potentially lead them not to manifest their psychological problems; the authors have suggested that such mental distress may become a physical symptom that cannot be explained [6, 7]. An influence on life events in the pathogenesis of SSDs has been repeatedly advocated [8]. Traumatic events, like bullying in school [9], a sibling's birth, and conflicts between parents, may predispose the subject to mental distress, further aggravated by the lack of comprehension and support among families [3].

The worldwide diffusion of the SARS-CoV-2 pandemic in March 2020 and the resulting social restrictions have had a strong impact on the mental health of children and adolescents [10, 11]. A series of studies have directly addressed the impact of the pandemic on pediatric populations and their caregivers, reporting limitations in relations with peers, food insecurity, reduction of physical activity, sleep problems, and inability to go to school [10, 12–16]. Social restrictions may have affected in different ways children of different ages, with a more relevant impact of school closure for children between 6 and 18 years, while parental stress influenced more heavily prescholar subjects [17]. More relevant mental health concerns have been reported in children whose parents were more involved in the pandemic [14, 17]. Among the most frequent psychological disorders reported in young people from the spread of COVID-19 infection, suicidal ideation, depression, anxiety, post-traumatic stress disorder, and behavior disorders have been described [14, 18, 19]. On the contrary, there is a lack of literature data regarding the impact of the SARS-CoV-2 pandemic on SSDs in children and regarding the clinical and management features of these conditions during the pandemic.

The knowledge of the clinical variables associated with SSD in children and adolescents could help pediatricians to early identify these conditions and promptly manage them, reducing the functional impairment of the child and his family.

Thus, the primary aim of this study was to describe the presentation and management of children with SSD in the context of a pediatric emergency hospital setting focusing on the clinical variables that may help recognize young patients with this condition. The secondary aims of the present study were (a) to investigate potential differences in the clinical presentation and diagnostic workup received by young patients accessing for SSD before and during the recent pandemic and (b) to identify potential differences and changes in the trends of admissions for SSD concurrent with the pandemic.

Materials and methods

Study design and participants

The present was a monocentric, observational, retrospective study, conducted at the Pediatric Emergency Unit (PEU) of S. Orsola University Hospital, a Tertiary Care Center in Bologna, Northern Italy. The study was approved by the local ethical committee (Comitato Etico di Area Vasta Emilia Centro Regione Emilia-Romagna, CE-AVEC) (protocol code NPI-NEUROCOV2021, 748/2021/Oss/AOUBo), and it was conducted in accordance with the Declaration of Helsinki. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were followed during the planning and conducting of the study [20]. Given the naturalistic nature of the study, missing data were not replaced.

The study was conducted on patients admitted to the Pediatric Emergency ward between January 1, 2018, and December 31, 2021, with a diagnosis compatible with SSD. The inclusion criteria were (a) being a hospitalized patient with a final diagnosis of SSD, consistent with criteria of DSM-5, and (b) age under 18 years at hospitalization. Exclusion criteria were (a) lack of complete clinical documentation; (b) parents or legal guardians who refused the collection and future use of data; and (c) the presence of an ongoing SARS-CoV-2 infection, or a personal or family history of SARS-CoV-2 infection. To ascertain this criterion, all the patients admitted during the pandemic

period were subjected to a molecular swab for SARS-CoV-2. Those with a positive molecular test for SARS-CoV-2 on a nasopharyngeal swab at the time of admission were excluded from the analyses. Moreover, patients were excluded from the analyses in case of personal or family history of SARS-CoV-2 infection. To assess this criterion, all the patients and their caregivers were systematically asked with questions concerning a previous SARS-CoV-2 infection. In addition, health documents from general practitioners and other pediatric health services were systematically assessed at admission. Caregivers were asked, finally, about potential ongoing SARS-CoV-2 infection affecting other members of the family. All the included patients received a thorough clinical evaluation, to disentangle the potential causes for ongoing symptoms (i.e., headache, asthenia), performed by pediatricians specialized in the management of individuals with a SARS-CoV-2 infection. All the dubious cases were excluded from the current analyses.

To investigate potential changes in the typology of the accesses for SSD occurring in the context of the recent pandemic, the patients were divided into two groups. The start of government restrictions in Italy (March 8, 2020) represented the cutoff to divide the two historical cohorts. A pre-pandemic (January 1, 2018, to March 8, 2020) and a pandemic (March 9, 2020, to December 31, 2021) historical cohorts were thus enrolled and compared.

We included the following information for all patients: demographic and anamnestic data, social and economic information, previous PEU accesses and hospitalizations, past medical history, clinical (organic symptomatology) and diagnostic (laboratory and radiological investigations and clinical consultations) variables, length of hospital stay. For both patients and their parents, the potential occurrence of chronic mental health or organic conditions (lasting more than 6 months) was registered. Psychopathology was reported only considering the final clinical diagnosis, including potential psychopathological and subthreshold clinical traits.

We also collected data on the total number of Pediatric Emergency Room accesses and PEU hospitalizations from January 1, 2018, to December 31, 2021, to assess the percentage of SSD cases over years.

Assessment methods

We retrospectively reviewed the records of children hospitalized with a diagnosis of SSD from January 1, 2018, to December 31, 2021. Diagnoses of SSD were made by clinical psychologists or pediatric neuropsychiatrists trained in the field of somatic symptoms and related disorders in the developmental age, according to DSM-5 criteria. The psychopathological assessment of the included patients was performed using three standardized measures, validated for the use in children and adolescents in the Italian language:

- *Children's Depression Inventory (CDI)* is a self-assessment scale for depressive symptoms that can be administered to subjects of developmental age, between 8 and 17 years. It is made up of 27 items, with three alternative possibilities of response, graded on a scale from 0 to 2 points with increasing severity of the symptoms, which the subject is invited to choose based on the feelings of the previous 2 weeks; the total score will be between 0 and 54 points. It can be administered both individually and collectively and it can be completed in 15 min [21].
- *Self-Administered Psychiatric Scales For Children And Adolescents (SAFA)* is a self-administered psychometric tool used to assess psychiatric comorbidities in children and adolescents. It is made up of six scales with different versions depending on the age group: 8–10 years "e"; 11–13 years "m"; 14–18 years "s." It consists of an anxiety rating scale (SAFA-A), a depression rating (SAFA-D), an obsessive–compulsive symptom (SAFA-O), a psychogenic eating disorder (SAFA-P), one for somatic symptoms and hypochondria (SAFA-S), and finally one for phobias (SAFA-F) [22].
- *Revised Children's Manifest Anxiety Scale—Second Edition (RCMAS-2)* is a self-report tool consisting of 49 items to be administered both individually and in groups, which allows assessing the level and nature of the anxiety of children and young people aged 6 to 19. Through dichotomous questions, scores are provided for six distinct scales: physiological anxiety (FIS); concern (PRE); social anxiety (SOC); total anxiety index (TOT); defensive attitude (DIF); inconsistency index in responses (INC) [23].

Statistical analysis

Descriptive statistics for demographic and clinical variables included means and standard deviations, or absolute and percentage frequencies. The Kolmogorov–Smirnov test was used to test for normality. Patients accessing before and during the COVID-19 pandemic were then compared using Student *t*-tests for continuous variables when appropriate (Mann–Whitney test for non-parametric distributions) and chi-square test for categorical variables (Fisher's exact test when needed). The significance level was set at 0.05, and all tests were two-tailed. All statistical analyses were conducted using SPSS, version 26 for Windows.

Results

Demographic variables and clinical history

Fifty-one children and adolescents with SSD were included in the study. Twenty-nine (56.9%) subjects accessed before the COVID-19 pandemic and 22 (43.1%) accessed during the

pandemic. The two samples were independent, and none of the included patients belonged to more than one of the two groups. The main features of the total sample and the two study groups are described in Table 1.

Most (66.7%) patients, as expected, were females, with a slightly higher prevalence during the pandemic period when compared to pre-pandemic data (77.3% versus 58.6%; $p = 0.162$). The mean age at the access was 10.8 (± 2.8) years during the pre-pandemic period and 12.2 (± 1.7) during the pandemic period. In most (82.4%) cases, the patients' country of origin was Italy. The most frequently documented geographic origin for the remaining patients was Northern Africa (3 cases, 5.8%).

A chronic disease in the medical history of the mothers of the patients was documented more frequently in the pandemic (68.2%) than in the pre-pandemic (24.1%) group ($p = 0.002$), including both mental health and internal medicine-related conditions. None of the parents presented a progressive metabolic or degenerative condition. In 42% of cases, both the mother and the father of the patient suffered from chronic pathologies.

Interestingly, patients in the pandemic group compared to the pre-pandemic group had a significantly lower rate of admission to the PEU for other diseases or the same symptomatology (27.3% versus 79.3%, $p < 0.001$, and 77.3% versus 89.7%, $p < 0.001$, respectively).

As for previous conditions, 21 (41.2%) participants were affected by a comorbid chronic disease. In the pre-pandemic period, underlying diseases were statistically less frequent than in the pandemic period (24.1% versus 63.6%, $p = 0.005$) including both neuropsychiatric and pediatric conditions. None of the patients presented a progressive metabolic or degenerative condition.

Symptomatology

Data concerning symptoms at presentation are reported in Table 2. Considering the entire study population, the most frequent symptom was headache, reported by 26 patients (50.1%), followed by gastrointestinal symptoms (47.1%) and osteoarticular/neuromuscular symptoms (39.2%). In the pre-pandemic period, osteoarticular and neuromuscular symptoms were the most frequent cause of hospitalization (48.3%). In the pandemic period, on the other hand, headache was the most common symptom with 15 cases (68.2%). Headache ($p = 0.032$), low-grade fever ($p < 0.001$), and asthenia ($p < 0.001$) were more frequently reported during the pandemic than before it.

Specialist consultations

Before the admission, 36 (70.6%) patients in the total sample had consulted at least one private specialist for their symptoms, 18 (62.1%) patients of pre-pandemic group, and 18 (81.8%) patients of the pandemic group. No statistically significant change was documented regarding the number of consultations in the two study groups ($p = 0.125$). During the hospitalization, 36 patients (70.6%) needed a neuropsychiatric consultation, and in 25 (49.0%) cases, a clinical psychological consultation was performed. The neuropsychiatric assessment represented the most frequently requested consultation in the overall sample. Children in the pandemic period received significantly more frequently a hospital psychologist consultation compared to the pre-pandemic cohort (77.3% versus 27.6%, $p < 0.001$), and this consultation represented the most frequently requested evaluation in the pandemic group. Relevantly, all the patients that did not receive an evaluation from a hospital psychologist were referred and evaluated from a psychologist on the community mental health services after discharge in both groups. Regarding other consultations, an increased frequency during the pandemic in referral to a gastroenterological ($p = 0.039$), cardiological ($p = 0.039$), and surgical ($p = 0.004$) consultations was documented as well, with a reduction in orthopedic consultations ($p = 0.031$). As for the received diagnostic interventions, electroencephalography (EEG), esophagogastroduodenoscopy (EGD), electrocardiography (EKG), lumbar puncture, and magnetic resonance imaging were documented. No statistically significant difference was documented between the pre-pandemic and pandemic groups concerning diagnostic interventions.

Data concerning consultations and diagnostic interventions are reported in Supplementary material 1.

Psychopathology

Thirteen (25.5%) patients presented some psychopathological traits. Specifically, anxious traits were documented in 11 (21.6%) cases, while a depressed mood was found in 8 (15.7%) cases. No statistically significant differences between the two study periods emerged concerning comorbid psychopathological traits, and no patient presented a comorbid diagnosed psychiatric disorder.

Data concerning psychological assessments and comorbid psychopathological traits are reported in Table 3.

SSD trend over time

Table 4 reports the percentage of SSD cases among hospitalized children and that among all children visited in the Pediatric Emergency Room in the pre-pandemic (2018–2019) and pandemic period (2020–2021). An increase in SSD percentage in the pandemic period emerged in both analyses, despite no statistically significant variation.

Table 1 Demographic and clinical history data of the study population

Variables		Total sample ($n=51$)	Pre-pandemic group ($n=29$)	Pandemic group ($n=22$)	p-value
Demographic variables					
Age, mean (SD), years		11.4 (±2.4)	10.8 (±2.8)	12.2 (±1.7)	$p=0.053$
Sex, *n* (%)	Males	17 (33.3)	12 (41.4)	5 (22.7)	$p=0.162$
	Females	34 (66.7)	17 (58.6)	17 (77.3)	
Social and economic variables					
School level, *n* (%)	Primary school	15 (30.6)	11 (39.3)	4 (19.0)	$p=0.287$
	Secondary school	27 (55.1)	13 (46.4)	14 (66.7)	
	High school	7 (14.3)	4 (14.3)	3 (14.3)	
Residence, *n* (%)	City center	19 (37.3)	8 (27.6)	11 (50.0)	$p=0.101$
	Outskirts	32 (62.7)	21 (72.4)	11 (50.0)	
Marital status of the parents, *n* (%)	Living together	42 (79.2)	22 (75.9)	20 (90.9)	$p=0.747$
	Divorced	5 (9.4)	3 (10.3)	2 (9.1)	
	Missing	6 (11.3)	4 (13.8)	0 (0)	
Maternal age at birth, mean (SD), years		33.1 (±5.6)	33.0 (±5.4)	33.1 (±5.9)	$p=0.870$
Patients with at least one sibling, *n* (%)		33 (64.7)	20 (69.0)	13 (59.1)	$p=0.534$
Number of siblings, mean (SD)		1.0 (±0.9)	1.3 (±0.9)	0.8 (±0.8)	$p=0.118$
Country of origin, *n* (%)	Italy	42 (82.4)	24 (82.8)	18 (81.8)	$p=1.000$
	Rest of the world	9 (17.6)	5 (17.2)	3 (18.2)	
Mother with a chronic disease, *n* (%)		22 (43.1)	7 (24.1)	15 (68.2)	**$p=0.002$***
Type of chronic disease, mothers, *n* (%)	Internal medicine	18 (81.2)	5 (27.8)	13 (72.2)	$p=0.565$
	Mental health	4 (18.2)	2 (50.0)	2 (50.0)	
Father with a chronic disease, *n* (%)		23 (45.1)	10 (34.5)	13 (59.0)	$p=0.080$
Type of chronic disease, fathers, *n* (%)	Internal medicine	22 (95.7)	9 (40.9)	13 (59.1)	$p=0.435$
	Mental health	1 (4.3)	1 (100.0)	0 (0.0)	
Sibling with at least a chronic disease, *n* (%)		14 (27.5)	9 (31.0)	5 (22.7)	$p=0.510$
Type of chronic disease, siblings	Pediatric	13 (92.9)	9 (69.2)	4 (30.8)	$p=0.357$
	Neuropsychiatric	1 (7.1)	0 (0.0)	1 (100.0)	
Clinical history					
History of developmental delay, *n* (%)		2 (4.0)	1 (3.4)	1 (4.5)	$p=0.842$
Previous accesses for other symptoms, *n* (%)		29 (56.9)	23 (79.3)	6 (27.3)	**$p<0.001$***
Previous hospitalization for other symptoms, *n* (%)		32 (62.7)	21 (72.4)	11 (50.0)	$p=0.256$
Previous accesses for the same symptoms, *n* (%)		43 (84.1)	26 (89.7)	17 (77.3)	**$p<0.001$***
Previous hospitalization for the same symptoms, *n* (%)		11 (21.6)	7 (24.1)	4 (18.2)	$p=0.450$
Previous SARS-CoV-2 infection, *n* (%)		0 (0)	0 (0)	0 (0)	$p=1.000$
Duration of current hospitalization, mean (SD), days		7.5 (±4.6)	8.0 (±4.3)	6.9 (±4.9)	$p=0.183$
Comorbidity, *n* (%)		21 patients (41.2)	7 patients (24.1)	14 patients (63.6)	$p=0.005$
Type of comorbidity, *n* (%)	Pediatric	13 patients (61.9)	2 patients (15.4)	11 patients (84.6)	$p=0.056$
	Neuropsychiatric	8 patients (38.1)	5 patients (62.5)	3 patients (37.5)	

Significant differences for p-values are indicated in bold with an asterisk

SD standard deviation

Table 2 Symptomatology at presentation of the study population

Symptoms	Total sample	Pre-pandemic group	Pandemic group	*p*-value
Gastrointestinal disorders, *n* (%)	24 (47.1)	11 (37.9)	13 (59.1)	$p=0.134$
Alterations of consciousness, *n* (%)	9 (17.6)	5 (17.2)	4 (18.2)	$p=1.000$
Headache, *n* (%)	26 (50.1)	11 (37.9)	15 (68.2)	$\mathbf{p=0.032}$*
Fever, *n* (%)	17 (33.3)	4 (13.8)	13 (59.1)	$\mathbf{p<0.001}$*
Asthenia, *n* (%)	17 (33.3)	4 (13.8)	13 (59.1)	$\mathbf{p<0.001}$*
Osteoarticular/neuromuscular disorders, *n* (%)	20 (39.2)	14 (48.3)	6 (27.3)	$p=0.128$
Dyspnea, *n* (%)	0 (0)	0 (0)	0 (0)	$p=1.000$
Tics/tremors, *n* (%)	3 (5.9)	3 (10.3)	0 (0)	$p=0.249$
Retrosternal pain, *n* (%)	3 (5.9)	1 (3.4)	2 (9.1)	$p=0.571$
Dizziness, *n* (%)	6 (11.8)	1 (3.4)	5 (22.7)	$p=0.073$

Significant differences for *p*-values are indicated in bold with an asterisk

Table 3 Psychopathological variables of the study population

Variables	Total sample	Pre-pandemic group	Pandemic group	*p*-value
Psychopathology				
Depressed mood, *n* (%)	8 (15.7)	4 (13.8)	4 (18.2)	$p=0.718$
Anxious traits, *n* (%)	11 (21.6)	8 (27.6)	3 (13.6)	$p=0.306$
Others, *n* (%)	6 (11.8)	4 (13.8)	2 (9.1)	$p=0.683$
Psychological follow-up				
Days before psychological consultation, mean (SD)	6.6 (±9.6)	7.2 (±11.9)	5.7 (±4.1)	$p=0.699$
Number of inpatient consultations with a psychologist per patient, mean (SD)	3.6 (±2.8)	3.4 (±2.6)	3.8 (±3.1)	$p=0.468$

Table 4 SSD accesses compared between the considered periods in the two different study groups

Variables	Total cases, *n*	Somatic symptom disorders cases, *n*	Report, %	*p*-value
Pediatric Emergency Room accesses				
Pre-pandemic period	38,408	26	0.068	$p=0.322$
Pandemic period	26,544	25	0.094	
Hospitalizations				
Pre-pandemic period	2740	26	0.949	$p=0.425$
Pandemic period	2105	25	1.188	

Discussion

The present study reported the clinical presentation and management of children hospitalized with SSD in an Italian tertiary care center. To our knowledge, this is the first study to compare the clinical, psychological, and management features of pediatric subjects with SSD before and during the COVID-19 pandemic. A series of considerations can be drawn.

The average age of our sample was 11.2 years, and the most frequent sex was female, and these data are in line with literature. In fact, previous studies reported a higher frequency of SSD in females (11%) than in males (4%), with an average age between 12 and 16 years [24, 25], only slightly higher than what was found in our sample.

Only 4% of patients in our sample presented developmental delays, a factor which, according to literature, would represent an element of vulnerability for the individual, but which does not seem relevant in our sample [26, 27]. In our sample, almost half of the patients had a parent suffering from chronic diseases, which, according to the literature, is a potential risk factor for SSD. A significant increase in both maternal chronic diseases and underlying chronic diseases in patients during the pandemic period has been documented as well, potentially representing a risk factor for children, who may be influenced by parental experiences of illness [28]. The current literature,

in fact, describes the tendency of children with SSD to present similar symptoms to those observed in their family models [28, 29]. Moreover, among the children enrolled, 64.7% have siblings, and 27.5% at least one sibling with a chronic disease: this can contribute to creating a stressful family environment [3, 8]. Nonetheless, this increasing trend was documented only in mothers and not in fathers, as well as the heterogeneous classification of "chronic diseases" adopted in this study, potentially including both severe and milder conditions. Thus, clinicians should carefully weigh the evidence here reported in a relatively small sample. Prospective studies are required to assess the potential link between a stressful family environment and SSDs, since identifying the specific familiar factors linked to higher SSD psychopathology could potentially promote the development of targeted psychological interventions.

No statistically significant difference was documented concerning socio-economic variables between the two historical cohorts. Considering the overall sample, the included children mostly had an Italian geographical origin, were frequently attending the secondary school, were living in the outskirts of the metropolitan area in which the study was conducted, and had parents living together and an average of one sibling. Interestingly, Bujoreanu and colleagues conducted a retrospective chart review for medically hospitalized pediatric patients with somatoform diagnoses [30]. The authors found that the included patients were most frequently white (73%), with a median household income of $79.797, meaning that most patients (84%) presented a median annual household income greater than the national average (~$50.000) [30]. Nonetheless, relevant differences should be considered when comparing these studies, since data from the study by Bujoreanu et al. were collected in a tertiary pediatric clinic in New England (USA), thus implying key healthcare differences from the context of our research (Italy). Future longitudinal and controlled studies should assess the potential connection between socio-economic factors and the clinical features of SSD, both in western and non-western samples.

In our sample, moreover, the most frequent symptoms were represented by headache, followed by gastrointestinal symptoms, and osteoarticular or neuromuscular disorders in third place. Similarly, in the study by Ghandour and colleagues, the first three symptoms reported in order of frequency were headache, abdominal pain, and osteoarticular pain. Silber and colleagues, as well, documented the highest frequency of abdominal pain and headache among the symptoms of patients with SSD [25, 31]. We documented a statistically significant increase in symptoms such as headache, fever, and asthenia in the period of the pandemic compared to the previous period. It is interesting to note that these symptoms are comparable to the symptoms related to the COVID-19, which was excluded by a molecular nasopharyngeal swab for SARS-CoV-2 in our patients. Similarly, one of the rare, published studies analyzing SSD during the pandemic, conducted on the general population, reported that dyspnea—a well-known symptom of COVID 19 in adults—has increased in a statistically significant way [32]. Recent studies have attributed these symptoms to a possible long-COVID syndrome, defined as the symptoms that continue or develop after acute COVID-19 infection and which cannot be explained by an alternative diagnosis [25]. However, while long-COVID syndrome is frequent in the adult population (20–40%) [33], in the pediatric age, it seems to be partly overestimated indicating a potential risk of misleading diagnosis with SSD [34, 35]. According to this, no previous history of SARS-CoV-2 infection has been reported by none of our patients.

Concerning clinical evaluations occurring during the hospital treatment for SSD, the most requested consultation is represented by pediatric neuropsychiatric assessments. These results confirm the previous literature since SSD has been reported as the second cause of pediatric neuropsychiatric consultations [4]. During the pandemic, nonetheless, the most requested specialist consultation was a clinical psychological assessment, which compared to the pre-pandemic period saw a significant increase. This highlights an important improvement in the management of these patients. According to the literature, pediatricians may face difficulties in the diagnosis and recognition of SSD and they may not consult or delay the psychologist, increasing healthcare costs [3, 12, 38]. In the present study, the days spent in ward before the psychologist consultation showed a reduction, even if not statistically significant, during the pandemic.

According to the previous literature [1], children with SSD often present a history of excessive medicalization. In our study, there was a significant reduction in the number of previous visits to the Pediatric Emergency Department during the pandemic, both for other diseases and the same symptomatology, as confirmed by previous reports from the outbreak of the pandemic [39]. Children with SSD hospitalized during the pandemic had less frequent previous medical treatments. The accesses in Pediatric Emergency Departments, nonetheless, largely decreased in Italy during the considered period, with researchers reporting a significant reduction (−47%) in pediatric accesses in 2020 compared to 2019 [40]. Thus, lower rate of admissions during the pandemic in the general population could have indirectly reduced both accesses for other diseases and for the same symptoms, in children and adolescents with SSDs.

Referring to our analyzed data, despite an increase in the accesses and consequent hospitalizations for SSD (with respect to total accesses/hospitalizations for all causes), no significant difference was documented. The growing trend of SSD in pediatric populations has already been reported in literature, with a prevalence ranging from 10 to 15% [4, 7] among children who make visits to primary care. The same trend has also been reported in Pediatric Emergency Departments, representing an important health cost, with the use of economic resources and beds for children whose disorders do not always have an organic substrate [12, 38].

Limitations

This study is a retrospective and single-center study. In this study, only children hospitalized in the PEU were considered, so our results cannot be generalized to all pediatric populations. Moreover, in the pandemic period, patients included in the study did not undergo SARS-CoV-2 serological test; thus, we cannot exclude a previous asymptomatic infection. However, all the included patients were subjected to a molecular swab for SARS-CoV-2, which made it possible to exclude an ongoing COVID-19. Furthermore, none of the patients enrolled had a personal or family positive history of COVID-19, which makes long-COVID syndrome extremely unlikely. Another limitation of the study is that with the psychological tests administered, there were no specific data regarding the impact of COVID-19 on the patient. Furthermore, concerning the impact of the SARS-CoV-2 pandemic on the development of SSD, it is necessary to consider that this study enrolled patients who were hospitalized until December 31, 2021, therefore 22 months after the beginning of the pandemic (March 2020), and that SSD may require a longer latency period to develop.

Despite these limitations, the present study significantly expands, with real-word data from a Pediatric Emergency Department, the existing literature on the role of the SARS-CoV-2 pandemic on the development of SSD in the pediatric age. This may have implications with clinical relevance, as pediatric patients with SSD represent a population frequently accessing to pediatric emergency services, and at risk of being unrecognized and mismanaged [34].

Conclusions

This study showed the significant burden of SSD in children, highlighting the need for pediatricians working in the emergency department to be prepared to manage these patients effectively. Moreover, this is the first study to investigate differences in the clinical features of children with SSD before and during the COVID-19 pandemic. A psychologist was promptly consulted during hospitalization significantly more often in the pandemic period, demonstrating a raising awareness of SSD by pediatricians over time. However, the length of hospital stay and the time needed for the diagnosis were still high. These results emphasize the need to implement pediatricians' education, possibly with the development of specific guidelines, which are, at the time being, not available for Pediatric Emergency Departments, and the importance of a multidisciplinary approach to optimize the management of SSD patients.

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Author contribution CT and JP collected the data. JP analyzed the data. JP, CB, and ML wrote the first draft of the manuscript. DMC, CB, LS, AF, LA, and ML critically revised the manuscript. All authors reviewed the final version of the manuscript.

Data Availability Non-available.

Declarations

Ethics approval The study was approved by the local ethical committee (code NPI-NEUROCOV2021).

Consent to participate Consent to participate by all the participants was obtained or waived as approved.

Consent for publication Consent for publication by all the participants was obtained or waived as approved.

Conflict of interest The authors declare no competing interests.

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