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[Lia von Spreckelsen](#)\*, [Anneke Haddad](#), Shrabon Insan, Henriette Högl, Annette Mund, Thorsten Langer, Anne Geweniger

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Article

# Building Resilient Pediatric Care: Lessons from Service Disruptions for Children with Special Healthcare Needs During the COVID-19 Pandemic in Germany

Lia v. Spreckelsen <sup>1</sup>, Anneke Haddad <sup>2</sup>, Shrabon Insan <sup>2</sup>, Henriette Högl <sup>2</sup>, Annette Mund <sup>2</sup>, Thorsten Langer <sup>2</sup> and Anne Geweniger <sup>2,\*</sup>

<sup>1</sup> Department of Orthodontics, Medical Center - University of Freiburg, Freiburg, Germany;

<sup>2</sup> Department of Neuropediatrics and Muscle Disease, Medical Center - University of Freiburg, Freiburg, Germany

\* Correspondence: Lia.spreckelsen@gmail.com; Phone: +4915207195481

## Highlights

### What are the main findings?

- During the first wave of the COVID-19 pandemic in Germany, up to 88% of children with special healthcare needs (CSHCN) experienced reduced access to pediatric healthcare and therapeutic services.
- Disruptions in care were closely linked to higher disease complexity, while no significant associations were identified with socioeconomic status or caregiver mental health.

### What are the implications of the main findings?

- The study reveals critical structural weaknesses in pediatric healthcare systems, highlighting the urgent need to strengthen continuity of care for children with complex medical needs.
- Developing crisis-resilient, integrated, and family-centered pediatric healthcare frameworks is essential to protect CSHCN and ensure equitable access during future public health crises.

## Abstract

**Introduction:** This study aims (1) to describe services involved in healthcare provision for children with special healthcare needs (CSHCN) and explore changes in frequency of service provision described by parents during the first wave of the COVID-19 pandemic, (2) to analyze associations between service provision and disease complexity, (3) to explore potential associations of changes in frequency of service provision with disease complexity, socioeconomic status (SES) and psychosocial factors, to then be able (4) to generate actionable insights for building crisis-resilient care systems. **Methods:** A sequential series of cross-sectional online surveys at three points in time was conducted among caregivers of children with and without SHCN in Germany. We analyzed data from the first survey (08/2020-10/2020). **Results:** Among CSHCN, reduction of treatment reached up to 88.4%. Positive associations between reduction of treatment during the pandemic and disease complexity could be shown. There was no evidence for associations between reduction of healthcare provision, SES and/or mental health. Structural vulnerabilities within existing care pathways for children with and without special healthcare needs (CSHCN) could be identified. **Conclusions:** Findings highlight major gaps in healthcare continuity and underscore the urgent need for crisis-resilient care structures. CSHCN with complex needs require prioritized, consistent, and structurally protected access to multidisciplinary services. The study calls for long-term investment in integrated, cross-sectoral, and family-centered healthcare frameworks to safeguard CSHCN in future public health emergencies.

**Keywords:** healthcare provision; COVID-19; children with special healthcare needs; caregivers; crisis-resilient care structures

## 1. Introduction

After the World Health Organization (WHO) had declared the COVID-19 outbreak a global pandemic, worldwide intervention measures were taken to curb the spread of SARS-CoV-2 thus trying to protect the health care system from collapsing[1]. An international WHO survey showed that over 70% of medical and therapeutic care for children had been cancelled worldwide during the first wave of the pandemic (01/2020-06/2020)[2]. Full school closures occurred at a national level among almost all European countries during the pandemic (01/2020-03/2022)[3]. In Germany, the first COVID-19 wave lasted 6 months (01/2020-06/2020)[4]. Since then, extensive data has emerged on how COVID-19 regulations have impacted entire health care systems worldwide[5]. While children generally showed only low primary burden of disease, the impact of disruptions in their everyday life on mental wellbeing, education, social and other support systems has been widely reported[2,6]. In this context, children with special healthcare needs (CSHCN) are a particularly vulnerable group as international research relating to provision of medical care, physical and mental wellbeing of CSHCN suggests[5]. However, data on healthcare provision during the first wave of the COVID-19 pandemic for CSHCN in Germany is scarce[5,6]. This study therefore aims

- (1) to describe services involved in healthcare provision for CSHCN and explore changes in frequency of service provision during the first wave of the COVID-19 pandemic,
- (2) to analyze associations between complexity of service provision and disease complexity,
- (3) to explore potential associations of changes in frequency of service provision during the first wave of the COVID-19 pandemic and associations with disease complexity, psychosocial factors and SES
- (4) to generate actionable insights for building and reimagining crisis-resilient pediatric care systems.

By identifying structural weaknesses and population-specific risks, this study offers critical insights for building more resilient, equitable, and inclusive care infrastructures.

## 2. Materials and Methods

**Study design.** A cross-sectional online survey at different points in time since the beginning of the pandemic was conducted among caregivers of children ( $\leq 18$  years) in Germany. For this study, data from the first survey (08/2020-10/2020) was evaluated. Participants, i.e. caregivers of healthy children, caregivers of children with non-complex chronic diseases (e.g. well-controlled asthma), as well as caregivers of children with complex SHCN (e.g. home ventilation required) were recruited via the patient organization Kindernetzwerk e.V., social media and freely accessible websites.

**Public involvement.** The Kindernetzwerk e.V., a large German patient organization for families with children with chronic disease and/or disability was involved in the entire process of developing the study concept and methodology, promoting the study, data collection and dissemination of study results.

**Measures.** Disease complexity was assessed using the CSHCN Screener, a standardized five-item parent-reported screening instrument that considers non-disease-specific measures to identify chronic physical, mental, developmental and / or other health problems (19,20). Children were grouped into children with no SHCN (CSHCN score = 0), children with chronic diseases ( $0 < \text{CSHCN} \leq \text{score } 2$ ) and children with complex chronic diseases (CSHCN score  $\geq 3$ ).

Services involved in health care for CSHCN before and during the COVID-19 pandemic were assessed using individually drafted items. Complexity of care provision was defined and categorized by the number of disciplines involved in medical-therapeutic measures and a variable was coded to outline complexity of care. Parent-reported reduction or complete absence of treatment measures in medical, educational and social sectors during the first wave of the pandemic served to categorize the reduction in care. Reduction in all three sectors were subsumed under a new variable to examine entirety of healthcare reduction per child. Due to the survey design, reasons for reduction of care were not elicited.

Mental wellbeing of children and adolescents ( $\leq 16$  years) was evaluated using the parent version of the Strengths and Difficulties Questionnaire (SDQ), an established and validated survey for parent-reported mental health problems of children and adolescents[7]. Validity and reliability of the German version correspond to the original English version[7,8]. The total difficulties score ranges from 0 to 40, with high values indicating psychological or behavioral problems[9]. Reflecting the work

of previous studies, age appropriate SDQ versions were used to assess comparable data[10]. In accordance with published standards, a cut-off value of 13 was set for the total difficulties score[8].

Caregiver mental wellbeing was assessed using the WHO-5 Well-Being Index (WHO-5). Since the first publication in 1998, various studies have proven its validity and reliability[11]. The WHO-5 assesses self-reported current mental wellbeing and consists of five statements which are rated on a six-point Likert scale (0=never, 5=always). Scaled scores (ranging from 0 to 100) are obtained by multiplying the original score (0-25) times four. High scores indicate good psychological well-being. According to published standards, a cut-off value of 50 can be used for depression screening[11].

Sociodemographic characteristics were assessed using individually drafted items on age and gender as well as country of birth, marital status, place of residence, household size, education, occupation and monthly household income. An SES index was constructed to measure socioeconomic status, based on the approach of the Federal Health Survey for Children and Adolescents in Germany (KiGGS)[12]. It comprises the caregivers' education, job and income, weighted according to household size and added up to the total score[12].

**Statistical Methods.** To be able inclusion of all cases in the statistical analysis (N=1619), missing data were imputed for relevant items using a regression model. This included the key variables SDQ, WHO-5 and CSHCN questionnaires, as well as variables used to determine SES. For all other relevant variables included in the analysis, percentages of missing values are reported. Descriptive data analysis included absolute and relative frequencies, mean values and standard deviations. Chi[2] tests were used to determine the level of association of SDQ / WHO-5 and CSHCN. Fischer exact test was used to assess associations between healthcare provision in the educational sector and CSHCN. Associations between disease complexity and complexity of healthcare provision as well as reduction in healthcare provision were tested using simple linear regression. The multiple linear regression calculation model was used to determine associations between reduction in medical-therapeutical care and disease complexity, SES and psychosocial factors of both children and caregivers. Statistical analysis was performed using IBM SPSS© Statistics Version 28 (IBM Corporation, Armonk, NY, USA).

### 3. Results

**Participants' characteristics.** A total number of n=2004 persons accessed the online survey, of which n=1619 met the inclusion criteria. The respondents' mean age was 41 years (SD=6.9), 90.1% were female (Table 1).

**Table 1.** Sociodemographic characteristics (N = 1619).

	Health condition of children					
	Total		Children without SHCN		Children with SHCN	
	M (SD)	Range	M (SD)	Range	M (SD)	Range
Age in years (N = 1619)						
Caregivers	41.2 (6.94)	17-72	40.8 (6.80)	17-72	41.8 (7.10)	17-61
Children	8.1 (4.2)	0-18	7.7 (4.1)	1-18	9.0 (4.4)	0-18
	n	%	n	%	n	%
Gender of respondent (N = 1619)						
Male	161	9.9	113	7.0	48	3.0
Female	1458	90.1	835	51.5	623	38.5
Gender of child (N = 1619)						
Male	899	55.5	526	32.5	373	23.0
Female	710	43.9	414	25.6	296	18.3
Diverse	10	0.6	8	0.5	2	0.1
Disease complexity of child (N = 1619)						
CSHCN ≤ 1	193	11.9	-	-	193	11.9
CSHCN ≥ 3	478	29.5	-	-	478	29.5
Country of birth of caregivers (N = 1281)						
Germany	1187	92.7	698	54.5	489	38.2
Other	94	7.3	63	4.9	31	2.4
Country of birth of partner (N = 1282)						
Germany	1129	88.1	667	52.0	462	38.1

Other	153	11.9	100	7.8	53	4.1
Place of residence (N = 1619)						
City (> 100 000 inhabitants) / Suburbs	784	48.5	500	30.9	284	17.5
Small town / rural area	835	51.5	446	27.6	387	23.9
Relationship status (N = 1619)						
With partner, in same household	1441	89.0	863	53.3	578	35.7
With partner, not in same household	46	2.8	24	1.5	24	1.5
No partner	132	8.2	61	3.8	71	4.4
Educational level (N = 1619)						
No qualification						
A-levels (qualification at age 18)	1	0.1	1	0.1	0	0.0
Certificate of 2° Education (9 yrs of schooling)	36	2.2	14	0.9	22	1.3
Certificate of 2° Education (10 yrs of schooling)	409	25.3	206	12.7	203	12.5
Other	1140	70.4	710	43.9	430	26.5
Employment status before pandemic (N = 1619)						
Inactive / unemployed	30	1.9	13	0.8	17	1.1
Maternity leave / parental leave	23	1.4	10	0.6	13	0.8
Short term / temporary employment	98	6.1	57	3.5	41	2.5
Part-time	254	15.7	123	7.6	131	8.1
Full-time / free lance	1214	75.0	745	46.0	469	29.0
Household net equivalent income during pandemic (monthly, in Euro, quintiles) (N = 1619)						
Up to 850	368	22.7	176	10.9	192	11.9
850 - 1000	312	19.3	166	10.3	146	9.0
1000 - 1299	314	19.4	201	12.4	113	7.0
1300 - 1399	364	22.5	238	14.7	126	7.8
1400 - 2750	261	16.1	167	10.3	94	5.8
Household net equivalent income during pandemic (N = 1275)						
Less	348	27.3	187	14.7	161	12.6
Same	874	68.6	537	42.1	337	26.4
Higher	53	4.2	36	2.8	17	1.3
SES index (N = 1619)						
Low	301	18.6	127	7.8	174	10.8
Middle	839	51.8	498	30.7	341	20.1
High	479	29.6	323	20.0	156	9.6

SHCN, Special Healthcare Needs; CSHCN, Children with Special Healthcare Needs; SES, Socioeconomic Status

41.4% caregivers of CSHCN completed the questionnaire, 29.5% of children screened positive for complex chronic diseases. 29.0% of caregivers of CSHCN were working full time before the pandemic with a high educational level and an overall high net equivalent income. The SES index was low in 10.8%. During the first wave of the pandemic, net equivalent income decreased for 14.7% (21.2% missing) of caregivers of CSHCN (Table 1). 55.6% of CSHCN were male, their mean age was 9 years (SD=4.4) (Table 1). A majority of CSHCN attended kindergarten (27.0%), primary school (23.5%) or schools for children with special educational needs (19.8%). 12.4% of children with chronic disease and 57.1% of children with complex chronic disease had a physical impairment, 12.7% of children with chronic disease and 60.4% of children with complex chronic disease had a behavioral impairment (Table 2). 49.3% of caregivers of children with complex chronic disease described the daily nursing care as demanding and 12.2% as very demanding (Table 2).

**Table 2.** Impairment and healthcare needs of children with chronic (n = 193) and complex chronic diseases (n = 478).

Health condition of children

	Total (N = 671)		Children with chronic diseases		Children with complex chronic diseases	
	n	%	n	%	n	%
<b>Impairment</b>						
Physical impairment	466	69.6	83	12.4	383	57.1
Behavioral impairment	490	73.0	85	12.7	405	60.4
Impairment in language development	360	53.7	52	7.8	308	45.9
Deficits in communication	188	28.0	9	1.3	179	26.7
<b>Healthcare needs</b>						
Home ventilation	11	1.6	1	0.2	10	1.5
Tube feeding	38	5.7	2	0.3	36	5.4
<b>Daily nursing care</b>						
Very demanding	86	12.8	4	0.6	82	12.2
Demanding	397	59.2	66	9.8	331	49.3
Not demanding	188	28.0	123	18.3	65	9.7

**Services involved in healthcare provision before the first wave of the pandemic.** Before the pandemic, 43.5% of CSHCN attended regular medical appointments (Table 3). 38.3% received physiotherapy and 49.0% occupational therapy, speech therapy or inclusive education (Table 3). 24.0% of children were supported by an integration aid in kindergarten or school. 26.8% of the CSHCN attended special education facilities (Table 3).

**Table 3.** Healthcare provision in CSHCN (N = 671) before the COVID-19 Pandemic in medical, educational and social sector.

	Health condition of children					
	Affirmative reply		Children with chronic diseases		Children with complex chronic diseases	
	n	%	n	%	n	%
<b>Healthcare provision in medical sector (N = 671)</b>						
Regularly scheduled doctor's appointments	292	43.5	50	25.9	242	50.6
Physiotherapy	257	38.3	17	8.8	240	50.2
Occupational therapy / speech therapy / inclusive education	329	49.0	38	19.7	291	60.9
Early intervention	97	14.5	10	5.2	87	18.2
Home care services	51	7.6	1	0.5	50	10.5
<b>Healthcare provision in educational sector (N = 671)</b>						
Nurses in kindergarten / school	46	6.9	3	0.5	43	6.4
Integration aid in kindergarten / school	161	24.0	6	0.9	155	23.1
Special educational care	180	26.8	7	1.0	173	25.8
<b>Healthcare provision in social sector (N = 671)</b>						
Social and pedagogical family assistance	20	3.0	0	0.0	20	3.0

**Associations between complexity of healthcare and children's disease complexity.** Simple linear regression showed positive associations between complexity of healthcare and children's disease complexity (B=0.57, 95% CI [0.55; 0.59]; p<0.001). Similar results could be shown for both subgroups of care complexity in both medical and educational sector (p<0.001).

**Changes in healthcare provision during the pandemic.** The COVID-19 pandemic led to a reduction in health care provision for CSHCN, ranging between 49.0% (doctor's appointments) and 84.7% (occupational therapy, speech therapy, inclusive education) in the medical sector (Table 4). 88.0% (1.9% missing) received less or no support by integration aid in kindergarten or school and socio-educational family support ceased completely in 65.0% of cases (Table 4).

**Table 4.** Healthcare provision during COVID-19 Pandemic of CSHCN in medical, educational and social sector.

	Health condition of children						Chi <sup>2</sup>	df	p-value	Exact*
	Total		Children with chronic diseases		Children with complex chronic diseases					
	n	%	n	%	n	%				
Doctor's appointments (N = 292)										
Same	147	51.0	31	10.6	116	39.7				
Less / none	143	49.0	18	6.2	125	42.8	3.73	1	0.053	0.038
Physiotherapy (N = 254)										
Same	54	21.3	6	2.4	48	18.9				
Less / none	200	78.7	11	4.3	189	74.4	2.14	1	0.143	0.126
Occupational / Speech therapy / Inclusive education (N = 326)										
Same	50	15.3	4	1.2	46	14.1				
Less / none	276	84.7	34	10.4	242	74.2	0.77	1	0.381	0.271
Early intervention (N = 95)										
Same	11	11.6	1	1.1	10	10.5				
Less / none	84	66.4	9	9.5	75	79.0	0.03	1	0.869	0.674
Home care services (N = 51)										
Same	20	39.2	0	0.0	20	39.2				
Less / none	31	60.8	0	0.0	31	60.8	0.66	1	0.417	0.608
Nurses in kindergarden / school (N=44)										
Same	8	18.2	1	2.3	7	15.9				
Less / none	36	81.8	2	4.6	34	77.3	0.50	1	0.481	0.461
Integration aid (N=158)										
Same	19	12.0	1	0.6	18	11.4				
Less / none	139	88.0	4	2.5	135	85.4	0.31	1	0.580	0.478
Special educational care										
Emergency care (N=88)	88	100.0	35	39.8	53	60.2	0.70	1	0.403	0.453
Online support (N=380)	380	100.0	133	35.0	247	65.0	5.24	1	0.073	0.070
Socio-educational family support (N=20)										
Same	7	35.0	0	0.0	7	35.0	-	-	-	-
Less / none	13	65.0	0	0.0	13	65.0				

\*Fischer Exact Test.

Associations of changes in frequency of service provision during the COVID-19 pandemic and associations with disease complexity, psychosocial factors and SES. Associations between reduction in care during the first wave of the pandemic and disease complexity could be shown using multiple linear regression analysis (B=0.50, 95% CI [0.43; 0.57], p<0.001). There was no evidence of association between reduction in care and SES (B=0.02, 95% CI [0.03; 0.07], p=0.38) and psychosocial factors of the children (B=0.02, 95% CI [0.01; 0.37], p=0.13). Also, no association was found between reduction in care and psychosocial factors of the caregivers (B=0.00, 95% CI [0.01; 0.01], p=0.95).

#### 4. Discussion

To our knowledge, this is the first cross-sectional study that provides data on healthcare provision and reduction of care in medical, educational, and social sectors in Germany during the first wave of the COVID-19 pandemic in a large sample (n=1619) of children with and without SHCN.

The findings reveal a stark picture: up to 88% of children with complex chronic conditions experienced reductions or complete disruption of essential healthcare services. These disruptions spanned medical, therapeutic, educational, and social domains, undermining core components of health and participation for this vulnerable group.

**Healthcare provision for CSHCN before and during the COVID-19 pandemic.** Overall, the need for care in CSHCN before the pandemic was very high (Table 3). These circumstances render CSHCN, especially those with complex chronic diseases, particularly vulnerable to changes in healthcare provision[13]. The abrupt breakdown of service continuity highlights a critical gap in crisis preparedness within pediatric care systems[5,14,15]. Although Germany has robust healthcare infrastructure under normal conditions, it became evident during the pandemic that these structures are not sufficiently crisis-resilient, particularly for children requiring interdisciplinary and intersectoral care. Their dependency on coordinated services across health and education sectors made them disproportionately vulnerable. Our results show strong evidence for an association between reduction in care and children's disease complexity. This aligns with international literature, indicating that CSHCN often bear the greatest burden when systems are under stress[16,17].

**Potential associations of changes in frequency of service provision with SES and psychosocial factors in families with CSHCN.** Our data showed no evidence for associations between SES and reduction in care in families with CSHCN during the first wave of the pandemic. These results raise the question whether families with CSHCN in Germany, both those with high and low SES, were equally affected by Public Health and Social Measures (PHSM). As our data suggests and international research underlines, access and utilization of medical care was radically restricted for all population groups during the first wave of the pandemic, which could explain our findings[14].

While Geweniger et al. outlined clear associations between disease complexity and children's psychological well-being, no association between care reduction and psychological well-being of children and the children's caregivers could be shown[18,19]. This may indicate stable family relationships and family support within this study's population group to be able to cope with the abrupt reduction in care in all sub-areas described. As Fogel et al. reported, constant and intimate relationships among family members had significant positive effects on both the family's and children's well-being during the first lockdown[20]. However, to evaluate associations between psychological well-being and reduction in care for CSHCN during the course of the pandemic, further research in this area is required.

**Actionable insights for building and reimagining crisis-resilient pediatric care systems.** Our findings highlight substantial disruptions in the care of children with special healthcare needs (CSHCN) during the first wave of the COVID-19 pandemic in Germany. Children with more complex conditions faced significantly greater care reductions, underscoring the system's fragility under stress. Notably, the reduction in care did not correlate with socioeconomic status or caregiver mental health, suggesting a systemic vulnerability affecting all CSHCN rather than selective inequality. This highlights the urgent need for resilient and inclusive care infrastructures that do not collapse under emergency conditions. Our results serve as a foundation for rethinking pediatric care in three ways:

1. Early identification of vulnerable care pathways - especially for CSHCN with high complexity - must guide future emergency planning[23]
2. Cross-sector coordination between health, education, and social services is essential to maintain service continuity during disruptions[21,22]
3. Digital infrastructure and telehealth solutions should be expanded as fallback systems to prevent total service breakdown[21,22].

The findings provide several key takeaways for future action:

**1. Resilience through integration.** Crisis-resilient care systems must ensure service continuity for high-need populations even under restrictive conditions. This requires pre-established, integrated care pathways with digital backup solutions (e.g., telemedicine, virtual therapy), sector-bridging coordination, and decentralized emergency care protocols[21,22].

**2. Institutionalizing family involvement.** Families are experts in their children's needs. Their voices must be formally integrated into health system design, policy development, and quality assurance. Active participation can improve service relevance and responsiveness, especially in crisis contexts [23].

**3. Research for future readiness.** Although this study found no association between SES and care reduction, future longitudinal research is essential to uncover delayed or cumulative effects,

particularly on marginalized families. Future studies should focus on how different social determinants interact with system vulnerabilities during and after public health emergencies.

**4. Mental health requires proactive strategies.** Although no direct association was observed between care reduction and psychological distress in this study, international evidence suggests otherwise[6,20]. The apparent resilience observed in our study may be due to strong family support networks in the sample. Broader, more representative studies are needed to assess the true scope of psychosocial impacts and to inform preventive strategies.

**5. Policy transformation is necessary.** The pandemic must be a turning point. CSHCN and their families should be explicitly included in national emergency response plans. Their access to therapy, education, and support services must be codified as essential - legally protected and operationalized through funded frameworks.

## 5. Limitations

Despite the large sample, the empirical design of this cross-sectional study depicts a non-representative study group, which limits the generalizability of the study results. Compared to the prevalence of chronic diseases in children and adolescents in the general population (16.2%), CSHCN are over-represented in our study sample[24]. Also, the results showed an above-average level of education and SES of the caregivers compared to the total population.

As a non-diagnosis-based approach, the CSHCN-Screener uses health care services as one variable among others to categorize disease complexity of CSHCN, which explains our findings of strong associations between disease complexity and complexity of health care, but also only allows for a limited validity of the results for this reason.

The survey retrospectively assessed frequency of services provided before the pandemic, which might lead to either over- or underestimating the actual change in service provision during the first wave of the COVID-19 pandemic in Germany. Reasons for reduction in service provision and / or utilization were not elicited.

Regarding statistical evaluation, it must be considered that the percentage of missing values in the respective variables amounted to 15 to 24%. Missing values were imputed using multiple linear imputation to adequately reflect SES, disease complexity and psychosocial factors. Measurement errors could not be completely neutralized in this way. This approach should be seen as a compromise in dealing with missing data[25].

## 6. Conclusions

This study demonstrates that children with complex chronic diseases require multi-professional care in complex care structures and thus have been particularly affected by pandemic control measures during the first wave of the COVID-19 pandemic in Germany.

The results indicate high stress and restrictions on families with CSHCN both before and during the pandemic: Positive associations between disease complexity and complexity of health care provision identify CSHCN as particularly vulnerable to changes in healthcare provision. A significant reduction in medical-therapeutic care for CSHCN during the COVID-19 pandemic in Germany could be shown.

Potential long-term impacts of this reduction on health, psychological factors and education in this population group yet remain unclear and will need future investigation[26]. Additionally, strategies to expand service provision for CSHCN permanently and resiliently will have to be developed and implemented[27]. Clear demands have already been put forward to maintain inpatient, outpatient, rehabilitative as well as medical-therapeutic care in crisis without restricting the range of services[28]. As could be shown, CSHCN and their families have been severely affected by the pandemic measures, and thus should be given particular consideration when reorganizing and reorienting politics and healthcare services to form crisis resilient frameworks and to contain consequences of the pandemic restrictions[21,22].

In short, the pandemic acted as a stress test for pediatric care systems and the results revealed significant structural weaknesses. Our data provide clear indicators of where targeted investments, contingency planning, and policy innovation are urgently required to build future-proof, child-centered health systems.

## Key Messages

Children with special healthcare needs are especially vulnerable and must be prioritized in health crisis planning.

CSHCN with higher disease complexity were shown to be even more vulnerable

Their care requirements should guide the development of future-resilient service models.

Disruption of multidisciplinary care during the pandemic highlights the need for protected, integrated care pathways

Longitudinal studies are essential: Monitoring the medium- and long-term impacts of pandemic-related care disruptions will help identify lasting effects and adjust services accordingly

Inclusive health policy is critical, family voices must be embedded in health system design, evaluation, and crisis response planning

Future policies must ensure that pediatric care services - especially for high-need populations - remain uninterrupted during public health emergencies

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## Abbreviations

The following abbreviations are used in this manuscript:

MDPI	Multidisciplinary Digital Publishing Institute
DOAJ	Directory of open access journals
WHO	World Health Organization
CSHCN	Children with special healthcare needs
SES	Socioeconomic Status
SDQ	Strengths and Difficulties Questionnaire

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