



Increase in depression and anxiety disorder diagnoses during the COVID-19 pandemic in children and adolescents followed in pediatric practices in Germany

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Abstract

The coronavirus pandemic and related restrictions impacted the daily lives of children and youth, partly due to the closure of schools and the absence of outdoor activities. The aim of this study was to investigate, quantify, and critically discuss the effect of the pandemic and related restrictions on consultations pertaining to depression and anxiety disorders in children and adolescents. This retrospective cross-sectional study was based on medical record data from the Disease Analyzer database (IQVIA) and included all children and adolescents aged 2–17 years with at least one visit to one of 168 German pediatric practices between April 2019 and December 2019 ($n=454,741$) or between April 2020 and December 2020 ($n=417,979$). The number of children and adolescents with depression and anxiety disorder diagnoses per practice and the prevalence of these diagnoses were compared for April 2020–December 2020 versus April 2019–December 2019. The number of children and adolescents with depression and anxiety diagnoses per practice increased in April 2020–December 2020 compared to the same period in 2019 (anxiety: +9%, depression: +12%). The increase was much greater in girls than in boys (anxiety: +13% vs. +5%; depression +19% vs. +1%). The prevalence of anxiety disorder increased from 0.31 to 0.59% ($p < 0.001$), and that of depression from 0.23 to 0.47% ($p < 0.001$). The biggest increases were observed for girls (anxiety from 0.35 to 0.72% (+106%, $p < 0.001$), depression from 0.28 to 0.72% (+132%, $p < 0.001$). This study shows an increase in the number of pediatric diagnoses of depression and anxiety disorders in the pandemic year 2020 compared to the previous year.

Keywords COVID-19 pandemic · Children · Adolescents · Depression · Anxiety disorder

Introduction

Since its first description in China in December 2019, COVID-19 has spread around the world and subsequently induced a severe pandemic (1). To prevent healthcare systems from being overwhelmed and to slow the spread of the disease, governments worldwide implemented a range of non-pharmaceutical measures at varying levels of intensity

(2). In Germany, these measures included, among others, the closure of schools and public playgrounds as well as a recommendation for businesses to allow and facilitate remote working (3).

The coronavirus pandemic and lockdowns also impacted the daily lives of children and youth, partly due to the closure of schools and the absence of outdoor activities. A number of Asian and European studies have shown that a significant proportion of children and adolescents are suffering from mental health problems as a result of the coronavirus pandemic or the related measures (4–17).

Ravens-Sieberer investigated the mental health and quality of life of children and adolescents during the pandemic in Germany. A total of 1586 parents with 7- to 17-year-old children and adolescents as well as 1040 children and adolescents were surveyed. Authors found that overall, 71% of children and adolescents felt burdened by the pandemic, reporting stressful homeschooling, less contact with their friends, and more arguments in the family. In addition, the

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prevalence of mental health problems increased from 18% before the COVID-19 pandemic to 30% during the crisis (13).

In their study of 1,146 children aged 12–17 in Switzerland, Mohler-Kuo et al. reported that during the COVID-19 pandemic, the prevalence rates of anxiety symptoms were 13.6% for girls and 12.5% for boys, and the prevalence rates of depression symptoms were 9.7% among girls and 4.6% among boys (14). Nearchou et al. provided a systematic review of the evidence concerning the impact of the COVID-19 pandemic on the mental health of children and adolescents, based on 12 studies. They reported the prevalence of anxiety symptoms as being between 18.9 and 37.4%, and depression symptoms as between 22.6 and 43.7% (15). Panda et al. analyzed 15 studies including 22,996 children and adolescents, where 34.5% were found to be suffering from anxiety and 41.7% from depression (16).

Although the studies published investigating the effect of the pandemic on the mental health of children and adolescents are of great interest, most of these are based on relatively small numbers of individuals and therefore might not be representative. Thus far, no database- or registry-based studies have been published in Germany that empirically examine the influence of the coronavirus lockdowns on the prevalence of depression and anxiety disorders in children or adolescents, documented in pediatric practices. Pediatricians assume primary care physician functions in Germany. Parents of children and adolescents usually first contact pediatricians, who then refer their young patients to psychiatrists. In addition, database studies allow for the use of longitudinal data pertaining to large, often nationwide sample sizes in a relatively short time.

The aim of this study was to investigate, quantify, and critically discuss the effect of the pandemic and related restrictions on consultations pertaining to psychiatric problems in children and adolescents. Our hypothesis is that the number of children and adolescents with depression and anxiety disorders may increase in the pandemic time.

Methods

Database

This retrospective cross-sectional study was based on medical record data from the Disease Analyzer database (IQVIA), which compiles drug prescriptions, diagnoses, and general medical and demographic data obtained directly in anonymous format from computer systems used in the practices of general practitioners (GP) and specialists (14). Diagnoses, prescriptions, and the quality of the reported data are monitored by IQVIA based on an array of criteria. In Germany, the sampling methods used to select physicians'

practices have been shown to be appropriate for obtaining a population-representative database of primary and specialized care practices (18). This database has already been used for a number of studies on COVID-19 (19, 20).

Participants

This study included all children and adolescents aged 2–17 years with at least one visit to one of 168 German pediatric practices between April 2019 and December 2019 or between April 2020 and December 2020. The database used has a coverage of approximately 3.5% for pediatric practices. These practices provide complete information on consultations and diagnoses of children and adolescents followed in them. German law allows the use of anonymous electronic medical records for research purposes under certain conditions. According to this legislation, it is not necessary to obtain informed consent from patients or approval from a medical ethics committee for this type of observational study that contains no directly identifiable data. Because patients were only queried as aggregates and no protected health information was available for queries, no institutional review board approval was required for the use of this database or the completion of this study.

Procedure and outcomes

The first outcome was the difference in the number of children and adolescents with at least one visit to these practices between April 2020 and December 2020 versus between April 2019 and December 2019. Comparisons were stratified by sex and age group (2–5, 6–9, 10–12, and 13–17 years). We used the classification we had often seen in other studies as we thought it was correct: small children (0–5 years), school children (6–12 years) and adolescents (13–17 years). However, we also further stratified 6–12-year-olds into two groups (6–9, 10–12) as this makes a difference between children attending primary school (first 4 years) and those attending secondary school in Germany—primary schools were not closed for as long as secondary schools.

The second outcome was the number of children and adolescents with depression (ICD-10: F32, F33) and anxiety disorder diagnoses (ICD-10: F41) per practice April 2020–December 2020 versus April 2019–December 2019. This analysis was also performed for new depression and anxiety disorder diagnoses, defined as diagnoses not previously documented in the database, to show patients who were initially diagnosed with depression or anxiety disorder during the coronavirus pandemic.

The third outcome of the study was the change in the prevalence of depression and anxiety disorder diagnoses in April 2020–December 2020 versus April 2019–December 2019. The prevalence rate was defined as the number

of children and adolescents diagnosed with depression or anxiety disorder in the selected period divided by the total number of children and adolescents with at least one visit within the same period.

Statistical analyses

Chi-squared tests were used to compare the prevalence between two time periods. The number of patient visits per practice as well as the number of children and adolescents with depression and anxiety disorder diagnoses per practice was compared for April 2020–December 2020 versus April 2019–December 2019 using a Wilcoxon signed-rank test. A p -value of < 0.05 was considered statistically significant in all analyses. The analyses were carried out using SAS 9.4 (SAS Institute, Cary USA).

Results

Study population

This study included 454,741 pediatric patients in the period April 2019–December 2019, and 417,979 patients in the period April 2020–December 2020. The baseline characteristics are shown in Table 1. There were partly significant differences in age between 2019 and 2020, but these were very small in terms of absolute numbers.

Changes in consultations per practice

Table 2 shows the differences by sex and age in the number of patients with at least one visit per practice between April 2019–December 2019 or April 2020–December 2020. The number of patients per practice was lower in April–December 2020 than in April 2020–December 2019 (2488 vs. 2,707, $- 8\%$, $p = 0.037$). These differences were

Table 1 Age and sex characteristics of patients with at least one visit to one of 168 German pediatric practices between April 2019 and December 2019 and April 2020 and December 2020

Patient group	April 2019– December 2019	April 2020– December 2020	P -value
N	454,741	417,979	
Average age (mean, SD)	6.6 (4.9)	6.7 (5.0)	< 0.001
Age 2–5 years (%)	49.3	48.4	< 0.001
Age 6–9 years (%)	21.8	21.8	0.889
Age 10–12 years (%)	13.4	13.7	0.002
Age 13–17 years (%)	15.3	16.1	< 0.001
Girls (%)	47.7	47.6	0.096
Boys (%)	52.3	52.4	

Table 2 Differences by sex and age in the number of patients with at least one visit to one of 168 German pediatric practices between April 2019 and December 2019, or April 2020 and December 2020

Patient group	April 2019– December 2019 (Mean, SD)	April 2020– December 2020 (Mean, SD)	Difference in %	P -value
Total	2,707 (1,133)	2488 (1,098)	$- 8$	0.037
Age 2–5 years	1,338 (595)	1205 (581)	$- 10$	0.011
Age 6–9 years	591 (244)	543 (236)	$- 8$	0.041
Age 10–12 years	363 (158)	339 (150)	$- 7$	0.141
Age 13–17 years	415 (212)	401 (204)	$- 3$	0.455
Girls	1,292 (539)	1183 (518)	$- 8$	0.029
Boys	1,415 (597)	1305 (582)	$- 8$	0.048

observed for both girls and boys as well as different age groups. The most prominent differences ($- 10\%$) occurred in the age group 2–5 years.

Changes in depression and anxiety patients per practice

The number of children and adolescents with depression and anxiety diagnoses per practice increased in April 2020–December 2020 compared to the same period in 2019 (anxiety: $+ 9\%$, depression: $+ 12\%$, Table 3). The increase was much greater in girls than in boys (anxiety: $+ 13\%$ vs. $+ 5\%$; depression $+ 19\%$ vs. $+ 1\%$). The increase of both anxiety ($+ 16\%$) and depression ($+ 29\%$) was strongest in the age group 10–12 years. Although none of the differences observed met the criteria for statistical significance due to the low number of practices included, they still provide important insights about the changes caused by the pandemic in Germany. This trend was also observed for new diagnoses ($+ 13\%$ for anxiety, $+ 18\%$ for depression). At $+ 29\%$, the increase in depression in girls was significant ($p = 0.010$) (Table 3).

Changes in the rate of depression and anxiety

The rate of anxiety disorder increased from 0.31 to 0.59% ($p < 0.001$, Fig. 1a), and that of depression from 0.23 to 0.47% ($p < 0.001$, Fig. 1b). The biggest increases were observed for girls (anxiety from 0.35 to 0.72% ($+ 106\%$, $p < 0.001$, Fig. 1a), depression from 0.28 to 0.65% ($+ 132\%$, $p < 0.001$, Fig. 1b).

Table 3 Differences by sex and age in the number of patients with depression and anxiety disorder diagnoses who visited one of 168 German pediatric practices between April 2019 and December 2019 and April 2020 and December 2020

Patient group	All diagnoses				New diagnoses			
	April 2019– December 2019 (Mean, SD)	April 2020– December 2020 (Mean, SD)	Difference in %	<i>P</i> -value	April 2019– December 2019 (Mean, SD)	April 2020– December 2020 (Mean, SD)	Difference in %	<i>P</i> -value
Anxiety disorder								
Total	10.1 (14.2)	11.1 (16.7)	+9	0.478	7.6 (9.8)	8.6 (12.0)	+13	0.309
Age 2–5 years	2.3 (8.7)	2.3 (9.9)	0	0.535	1.9 (6.4)	1.9 (7.6)	+2	0.623
Age 6–9 years	2.3 (2.9)	2.6 (4.0)	+13	0.525	1.9 (2.4)	2.3 (3.4)	+17	0.564
Age 10–12 years	2.3 (2.6)	2.6 (3.1)	+16	0.205	1.9 (2.2)	2.3 (2.5)	+20	0.105
Age 13–17 years	3.3 (2.9)	3.6 (3.3)	+9	0.568	2.5 (2.3)	2.9 (2.7)	+12	0.492
Girls	5.5 (7.3)	6.2 (9.1)	+13	0.596	4.1 (4.9)	4.8 (6.8)	+16	0.470
Boys	4.7 (7.2)	4.9 (7.9)	+5	0.730	3.5 (5.3)	3.8 (5.7)	+9	0.416
Depression								
Total	8.5 (9.3)	9.5 (9.9)	+12	0.315	5.9 (6.7)	7.0 (7.2)	+18	0.086
Age 2–5 years	–	–	–	–	–	–	–	–
Age 6–9 years	0.6 (1.0)	0.6 (1.0)	0	0.994	0.5 (0.9)	0.5 (0.9)	+2	0.966
Age 10–12 years	1.3 (1.8)	1.6 (2.5)	+29	0.221	1.1 (1.6)	1.4 (2.3)	+32	0.110
Age 13–17 years	6.5 (7.4)	7.2 (7.6)	+10	0.365	4.4 (5.4)	5.2 (5.3)	+16	0.086
Girls	5.2 (5.9)	6.2 (6.6)	+19	0.128	3.5 (4.2)	4.5 (4.6)	+29	0.010
Boys	3.3 (3.9)	3.3 (4.0)	+1	0.892	2.4 (3.0)	2.5 (3.2)	+3	0.910

Discussion

This study conducted in 168 pediatric practices in Germany showed that the total number of children and adolescents with anxiety disorder and depression, the number of children and adolescents newly diagnosed with anxiety disorder and depression, and the prevalence of anxiety disorder and depression among children and adolescents increased in April–December 2020 compared to April–December 2019.

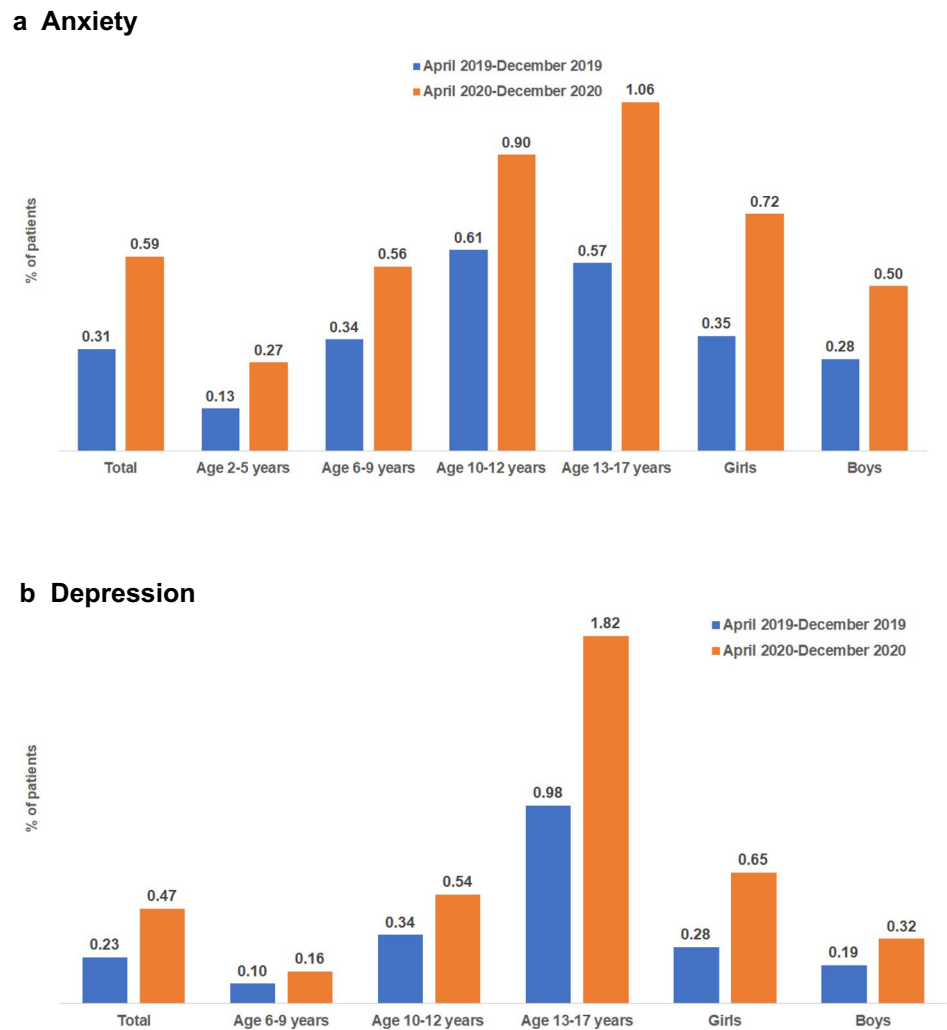
In addition, this increase was the strongest in girls and in children aged 10–12 years. To the best of our knowledge, this is one of the largest studies carried out on this topic in Germany to date, and is also the first study to use pediatric diagnoses.

In our study, the prevalence rates for anxiety and depression were much lower than in other publications (14–16), as only confirmed medical diagnoses by pediatricians were used, and individual symptoms of mental disorders do not necessarily result in diagnoses even when these symptoms are reported to or observed by pediatricians. We observed a significant increase in the rates of both anxiety and depression during the COVID-19 pandemic, but the proportion of children with these mental health diagnoses was relatively low. The strong increase in the rate of anxiety and depression diagnoses in our study may be due to the fact that the number of patients with consultations decreased while the number of patients diagnosed with anxiety and depression increased.

It is known that prevalence rate estimates based primarily on self-reporting of symptoms as used by online survey results differ from the prevalence documented in medical practices (21). In view of this, it is important to consider the specific conditions of pediatric and adolescent medicine practices in Germany. The pandemic had far-reaching consequences for pediatricians concerning the provision of services (22): the frequency of contact and also the density of services decreased, in particular the number of acute illnesses of the respiratory system decreased, fewer preventive examinations were carried out, and sick leave for parents caring for sick children was no longer necessary because many parents were working from home. Finally, many services were provided by telephone or video contact (22). Revet et al. estimated the impact of COVID-19 on child and adolescent psychiatry services in Europe and they reported that the perceived impact on the mental health and psychopathology of children and adolescents dramatically increased in 2020 and 2021 (11).

One particularly striking result of the present study is the development of mental disorders in school children aged 10–12 years as well as adolescents (13–17 years). These age groups is in an important transitional phase (23–25), which is usually characterized by the transition to secondary school, the onset of puberty, and an incipient detachment from the parental home and increased contact with the peer group. The strong increase in the anxiety and depression prevalence in the age group 13–17 may result from the lack

Fig. 1 Differences by sex and age in the prevalence of depression and anxiety disorder diagnoses in 168 German pediatric practices between April 2019 and December 2019 and April 2020 and December 2020



of access to health services usually provided through schools (26).

Although the data used for this study do not allow direct indications to be derived for measures aimed at reducing or treating anxiety or depression in children and adolescents, there are already a number of reviews in which possible interventions are presented (27). It has been pointed out that children and adolescents are a particularly vulnerable group due to the development of mental disorders such as anxiety and depression, and that certain subgroups, including female patients, are at a higher risk.

There is much evidence that quarantine measures can be associated with negative psychological consequences (28). For example, lockdowns caused drastic modifications to children's routines. Schools, which are responsible for providing structure and routine to children and adolescents' daily lives, were closed. Physical activity, which is associated with lower levels of depression and anxiety was curtailed. Social

relations and friendships, which are important for maintaining mental health, were also severely restricted (29).

Among children and adolescents, this particularly affects children in crowded living conditions where there is a chronic family conflict situation (e.g., divorce, separation, parental mental illness) (30).

We do not currently know the extent to which repetitive lockdowns continue to produce volatile situations with unpredictable consequences for children's mental health. Furthermore, without appropriate therapy, these mental disorders may have a negative impact on further child development, not only during the pandemic but also after it has ended. It is important to develop more targeted interventions to mitigate the negative impact of the pandemic on child and adolescent mental health. With this in mind, child and adolescent psychiatrists and psychotherapists as well as social centers and even government officials are calling for a recovery plan for children, adolescents, and their families (31).

In contrast to existing studies on mental health problems in children and adolescents during the COVID-19 pandemic which used surveys, our study features a large cohort of children that are representative for the sociodemographic situation in Germany and uses retrospective data from pediatric practices. A further advantage of this study is that database studies can show if there are inconsistencies between mental health burden detected in community samples and service utilization. We acknowledge that this work is subject to several limitations. First, the number of practices included in the analysis is relatively small. Second, misclassification or underestimation of individual diagnoses may have occurred due to the use of the ICD-10 coding system. Third, this study is based on data from pediatric practices, which assume a primary care physician functions in Germany, but psychiatrists are ultimately responsible for the treatment of depression and anxiety in children and adolescents. No data from psychiatrists were used in this study.

Fourth, the German Disease Analyzer database does not contain details of how diagnoses were made. Fifth, this database does not provide information on lifestyle or socioeconomic status, and the data available do not allow disease severity to be analyzed. Sixth, we only analyzed depression and anxiety disorder and did not focus on any other psychiatric disorders as these are rarely documented by pediatricians. Seventh, we cannot validate there was an increase in depression and anxiety diagnoses because there were more children with depression and anxiety or because more children with depression and anxiety sought help from professionals.

Finally, this study is of a descriptive nature and no complex statistical methods such as time-series analyses were used.

Nevertheless, the database presents a relevant overview of the diagnosis of depression and anxiety disorder among children and adolescents during the COVID-19 pandemic and shows an interesting shift in the number of pediatric diagnoses in the pandemic year 2020 compared to the previous year. Further studies on the impact of the COVID-19 pandemic and especially lockdowns and quarantine measures are needed in the near future, both during and after the end of the pandemic.

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Declarations

Conflict of interests The authors declare that they have no competing financial interests.

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